ASIAN INFRASTRUCTURE INVESTMENT BANK

P000387
January 12, 2024

Sovereign-backed Financing
Project Document

People's Republic of Bangladesh

P000387 - Bangladesh Integrated Solid Waste Management Improvement Project

Currency Equivalents

(As at date, January 1, 2023)

Currency Unit – Bangladesh Taka (BDT)
BDT 1.00 = USD 0.0095
USD 1.00 = BDT 105

Borrower's Fiscal year

July 1 to June 30

Abbreviations

AIIB	Asian Infrastructure Investment Bank
BCC	Behavioral Change Communications
COVID-19	Coronavirus Infectious Disease of 2019
DoE	Department of Environment
EA	Economic Analysis
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
E&S	Environmental and Social
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMPF	Environmental and Social Management Planning Framework
ESP	Environmental and Social Policy
ESS	Environmental and Social Standard
FAPAD	Foreign Aided Projects Audit Directorate
FM	Financial Management
GBV	Gender-based Violence
GEF	Grid Emission Factor
GHG	Greenhouse Gas
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanism
IEC	Information, Education and Communication
IFR	Interim Financial Report
IP	Indigenous People
LGD	Local Government Division
LGED	Local Government Engineering Department
IRR	Internal Rate of Return
LTS	Long-Term Strategy
M&E	Monitoring and Evaluation
MCF	Material Collection Facility
MDB	Multilateral Development Bank
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MoLGRDC	Ministry of Local Government, Rural Development & Cooperatives
MRF	Material Recovery Facility
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NPV	Net Present Value
O&M	Operations and Maintenance
OCAG	The Office of the Comptroller and Auditor General
PIE	Project Implementing Entity
PA	Paris Agreement
PIM	Project Implementation Manual
PCSPs	Primary Collection Service Providers
PDS	Project Delivery Strategy
PIU	Project Implementation Unit
PMC	Project Management Consultant
PMU	Project Management Unit
PPM	Project-affected People's Mechanism
PPSF	Project Preparation Special Fund
PPM	Project-affected People's Mechanism
PPP	Public Private Partnership
RLRP	Resettlement and Livelihood Restoration Plan
RPF	Resettlement Planning Framework
SDG	Sustainable Development Goal
SOC	Social Opportunity Cost of Capital
SWM	Solid Waste Management
TA	Technical Assistance
TDF	Tribal Development Framework
TPD	Tons of waste Per Day
TSC	Technical Support Consultant
ULB	Urban Local Body
3R	Reduce, Reuse, and Recycle

Contents

1. Summary Sheet

Project No.	P000387
Project Name	Bangladesh Integrated Solid Waste Management Improvement Project
AIIB Member	Bangladesh
Borrower	People's Republic of Bangladesh
Project Implementation Entity	Local Government Engineering Department (LGED)
Sector Subsector	Urban Integrated waste management
Alignment with AIIB's thematic priorities	Green infrastructure
Project Objective	To improve solid waste management (SWM) services in selected Urban Local Bodies (ULBs) in Bangladesh.
Project Description	Rapid urbanization along with increased population and accelerated business activities have resulted in a significant increase in municipal waste (or solid waste) production, while its proper handling, transport, treatment and safe disposal remain problematic primarily due to inadequate SWM infrastructure and weak service delivery systems. The Project will support selected ULBs in improving access to efficient and reliable delivery of SWM services to their populations. The Project includes the following components: *Component 1 (Waste Collection and Transportation)* will help improve and optimize solid waste collection and transportation services in selected ULBs including, but not limited to, provision of collection containers and fleet, and mechanical cleaning equipment. *Component 2 (Waste Processing and Disposal)* will finance prioritized waste processing and disposal infrastructure, including closure of polluting waste dump sites, construction and/or rehabilitation of sanitary landfills, provision of facilities related to composting and resource recovery, and ancillary facilities. *Component 3 (Capacity Building and Project Management Support)* will support strengthening of institutional capacity for relevant central and local agencies. It will also support Project management, monitoring and evaluation, environmental and social risk management, procurement, financial management, supervision and maintenance of infrastructure investments.
Implementation Period	January 1, 2024 – December 31, 2028
Expected Loan Closing Date	June 30, 2029
Proposed Amount of AIIB Financing	USD200 million
Financing Plan	Estimated total Project Cost: USD231 million

	Indicative financing plan: AIIB: USD200 million (86.5 percent); Government of Bangladesh: USD31 million (13.5 percent)
ES Category (or AIIB equivalent, if using another MDB's ES Policy)	A
Risk (Low/Medium/High)	High
Conditions of Effectiveness	(i) adopt an acceptable Project Implementation Manual (PIM); and (ii) the grievance redress mechanism for project-affected people has been established in form and substance satisfactory to the Bank and is operational.
Key Covenants	The Borrower will: (i) establish no later than one (1) month after the Effective Date, and thereafter maintain throughout the implementation of the Project a dedicated Project Management Unit ("PMU") under the LGED (ii) establish a Project Implementation Committee under the LGED no later than one (1) month after the Effective Date (iii) establish a high-level Project Steering Committee under the LGD no later than one (1) month after the Effective Date (ii) implement the Project in accordance with the Project's Environmental and Social instruments. (iii) monitor and evaluate the progress of the Project and prepare project progress reports, which cover the period of one calendar year and shall be submitted to AIIB within 45 days after the end of the period covered by such report. (iv) prepare and furnish to AIIB interim unaudited financial reports for the Project covering the preceding quarter, in form and substance satisfactory to AIIB no later than 45 days after the end of each fiscal quarter. (vii) have its financial statements audited by independent auditors acceptable to AIIB. Each such audit shall cover one fiscal year of the Borrower and submitted to AIIB no later than six months after the end of each fiscal year. (viii) submit a project completion report within six months after the closing date the Project; and (ix) Urban Local Body may only participate in the Project's implementation once the following requirements are met: (a) a Participation Agreement is executed between LGED and the participating Urban Local Body, in form and substance satisfactory to the Bank; (b) a Project Implementation Unit (PIU), with adequate staffing, is established in a manner

	satisfactory to the Bank; and (c) a designated account for waste management services is established.
Retroactive Financing (Loan % and dates)	n/a
Policy Waivers Requested	No
Policy Assurance	The Vice President, Policy and Strategy, confirms an overall assurance that AIIB is in compliance with the policies applicable to the Project.
Economic Capital (ECap) Consumption	ECap: USD31.63 million (ECap Ratio: 13.30%)

President	Liqun Jin
Vice President	Urjit Patel
Director General	Rajat Misra
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2. Project Description

A. Project Overview

1. **Project Objective.** The objective of the Project is to improve solid waste management (SWM) services in selected Urban Local Bodies (ULBs)[1] in Bangladesh. The Project will help: (i) improve environment, public health, and urban living conditions through efficient management of municipal waste and reduction in pollution; (ii) contribute to climate change adaptation by building climate and disaster resilient infrastructure, and reduce greenhouse gas emissions through waste minimization, resource recovery and reuse; and (iii) strengthen the government's capacity for delivering effective services across the SWM value chain.

2. **Project Description.** Bangladesh as one of the fastest urbanizing[2] and most densely populated countries in the region is facing significant challenges in providing basic urban services and infrastructure. Rapid urbanization along with increased population and business activities has led to significant increase in municipal waste production,[3] while proper waste collection, handling, transport, treatment, and safe disposal remain suboptimal. Key challenges that cities in Bangladesh face include: (i) having less than 50 percent waste collection efficiency; (ii) absence of source segregation and multiple handling;[4] (iii) inadequate SWM infrastructure and outdated equipment – lack of waste bins and containers, obsolete and unsafe vehicles and transportation facilities; (iv) minimal processing,[5] absence of recycling and resource recovery facilities; (v) crude dumping, lack of waste treatment facilities and sanitary landfills; (vi) limited awareness regarding Reduce, Reuse, and Recycle (3R) concept and environmental problems; and (vii) inadequate technical and financial capacity at the local-level in planning, financing and maintaining SWM facilities, among others (see Annex 2 for details).

3. According to the Local Government Act,[6] ULBs are responsible for planning and implementation of SWM within their administrative jurisdictions. The ULBs are mandated to provide SWM services such as transportation of municipal waste from designated collection points to the landfill, and management of the landfill facilities. Urban areas account for a majority of the total solid waste generated countrywide. Waste generation is far beyond the handling capacities of ULBs. Most of the ULBs practice open dumping without adopting any environmental measures.

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[1] ULBs in Bangladesh refer to City Corporations and Pourashavas (or Municipalities).
[2] Around 40 percent of the country's total population (169.4 million) live in urban areas. The country is rapidly urbanizing with an annual urban population growth rate of 3 percent.
[3] Between 1991-2021, Bangladeshi urban population increased by three times and total waste generation increased by three times as well. In the next 20 years, i.e., 2021 to 2040, the urban population is projected to grow by 1.46 times and the income and total waste generation will increase by 3.8 and 3 times, respectively. It is estimated that waste generation will reach 57,000 tons per day in 2030, and 118,000 tons/day in 2040, according to "*Assessment of SWM Investment Opportunities in Bangladesh (2021)*".
[4] Due to inadequate SWM systems, infrastructure and equipment (including vehicles, containers and bins), municipal waste is handled, at each step of SWM value chain, in an inefficient and unsafe way.
[5] Only 5 percent of the collected waste, for example, is composted in Bangladesh, whereas 80 percent of the generated waste is organic.
[6] According to the Act (2009, amended in 2011), ULBs are responsible for functions such as sanitation and environmental pollution control, SWM, water supply, public streets, traffic control, etc. They also carry out functions such as regulation of markets, planning and building control, preparation of development plans.

4. Consequently, less than half of the total waste is properly collected while uncollected waste is often informally burned, illegally buried or dumped in streets, public spaces, water bodies, and drainage channels resulting in a public health hazard, [7] air pollution, soil and water contamination and worsening local flooding. Hence, an integrated and modernized SWM system, covering the entire value chain - waste collection, transportation, treatment and processing, and final disposal, is urgently needed in cities and towns of Bangladesh.

5. The Project will support the Government of the People's Republic of Bangladesh (GoB) by providing: (i) SWM infrastructure investments; and (ii) institutional and capacity development support to the participating ULBs as well as the state agencies. The proposed investments will cover the entire SWM value chain - waste collection and transfer systems, treatment and disposal facilities (including material recovery and composting facilities, and sanitary landfills). Through institutional and capacity development support, the Project will help strengthen the regulatory framework in the sector and build capacity among national and local actors; facilitate development of '*private sector*' model for SWM; deepen efforts to encourage waste minimization, recycling and source separation; and support vulnerable groups through development of appropriate social inclusion and economic transition.

6. The Project will support up to 20 ULBs[8] which have been selected based on robust and objectively verifiable criteria developed after a series of detailed discussions with the GoB and relevant stakeholders. The selection criteria considered: (i) demand for improved SWM services; (ii) Project readiness, in particular, land availability for disposal infrastructure; (iii) institutional and financial capacity of ULBs; (iv) commitment for private sector involvement; and (v) readiness to launch waste separation at source programs (see Annex 2 for details).

7. **Expected Results.** The Project objectives will be evaluated against the following key result indicators: (i) number of people with access to improved SWM services; (ii) solid waste recycled, composted and/or treated; and (iii) solid waste disposed safely in engineered sanitary landfills. A results framework containing result indicators, monitoring and reporting arrangements is attached in Annex 1.

8. **Expected Beneficiaries.** Three main target groups will directly benefit from the Project: (i) at least 4.31 million residents of the participating ULBs through increased access to improved SWM services and environmental, social and health conditions; (ii) municipal staff, through improved capacity for planning, implementing, and financing SWM systems; and (iii) sanitation workers through improved working conditions and better livelihood opportunities in waste management sector.

[7] Poor and vulnerable populations have been suffering most from inadequate SWM practices.

[8] Rajshahi, Rangpur, Kushtia, Munshiganj, Bhola, Sirajganj, Phulpur, Chattogram (Batch 1); and Barisal, Chapai Nawabganj, Faridpur, Kishoreganj, Magura, Sreemongal, Madhabpur, Narshingdi, Nabinagar, Bera, Shahjadpur, Muktagacha (Batch 2). Additional ULBs, including Karimgonj, Mirkadin, Mirpur, Naohata, Katakhali, and Hargacha, are expected to be benefited from provision of regional-level disposal facilities.

B. Rationale

9. **Strategic fit for AIIB.** The Project is consistent with AIIB's mandate and thematic priority to promote green infrastructure. The Project is also aligned with the Sustainable Cities Strategy that targets promoting integrated development, providing basic infrastructure, and improving city resilience. The Project would result in improved access to critical SWM services which is expected to bring significant economic benefits with high social value. The Project is also expected to help improve the efficiency and sustainability of SWM investments by strengthening institutional systems and capacities of the participating ULBs. The Project is aligned with Paris Agreement, both in terms of climate mitigation and adaptation.

(i) *Improving municipal waste management services.* The Project will: (i) promote integrated service delivery covering waste segregation, collection and transportation, processing and safe disposal to achieve better and more sustainable SWM service delivery; (ii) provide a combination of financial and technical support to address both key infrastructure gaps and institutional capacity constraints in SWM; (iii) take a regional-level approach, where practical, for developing and operating waste disposal facilities; and (iv) leverage on technologies to improve SWM performance, for example, optimizing waste collection and transportation through Global Positioning System (GPS)-enabled route monitoring which will be integrated with a Management Information System (MIS) for real-time monitoring and performance evaluation.

(ii) *Promoting climate and disaster resilience.* Bangladesh is highly vulnerable to climate change and disasters.[9] The cities that are located on the low-lying areas and prone to local flooding are particularly at high risk due in part to mismanaged solid waste. Uncollected solid wastes have been significantly increasing local flooding by blocking waterways and clogging the drainage systems. The Project will fully mainstream climate change and disaster resilience throughout its entire investment cycle. Specifically, SWM infrastructure envisioned under Components 1 and 2 will incorporate resilient planning and sustainable design of facilities, adapting to the climate change vulnerability and disaster risks. In addition, the Project will reduce greenhouse gas (GHG) emissions[10] therefore contributing to both climate mitigation and adaptation finance.

(iii) *Increasing private sector participation in SWM.* The role of the private sector across the SWM value chain in Bangladesh is limited due to: (i) the limited opportunities at a scale that ensures financial viability; (ii) high-risk perception by private operators due to the history of public protests; and (iii) weak project development and contractual modalities that lack objective performance metrics, clearly defined obligations, and risk sharing mechanisms, among others. The Project seeks to enhance private sector participation in SWM services by: (i)

[9] The Global Climate Risk Index rates Bangladesh as the seventh most affected country in the world from extreme weather events.

[10] By investing in: (i) decentralized household composting systems for bio-degradable waste; (ii) centralized composting or anaerobic digestion facilities; (iii) material recovery and resource recovery facilities, the amount of waste going into landfills will be reduced. The Project will also support optimization of waste collection routes. It will lead to reduction of GHG emissions.

providing technical assistance for robust project structuring and adoption of performance based contracting for SWM services; (ii) support for formalizing the regional coordination mechanisms through inter-municipal agreements with clearly defined responsibilities and cost-sharing frameworks; (iii) building LGED and ULB's capacity for contract management and supervision systems; (iv) facilitating frequent interaction and Project sounding events with private sector during the project development and contracting cycle; and (v) setting up robust monitoring and grievance redress mechanisms for relevant investments.

(iv) *Improving medical waste management, public health and hygiene.* The existing biomedical waste management systems in urban areas are inadequate to manage medical wastes in compliance with relevant government's policies. The Project will strengthen the government's technical capacity and help sustain adequate waste management, sanitization, public hygiene, and cleanliness activities for better health risk preparedness.

(v) *Addressing plastic waste and marine litter.* Currently, in Bangladesh, a small portion of the plastic waste (3 percent) is collected and transported to the processing facilities, where it is shredded, bailed, and sold for road construction and to recyclers. The remaining plastic leaks into the environment, causing a plethora of problems. It pollutes marine life, affects human health and economic activities such as tourism and fishing. The Project will adopt a mix of preventive and responsive measures[11] to address mismanaged plastic waste problems in urban areas (particularly for ULBs adjacent to water bodies).

10. The Project is aligned to GoB's priorities for promoting sustainable urban development. The Project will directly contribute to GoB's Eighth Five Year Plan which provides direction[12] on management of solid waste in the country and is consistent with the relevant national policies and strategies on SWM (see Annex 2 for details).[13] The Project will support the GoB's climate objectives as articulated in the Nationally Determined Contributions (NDCs, updated in 2021) and also support ULBs to meet their mandate in providing SWM services. The Project will also support the Sustainable Development Goal (SDG) 3 by bringing positive benefits with respect to healthy lives and well-being of the target population and SDG 11 by promoting safe, resilient and sustainable urban development. The Project will fill critical gaps not covered by any of the current GoB's initiatives or through interventions of other development partners.

[11] The Project will provide necessary capacity building and training programs, under Component 3, to reduce and segregate plastic waste at source. Collected plastic waste will be either recycled and processed (for single use plastic) in the processing and disposal facility proposed under Component 2.

[12] The Eighth Five Year Plan recommends the followings: (i) provision of an integrated SWM covering waste collection, transport, disposal and resource recovery; (ii) incentivizing firms for door-to-door collection; (iii) awareness building to increase sorting and recycling, and source separation; (iii) promoting 3Rs; (iv) promoting Waste-to-Energy where appropriate, mainly in large cities; (v) given the large organic content, encouraging composting and biogas to electricity; and (vi) using Build Own Operate (BOO) or Design Build and Operate (DBO) approach to overcome the barriers of poor O&M of SWM investments.

[13] National Strategy for Water Supply and Sanitation (2021), National 3R Strategy for Waste Management (2010), National Environmental Policy (2018), SWM Handling Rules (2020), Bio-Medical Waste Management Rules (2008), Environment Conservation Rules (1997), Local Government Act (2009), Environment Conservation Act (1995), and National Action Plan for Plastic Waste (2021), among others.

11. **Value addition by AIIB.** Besides meeting the critical financing needs for SWM sector, AIIB's participation helped improve design and implementation readiness of the Project by providing necessary technical support as well as the Project Preparation Special Fund (PPSF) of the Bank. Specifically, the Bank has proactively provided the following support in addition to PPSF support: (i) rapid waste sector assessment for Bangladesh;[14] (ii) development of robust city selection criteria to prioritize Project ULBs; (iii) shaping Project scope and conceptual design; (iv) adoption of good SWM practices, locally-adoptable SWM technologies and solutions with climate consideration; and (v) provision of knowledge sharing and capacity building for key Project stakeholders. The PPSF supported the GoB to prepare the Project with quality at entry and improved implementation readiness following the Bank's standards and requirements, and also help improve implementation capacity of participating ULBs (see paragraph 20).

12. The Bank will continue to provide support in integrating measures for the management of environmental and social issues into the entire Project cycle, which would contribute to the overall quality of the Project. The Bank will also continue to help different ULBs adopt lessons learned from the Project and similar projects elsewhere and reflect them across the Project cycle as summarized in paragraph 14.

13. **Value addition to AIIB.** The Project is AIIB's first urban sector operation in Bangladesh, with a focus on SWM. This engagement will provide a good opportunity for the Bank to gain experience in enhancing urban environment and resilience through implementation of comprehensive SWM solutions. The Project will help establish a nation-level scalable platform to improve SWM services, which can potentially be expanded to other ULBs to achieve results at the national scale. Municipal waste management is a major challenge across South Asian cities and the learning from this Project can contribute significantly. The Project will provide an opportunity to lead the way in building the Bank's presence in the sector and strengthening the Bank's partnership with the GoB.

14. **Lessons learnt.** The Project design incorporates the following lessons learned from similar projects both in Bangladesh and in other countries: (i) the Project has adopted an integrated service delivery approach for improving SWM (collection, transportation, recycling/processing and safe disposal); (ii) sanitary landfills are essential for final disposal and construction of disposal facilities can only start when land ownership has been secured and permits have been obtained for waste management facilities; (iii) waste management is about habits and perception and necessary change is a complex process of shifting the public perception and ensure social acceptance for source segregation, waste treatment and disposal systems; (iv) given that operating costs in the SWM sector are high, clear revenue streams must be identified upfront to ensure that O&M is covered preferably from own-revenues (dedicated waste fees or municipal taxes), revenue from sale of end products, or through budget support and/or subsidies; and (v) developing and operating regional-level disposal facilities, despite their financial and technical advantages, could face significant political and coordination challenges. Political commitment and institutional mechanisms therefore are important for successful operations.

[14] "*Assessment of SWM Investment Opportunities in Bangladesh (2021)*".

C. Components

15. The proposed Project will support the government to improve the SWM in Bangladesh through: (i) infrastructure investments in SWM; and (ii) institutional and capacity development support to the participating ULBs and the central government agencies. The Project will support up to 20 ULBs in Bangladesh in improving access to efficient and reliable delivery of SWM services to their populations. The Project includes the following components:

16. **Component 1 (Waste Collection and Transportation)** will improve and optimize municipal waste collection and transport services in selected ULBs. This component will include, but not be limited to, investments in: (i) expansion of primary waste collection; and (ii) procurement of goods and equipment such as collection containers and fleet, mechanical cleaning equipment, and safety gears kits.

17. **Component 2 (Waste Processing and Disposal)** will finance prioritized waste processing and disposal infrastructure, including: (i) construction and/or rehabilitation of transfer stations; (ii) provision of city-level and/or regional-level waste processing and disposal facilities, including closure and/or rehabilitation of polluting waste dump sites, construction and/or rehabilitation of engineered sanitary landfills, and provision of facilities related to composting, resource recovery (or integrated landfill and resource recovery facilities) and medical waste processing; and (iii) community and/or household-level solutions for disposal and treatment including reuse, recycling, and composing.

18. **Component 3 (Capacity Building and Project Management Support)** will strengthen the institutional and technical capacity for relevant central and local agencies in SWM. This component will also support project management, monitoring and evaluation, environmental and social (including public awareness campaign and public consultation, support for informal waste pickers), procurement, financial management, and provide necessary support with respect to supervision and maintenance of infrastructure investments. The Project will cover maintenance costs of waste facilities, during Project implementation, on a declining basis.

D. Cost and Financing Plan

19. **Project Cost.** The total Project cost is estimated to be USD231 million, which will be financed by AIIB (USD200 million) and counterpart funds to be provided by GoB (USD31 million). A breakdown of costs and sources of funds by components is presented in the table 1.

Table 1. Project Cost and Financing Plan (indicative)

Item	Project Cost (USD m)	Financing (USD m and %)	
		AIIB	GoB
Component 1. Waste Collection and Transportation	**24.25**	19.65 (81.03%)	4.60 (18.97%)
Component 2. Waste Processing and Disposal	**168.00**	147.36 (87.71%)	20.64 (12.29%)
Component 3. Capacity Building and Project Management Support	**17.53**	13.46 (76.78%)	4.07 (23.22%)

Contingencies	**21.52**	19.53 (90.75%)	1.99 (9.25%)
Total	**231.30**	**200.00** (86.47%)	**31.30** (13.53%)

** More details on a breakdown of proposed activities and costs for each Project component is provided in Annex 2.*

20. **Project Preparation Special Fund (PPSF).** The Bank's PPSF of USD2 million helped the government carry out essential preparatory activities for the Project, including preparation of: (i) policy briefs and Project framework documents; [15] (ii) feasibility studies for subproject investments; (iii) detailed engineering designs for selected subprojects; (iv) subproject specific fiduciary assessments, environmental and social assessments and instruments; [16] (v) tender documents; (vi) project implementation manual; and provision of (vii) training and capacity building for relevant government officials.

E. Implementation Arrangements

21. **Implementation period.** The Project is expected to be implemented from January 1, 2024 – December 31, 2028.

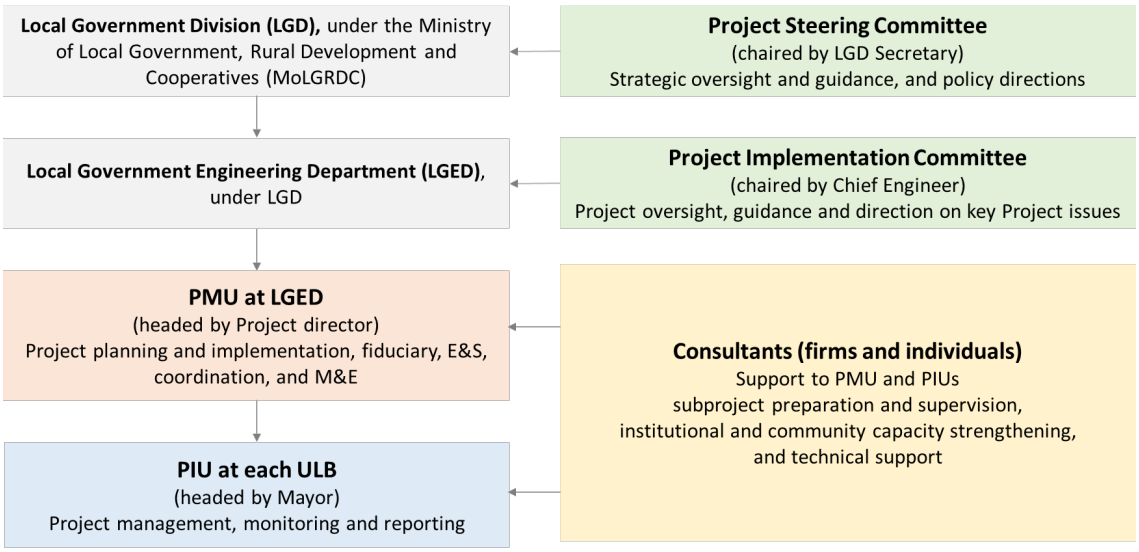
22. **Implementation management.** The Local Government Engineering Department (LGED) under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development and Cooperatives (MoLGRDC) will be the primary Project Implementing Entity (PIE) for this Project (Figure 1). A dedicated Project Management Unit (PMU) will be established at LGED headed by a Project Director and supported by a full-time deputy Project Director and a team of core technical staff. The PMU will be responsible for overall Project management. It will play an important role in coordinating with all agencies involved in Project implementation, ensuring overall quality and timeliness of investments. It will be also responsible for all fiduciary and Environmental and Social (E&S) requirements under the Project, and for Project Monitoring and Evaluation (M&E). All the participating ULBs will be required to constitute a Project Implementation Unit (PIU). PIUs, under the supervision of the PMU, will be also responsible for carrying out Project activities at the local-level and reporting it to the PMU.

23. The PMU and PIUs will be supported by a Project Management Consulting firm (PMC), hired by LGED, for technical support in carrying out subproject specific planning, design and implementation activities including preparation of all technical documents duly incorporating climate and disaster resilience, E&S impact assessment, procurement, contract management and implementation supervision. Detailed Project implementation arrangements, including compositions, roles and responsibilities of Project stakeholders are included in the draft Project Implementation Manual (PIM).

[15] Technical Guidance (including SWM regulatory and institutional assessment and guidance document of Best Practicable Options for SWM value chain), Environment and Social Management Planning Framework (ESMPF), Resettlement Planning Framework (RPF)/Livelihood Restoration Framework, Financial Management Manual (FMM), Project Delivery Strategy (PDS), and draft Procurement Plan.

[16] Environmental and Social Impact Assessment (ESIA)/Environmental and Social Management Plan (ESMP), and Resettlement and Livelihood Restoration Plan (RLRP).

Figure 1. Proposed Implementation Arrangement



24. **High-level coordination arrangement.** A high-level Project Steering Committee will be established, chaired by the Secretary of LGD to provide overall guidance and policy directions. [17] In addition, a Project Implementation Committee will be set up, chaired by the Chief Engineer of LGED, to provide guidance and direction on key Project implementation issues.

25. **Procurement.** Procurement for all contracts under the Project will be conducted in accordance with the requirements of the Bank's Procurement Policy (PP, November 2022) and the Interim Operational Directive on Procurement Instructions for Recipients (PIR, June 2016). The PMU will be responsible for overall procurement management of the Project, including the preparation and submission of the Project procurement plan, capacity assessment of PIUs for their adequacy in carrying out procurement and provision of necessary support. The subproject specific procurements shall be carried out by the PIUs with technical support from the PMU and the PMC. The PMU and PIUs will be supported by procurement specialists to facilitate effective and timely implementation of procurement activities under the Project.

26. **Financial Management (FM).** The PMU shall be responsible for the overall FM activities of the Project. The PMU and PIUs shall be staffed with qualified finance/accounts staff responsible for maintaining acceptable Project FM. The PMC shall provide additional Project fiduciary oversight and support including capacity building. The PMU together with PIUs shall prepare annual work plan and budget as per procurement plans and financing agreement. The PMU and PIUs shall maintain separate Project-related accounting, records and activities of all the eligible

[17] The committee will consist of representatives from the Ministry of Finance, relevant Ministries and government agencies. It will also help, as necessary, coordinate with relevant ministries such as the Ministry of Local Government, Rural Development and Co-operatives (for local governance and inter-government fiscal transfer); the Ministry of Environment, Forest and Climate Change (for sector policies and guidelines, oversight and monitoring, environmental regulations and rules, and permits, climate change); the Ministry of Power, Energy and Mineral Resources (for waste-to-energy regulations); the Ministry of Agriculture (relevant guidelines and requirements for composting); and the Ministry of Information (for awareness raising and IEC).

expenditures incurred by them. The PMU will consolidate and submit interim financial reports to AIIB within 45 days of the end of each fiscal quarter. The Project internal audit shall be carried out on annual basis and submit the Project internal audit report within three months. The internal audit shall be carried by an external accounting and audit firm on agreed ToR. The Project financial statements shall be audited annually by the independent auditors, acceptable to AIIB. The annual audited Project financial statements shall be submitted to AIIB within six months after the end of each fiscal year. The PIM shall include dedicated chapter on detailed Project FM arrangements.

27. **Monitoring and Evaluation (M&E).** The PMU will have the overall responsibility of results M&E for the Project. It will coordinate the collection of data and individual reports from PIUs and submit consolidated progress reports to AIIB periodically. Detailed M&E arrangements with clearly defined roles and responsibilities as well as the templates for periodic and annual progress reports have been developed and included in the PIM.

28. **AIIB's Implementation Support.** In view of the Project's scope and nature, the first standalone urban operation in Bangladesh, it would be prudent to plan on an intensive level of supervision through the first two years of implementation (see Annex 5 for details). Supervision missions will be scheduled about three times annually. Missions' frequency will be adjusted based on the implementation progress and performance of the Project. AIIB's supervision during the implementation period will include focused oversight and works supervision through a chain of technical and financial audits. In addition to formal missions, AIIB will conduct smaller and more targeted missions, when required, to resolve specific matters related to finalization of designs, procurement and FM matters, and the review and improvement of engineering supervision and implementation plans.

3. Project Assessment

A. Technical

29. **Project Design.** The proposed Project is taking the following approaches: (i) adopting an integrated service delivery approach for improving SWM covering its entire value chain, i.e., waste collection, transportation, processing and safe disposal; (ii) policy and institutional support at central and local levels to provide enabling environment for integrated and efficient SWM delivery system; (iii) supporting a regional approach, where practical,[18] for efficient SWM disposal and providing support to the ULBs in identifying the most optimal solution for their waste management; and (vi) starting with a set of high-capacity Project ULBs [19] with high level of Project implementation readiness. This approach will help facilitate learning and adaptation among Project ULBs.

30. All Project components are designed to actively support the government's strategies and regulations.[20] In particular, as per the SWM rules and the national 3R strategy, the Project will improve SWM services along its entire value chain: (i) segregation at source; [21] (ii) primary and secondary waste collection; [22] (iii) transportation; [23] (iv) recycling and resource recovery; and (v) sanitary landfilling[24] (see Annex 2 for details). The technical design is informed by the lessons learned from similar projects in Bangladesh and other countries and also adapted international best practices to the Bangladesh context. The Project design focuses on not only incorporating locally-adoptable SWM technologies and solutions while promoting the 3R principle for waste management.

31. The technical design of the Project is fully informed by the findings of the following studies and assessments carried out during Project preparation: (i) rapid waste sector diagnostics for Bangladesh; (ii) selection of Project ULBs based on robust and objectively verifiable criteria; (iii) knowledge sharing of good SWM practices with locally-adoptable SWM solutions and capacity building for key Project stakeholders; (iv) policy

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[18] Land availability, waste profile, transportation distances, technical and financial viability, and consultations with host and participating ULBs are considered.
[19] A set of 8 ULBs has been identified as a first batch and prepared the feasibility studies and subproject-level E&S instruments. Tender documents have been prepared for 4 ULBs.
[20] National Environmental Policy (1992), Environment Conservation Act (1995), Environment Conservation Rules (1997), and National 3R Strategy for Waste Management (2010), Bangladesh SWM Rules (2021), and other relevant regulations.
[21] Households will be encouraged to segregate their wastes to dry (inorganic; recyclable), wet (organic; compostable) and hazardous wastes using color-coded bins. The lessons of source segregation at batch 1 ULBs will be incorporated into batch 2.
[22] As an example, rickshaws with covered containers will collect segregated wastes from households and dispose of the collected wastes in storage containers placed at strategic locations to reduce travel times. It will reduce multiple handling of waste and improve efficiency (reduced manpower, time to unload and collect).
[23] The waste from the bins and transfer stations will be transferred to the waste processing facility by containerized waste collection vehicles. Geospatial planning tool has been used to design routing of waste transfer from the secondary collection points to the waste processing facility.
[24] An integrated resource recovery facility consisting of a composting, pyrolysis plant, material recovery facility and landfill is proposed. The pyrolysis plant will help recover oil from single use plastic and the material recovery facility will help salvage materials of value (paper, plastics, glass, etc.). The organic fraction or the wet waste will be composted. The inerts generated during the process of composting will be disposed in the landfill.

briefs including regulatory and institutional assessments and technical guidance on best practicable options for SWM; (v) Project framework documents relating to E&S, fiduciary aspects and pre-feasibility studies for all 20 Project ULBs; [25] (vi) feasibility studies for subproject investments for 8 Project ULBs; (vii) subproject specific E&S instruments; and (viii) draft PIM. The remaining subproject investments will be determined and prepared with support under Component 3 in compliance with the government's as well as the Bank's relevant policies. [26]

32. Detailed engineering designs (DEDs) for subprojects in 4 Project ULBs have been also prepared with the Bank's PPSF support. The infrastructure has been designed based on the technical design guideline[27] prepared under the Project, in line with the SWM Rules (2021) and respective technical guidelines by line ministries and agencies. All DEDs are subject to third party review by a project management consultant. The consultant will also support construction management and management of civil works contracts during implementation, with oversight from LGED, PMU and PIUs.

33. **Operational sustainability.** The Project will provide necessary technical and financing support to ensure operational sustainability of the Project investments. Appropriate budgeting and financial systems for medium- to long-term cost recovery will be established. With the operationalization of end-to-end service delivery solution ULBs will be required, with support under Component 3, to develop and implement financial sustainability plans with a transparent cost structure and identification of all revenue streams (both a dedicated SWM fee and an earmark from the ULB general budget) to incrementally meet the O&M costs of the entire SWM system. Technical trainings will be imparted to ULB officials for O&M of SWM value chain. The ULB officials will be supported by the technical consultancy firm for supervision of investment activities and for addressing issues such as behavior change for source segregation and willingness to pay for improved SWM services. Operational sustainability has been assessed as part of a financial analysis and incorporated into Project design (see details in Annex 3).

34. **Paris Agreement.** The proposed Project has captured the potential climate considerations of the SWM infrastructure in accordance with the AIIB Paris Agreement (PA) methodology[28] including an assessment of the climate mitigation and adaptation measures under the Project to ensure its alignment with PA. In the context of SWM, achieving PA involves implementing strategies and measures that contribute to reducing GHG emissions, promoting circular economy principles, and minimizing the environmental impact of waste disposal. The Project emphasizes the need to transition from traditional waste management practices, such as landfilling and open dumping, to

[25] Baseline information on each ULB on the existing waste management practices, investment needs, institutional capacity, expenditure and revenue streams have been collected. The Bank's technical assessment focused on, inter alia, the following aspects: (i) adequacy of technical standards and designs; (ii) adequacy of the government's and contractors' capacity to implement the Project; (iii) levels and adequacy of quality control during implementation; and (iv) Project monitoring and reporting methodology.
[26] Relevant Terms of Reference (ToRs) and subproject selection criteria are included in the PIM.
[27] Design considerations for disposal infrastructure, as an example, include: (i) expected waste input; (ii) target operational life (20 years, with the individual cells lasting for 5-7 years); (iii) geology; (iv) hydrogeology (minimum 2 meters above the water table); (v) hydrology; (vi) availability of cover materials; (vii) ground conditions and prevention of seepage among others.
[28] With the adoption of the methodology for assessing the alignment of AIIB's investment operations with the Paris Agreement (PA) on July 1, 2023, AIIB meets its commitment to actively support infrastructure projects that contribute to climate change mitigation, adaptation and resilience.

more sustainable approaches like waste reduction, recycling, and resource recovery. PA recognizes a significant role that waste management plays in mitigating climate change. By reducing GHG emissions associated with waste generation and disposal, improving waste treatment technologies, and promoting sustainable waste management practices, countries and communities can contribute to the global efforts of achieving the goals set out in the PA.

35. Solid waste has several obvious links to climate change. On the mitigation front, the waste sector in Bangladesh is a significant contributor to GHG emissions particularly methane emissions. [29] On the adaptation front, most of ULBs are located on the low-lying areas and prone to local flooding. Uncollected solid waste has been also significantly increasing local flooding by clogging drains and waterways. The Project is fully aligned with PA for the following reasons:

(i) *Climate Mitigation.* The proposed Project interventions are in line with the possible mitigation actions to deliver Bangladesh's Nationally Determined Contributions (NDCs) [30] and Long-Term Strategy (LTS) within a context of overall reduction of GHG emissions in the waste sector, including improvement of municipal waste management and implementation of the 3R principle for waste management. The Project is also aligned with the National 3R Strategy for Waste Management issued by the Department of Environment (DoE) under the Ministry of the Environment, Forest and Climate Change to eliminate waste disposal on open land, rivers, and flood plains.

Paris Agreement
Adopted in 2015 to take actions to limit global warming to well below 2 degrees Celsius above pre-industrial levels.
Nationally Determined Contributions (2021)
Emphasized SWM by ensuring 3R principles (Reduce, Reuse, and Recycle).
National Adaptation Plan (2023-2050)
Targeted Integrated waste and urban drainage management, promoting climate-smart, livable, pollution-free, clean and healthy cities, prioritizing urban waste and nature management.

The Project is also consistent with the Bangladesh Climate Change Strategy and Action Plan under the theme of mitigation and low carbon development as proper municipal waste management is being sought to lower GHG emission while promoting sustainable and livable cities. The Project will primarily cater for integrated SWM services and therefore will not compete with any existing more efficient alternative modes. The Project design is expected to significantly reduce fuel consumption during operation through route optimization. Further, the Project will support various GHG reduction measures such as waste segregation, composting, leachate treatment and material recovery.

(ii) *Climate Adaptation (BB2).* The Project has fully incorporated various climate adaptation measures into its design. During Project preparation, climate risk and

[29] The waste is one of the largest sources of methane emissions. Methane is a powerful greenhouse gas as its impact is much more pronounced in the short-term than carbon.
[30] Bangladesh submitted the updated NDCs in August 2021 with the enhanced GHG reduction targets of 21.85 percent below Business As Usual scenario (6.73 percent reduction in the unconditional scenario and additional 15.12 percent reduction in the conditional scenario with external financial and technology support).

vulnerability assessments have been carried out to analyze various potential risks, including precipitation, geology and earthquakes, flooding, and sea level rises, and which ranked project as Moderate risk. The major risks that can pose impacts to Project sites include, but are not limited to: (i) flooding due to extreme rainfall events especially during monsoon periods; and (ii) an increase in annual average temperature.

The most significant disaster and climate change risks associated with the subprojects are during operation. Landfill sites can be impacted by heavy rain and flooding. Surface water draining towards the landfill area could potentially increase leachate and bring about local flooding during major rain events. Considering these risks, climate responsive design features have been proposed to be incorporated into Project design, in particular in waste treatment and disposal facilities, to withstand extreme weather events, such as flooding, cyclones, extreme temperature. Furthermore, the Project investments will incorporate peripheral drainage systems and diverting water from the landfill cells. Elevated plinth and finished ground and embankment around the landfill have been introduced to mitigate flooding risks. The high rainfall standards have been considered in the design of leachate collection and rewater discharge systems. These adaptation measures to address climate risks were selected following the climate vulnerability assessment carried out as part of Environmental and Social Management Planning Framework (ESMPF). This makes the Project is PA-aligned on climate adaptation. Based on the above, the estimated climate adaptation financing amount will be USD11.8 million.

36. The PA assessment performed demonstrates that the Project is aligned with PA, both in terms of climate mitigation and adaptation and thus can be considered fully PA-aligned (see Annex 4 for details).

B. Economic and Financial Analysis

37. **Economic Analysis.** The economic analysis has been carried out on a cost-benefit framework, a methodology that compares scenarios '*with*' and '*without*' the Project to assess the economic viability of the Project in terms of economic internal rate of return (EIRR) and economic net present value (ENPV). The analysis considered various cost components, including capital investments, operations and maintenance costs, and anticipated benefits. The benefits encompassed cost savings derived from avoiding landfills, public health benefits associated with reduced incidents of waterborne diseases through effective SWM, cost implications of substituting chemical fertilizer with composts and quantification of reduced GHG emissions. Project benefits such as improved living standards and environmental quality are intangible and difficult to measure and thus not included in the analysis.

38. To arrive at the economic value, the stream of financial costs was adjusted to exclude applicable value-added tax and was also considered for the shadow price of labor, using an estimated conversion factor [31] of 0.93. All prices were expressed in

[31] Due to interruptions in supply chain and volatility in export and import volumes as an impact of the pandemic, shadow price of labor has been used instead of standard conversion factor.

constant values of the base year 2023. A discount rate of 12 percent[32] was applied, representing the Social Opportunity Cost of Capital (SOC). The sensitivity of the EIRR has been tested by varying Project costs and benefits.

39. The Project's economic net benefit is significant in the base case at a 12 percent SOC — with a positive ENPV for 20 years and an EIRR of 19 percent. The base case was stress tested for capital costs overrun, increase in O&M costs, and reduced expected benefits (see Table 2). The results show the Project will produce net economic benefits even under potential high-risk scenarios; which indicates the Project's robustness and ability to deliver positive economic outcomes (see detailed analysis in Annex 3).

Table 2. Economic analysis results and sensitivity analysis

Scenario	Change	NPV (Mil. USD)	IRR (%)
Base case		**102**	**19%**
Increase in capital costs	20%	70	16%
Increase in O&M costs	20%	95	19%
Decrease in benefits	20%	42	15%
Increased cost + decreased income	20%	2	12%

40. **Financial analysis.** The financial analysis of the Project focused on determining the incremental implementation and maintenance costs posed by the SWM investments and on O&M cost recovery for SWM investments in each participating ULB. It delved into the Project's financial aspects, including revenue generation, cost management, funding requirements, and financial projections. By incorporating projected cash flows, revenue streams, operating costs, and capital investment in the model, the key financial indicators such as the Internal Rate of Return (IRR), Net Present Value (NPV), and Benefit-Cost Ratio (BCR) were assessed to infer the Project's ability to generate sufficient cash flows, and its financial viability.

41. The assessment of financial viability is based on data collected on the current (2023) conditions and practices prevailing in the targeted ULBs. The analysis utilized the arithmetic mean of relevant parameters found in Project ULBs to assess key financial indicators over a Project lifespan of 20 years. In the base case scenario, the Project demonstrates a significant net income, especially when considering the potential financing support from Multilateral Development Banks (MDBs) at a 6 percent interest rate. The analysis resulted positive NPV over the 20-year period, indicating that the Project is expected to generate financial returns that exceed the initial investment even in high-risk scenarios (see Table 3).

Table 3. Financial analysis results

Scenario	Change	NPV (Mil. USD)	IRR (%)
Base case		**381**	**15%**
Increase in capital costs	20%	206	13%
Increase in O&M costs	20%	223	15%
Decrease in benefits	20%	144	12%

[32] The rate is used by the GoB to apprise projects; which is a conservative number, considering the commercial lending rate is up to 9 percent and MDBs interest rate ranges from 3.5 ~ 6.5 percent.

Increased cost + decreased income	20%	98	10%

C. Fiduciary and Governance

42. **Procurement.** A procurement assessment has been undertaken during Project preparation to identify capacity gaps and challenges in LGED and in participating ULBs which will be responsible for the procurement of goods, works and services under the Project. The LGED and PMU executed the MDB-financed projects,[33] and it has the adequate capacity in carrying out procurement-related activities such as tendering, tender evaluation and overall contact management. The capacity of ULBs and PIUs vary and many of them are not familiar with MDB-financed projects. To mitigate the risk, the procurement capacity of the PMU and PIUs will be strengthened under the Project by hiring procurement qualified experts and providing specialized trainings. PMC will also deploy qualified procurement professionals to support ULB-level procurement.

43. A Project Delivery Strategy (PDS) and Procurement Plan (PP) have been prepared with support from the consulting firm financed under the Bank's PPSF. At time of the Project appraisal, the feasibility study and activities in 8 Project ULBs have been identified and reflected in the PDS and PP. Project activities in the remaining ULBs will be identified and approved during Project implementation.[34] The PDS and PP will be updated during Project implementation to reflect the actual implementation, particularly for subprojects in the remaining ULBs.

44. Each ULB will carry out the procurement of simple works related to the SWM services following the National Competitive Tendering (NCT) procedures, while the PMU will carry out: (i) the procurement of goods following the International Open competitive Tendering (IOCT) and Request for Quotations (RfQ) procedures. The procured goods will be delivered to ULBs, and (ii) all selection of consultants under the Project. The Bangladesh National e-Government Procurement (e-GP) [35] (https://www.eprocure.gov.bd) is developed, owned and operated by the Central Procurement Technical Unit, which is a unit under the Implementation Monitoring and Evaluation Division of the Ministry of Planning. The e-GP system will be used for the Project for all civil works contracts executed by ULBs and procured following the NCT. All other procurement (i.e., including the procurement of goods procured following the IOCT, RfQ, and the selection of consulting services) will not use the e-GP system. It will be done manually instead.

45. **Financial Management (FM).** The Bank's review indicates that LGED has past experience in managing MDB-funded projects and familiar with FM requirements. Some of the ULBs also have implemented MDB-funded projects in the past. Based on the FM assessment, the capacity is considered adequate and the residual FM risk as "*Medium*". The proposed mitigation measures are the adoption of PIM, additional fiduciary support through PMC, and hiring of internal auditor.

[33] The existing PMU has experience in implementing the ADB-financed City Region Development Project II.
[34] It will follows the procedures included in the PIM.
[35] It was launched in 2011 and has been certified by World Bank and ADB for use for the procurement of works following the national competitive tendering procedures. Subject to the readiness of the readiness of the implementing agencies and the potential tendering community.

46. **Budgeting.** The Project shall follow GoB's planning and budgeting procedures. Based on the procurement plan, the PMU, together with PIUs, shall provide estimated budgetary requirements on an annual basis for review and approval. The approved Project work plan shall be included in the annual GoB budget as a separate budget head.

47. **Accounting and Reporting.** The PMU and ULBs follow a cash basis of accounting. The financial transactions are maintained on a manual basis. The PMU and PIUs shall make payments for project activities implemented by them. They shall maintain a separate account and have custody of Project-related supporting documents. On quarterly basis, PIUs shall submit financial reports to PMU in an agreed format and PMU shall consolidate and submit to AIIB. The PMC shall support PMU and PIUs in maintaining proper project related books of accounts and in reporting.

48. **Staffing.** The PMU shall depute a dedicated finance/accounts staff. PIUs have some constraints in deputing a dedicated finance/accounts staff. Hence, existing finance/accounts staff of PIUs shall also manage this Project and there shall be additional fiduciary support from the PMC. The PMC shall also provide training and capacity building of finance/accounts staff of PMU and PIUs.

49. **Internal Controls and Internal Audit.** LGED and ULBs have their regulations and procedures laid out for internal control environment. However, in practice, there are some weaknesses noted in areas of internal control environment in ULBs such as revenue recognition, asset accounting, contract management etc. The LGED has in-house internal audit team however, constrained by capacity and their audit does not cover ULBs. At ULBs, the internal audit function is weak or non-existent. The PMU shall hire an accounting/auditing firm to carry out an internal audit of Project activities including ULBs and report to AIIB. The PMU shall hire an internal auditor based on agreed ToR with AIIB. The cost of internal audit services may be covered through Project funds.

50. **External Audit**. The Comptroller and Auditor General of Bangladesh (OCAG) carries out external and statutory audit of ULBs. However, OCAG conducts audit in the cycle of 2/3 years and hence some backlogs were noted. The audit observations noted by OCAG were not timely resolved by the ULBs. The auditors have noted audit observations on some procedural non-compliances, loss of revenue, weakness in managing private sector operators etc. For the Project, the Foreign Aided Projects Audit Directorate (FAPAD), an arm of OCAG shall carry out external audit of the Project activities on agreed ToR with AIIB and report to AIIB.

51. **Funds Flow and Disbursement Arrangements.** The GoB shall use its existing treasury system for releasing its counterpart funds. It shall provide adequate counterpart and release funds to PMU and PIUs on a timely basis. The loan proceeds shall be disbursed by direct payment, reimbursement, and/or advance methods of disbursement. The direct payment method shall not be used for local currency (BDT) payments, whereas the advance method will be used for both local currency (BDT) and any other foreign currency payments. The PMU shall prepare withdrawal applications together with supporting documents and submit to AIIB. Upon receipt of the withdrawal claims, AIIB shall review and make disbursement accordingly. The details of Project specific disbursement arrangements shall be made in the disbursement letter. The Project shall

follow the Bank's standard disbursement methods, such as: (i) payments against Special Commitments; (ii) reimbursement of eligible expenditures; (iii) designated advance (DA); and (iv) direct payments. Disbursement Letter shall detail out the authorized signatories, DA conditionalities, process of submitting claims and other terms.

52. **Governance and Anti-corruption.** AIIB is committed to preventing fraud and corruption in the projects it finances. AIIB places the highest priority on ensuring that the projects that AIIB finances are implemented in compliance with AIIB's Policy on Prohibited Practices (2016). Implementation will be monitored regularly by AIIB staff. The Bank reserves the right to investigate, directly or indirectly through its agents, any alleged corrupt, fraudulent, collusive, coercive or obstructive practices, and misuse of resources and theft or coercive practices relating to the Project and to take necessary measures to prevent and redress any issues in a timely manner, as appropriate. The Bank will facilitate and monitor the work related to tender document preparation and tender/proposal evaluation under Bank financing.

D. Environmental and Social

53. **Categorization.** AIIB's Environmental and Social Policy (ESP) applies to the Project, including the Environmental and Social Standards (ESSs) and the Environmental and Social Exclusion List. The initial E&S due diligence determined that ESS 1 (Environmental and Social Assessment and Management) applies to the assessment of E&S impacts of Project activities. ESS 2 (Land Acquisition and Involuntary Resettlement) also applies as Project-related activities can lead to adverse direct and indirect impacts on waste pickers and those who derive income from landfills and potentially cause physical and economic displacement of title and non-title holders coinciding within the buffer zone[36] and those located along the access road alignment that will be upgraded. The extent of physical displacement for upgrading access roads to the disposal facilities is anticipated to be limited as construction activities will be within the existing Right of Way (RoW). ESS 3 (Indigenous Peoples) will not apply to this Project.

54. As per the Bank's ESP, the Project has been assigned Category A, and an Environmental and Social Management Planning Framework (ESMPF) and Resettlement Planning Framework (RPF) have been prepared. The ESMPF and RPF will guide the preparation of subproject specific Social Impact Assessments (ESIAs) and mitigation plans for all subprojects. Moreover, for four ULBs, draft versions of ESIAs, Environmental and Social Management Plans (ESMPs), and Resettlement and Livelihood Restoration Plan (RLRPs) have been prepared.

55. **Environment.** The Project will reduce exposure to pollutants and disease vectors associated with solid waste through enhanced SWM services thereby improving environmental and public health conditions. The Project will construct SWM infrastructure covering waste collection, transportation, processing and disposal facilities, and dumpsite remediation. The potential environmental risks and impacts of the Project will be related to construction of these facilities such as air pollution, soil,

[36] DOE has mandated a buffer zone of 200 meters from the landfill site for assessing the impact of the landfill and for restricted developmental activities.

surface and ground water contamination. Operational impacts include occupational and community health and safety, and odor nuisance from landfills. These potential risks and impacts can be avoided, minimized or mitigated by adoption of the good engineering design as a first step, and application of mitigation measures identified in the ESIA which will be incorporated into the site-specific ESMP. The detailed design for all subproject areas will be further examined to incorporate the appropriate design measures to minimize environmental risks and impacts of the Project at an acceptable-level.

56. **Social Aspects.** Project activities will be carried out in 20 ULBs where land is available. The land for the identified Project activities is currently under the ownership of Project ULB. No land acquisition is presently anticipated for the Project. The primary social impacts stemming from the Project include direct and indirect economic displacement of waste pickers and those who derive income from the landfills, especially during construction. Moreover, set-back area requirements around the landfill sites prescribed by the DoE may lead to potential physical displacement of structures. The Project also plans to upgrade selected access roads to the landfills, and the civil works for road rehabilitation will be confined to the RoW. It is anticipated that there will be a temporary loss of access and income for affected titleholder businesses residing along the proposed road segments.

57. The Project is also likely to generate differentiated impacts on vulnerable groups, including women, children, and the elderly. Moreover, labor influx may heighten potential risks related to Gender-based Violence (GBV) and Sexual Exploitation and Abuse/Sexual Harassment. The nature of the Project may also cause potential health risks to communities due to pollution of soil, water resources etc. The area surrounding the Project site is also likely to experience increased traffic flows.

58. Based on the currently available ESIAs and RLRPs for four ULBs, it is estimated that 52 waste pickers (*tokai*) (25 males; 27 females), 13 *vangari* shop[37] owners, and 17 van collectors and drivers will be directly affected. Given the seasonal patterns of work of waste pickers and other entities that derive income from landfills, the RLRP will be updated, and a cut-off date will be declared closer to Project implementation. Temporary loss of income during the road improvement is expected to affect 214 titleholder commercial establishments along the proposed alignment.

59. In order to mitigate the negative impacts of the Project, the RLRP has been prepared following the RPF. The RLRP includes an entitlement matrix that links the various categories of losses incurred by title and non-titleholders to entitlements. Along with provision of compensation for loss of assets at replacement cost, the RLRP provides long-term measures for the rehabilitation of the adverse impacts on various groups. The compensation under the RLRP includes payment to the affected waste pickers and other entities, training opportunities, provision of employment opportunity in the recycling facility, and opportunity to work for the Project during construction of the landfill. Replacement costs for the affected structures and other entitlement for *vangari* shop structures and commercial establishment owners are also included as part of the entitlement matrix.

[37] Small shops that buy and sell recyclable waste and old and scrap items.

60. **Gender and Social Inclusion.** Socio-economic surveys and field visits have identified women and elderly to be involved in waste picking and it is expected that the impacts on these groups are likely to be disproportionate. Separate consultations with women and vulnerable groups were conducted to better understand their concerns and aspirations in order to inform the development of mitigation measures. The Project design also includes training and awareness-raising sessions for women and vulnerable groups. Currently waste pickers face health issues that leads to loss of working days and this project has included provisions for health screening and care to reduce adverse health impacts. A Gender and Social Inclusion Plan (GSIP) is prepared, as part of the ESIA, providing specific actions to improve women and vulnerable groups' participation and to empower them.

61. Specifically, the GSIP includes provisions to conduct gender assessment, policy dialogues, capacity building, and training for women in the waste sector. The Project will strive to reduce the discriminations of a male-female ratio in all works under Project, engage women in construction and maintenance where possible. A safe working environment and amenities will also be provided for women (e.g., waiting room, toilets, day-care center). Also, specific measures to improve women's participation are provided in the plan (e.g., connecting female graduates and trainees with employment opportunities and supporting vulnerable groups to access wider economic opportunities).

62. **Occupational Health and Safety, Labor and Employment Conditions.** It is envisaged that the Project will lead to positive impacts in participating ULBs as compared to the current waste management practices which have negative impacts on community and worker health and safety. Construction workers will be guided by the subproject specific ESMPs which also provides the use of the World Bank Group Environmental, Health and Safety (EHS) Guidelines for Water, Sanitation, Solid Waste Management and Health Care Facilities. The Project also supports training in SWM, robust protocols for ensuring continuity of waste management services and use of protective gears/equipment by sanitation workers to minimize health risks.

63. **Stakeholder Engagement, Consultation and Information Disclosure.** Several consultations, meetings, and focus group discussions (FGDs) with stakeholders were carried out for the Project, particularly during the preparation of the ESIA and RLRP. Continued consultations with Project-affected people, vulnerable groups, and communities will be conducted throughout the Project cycle. Documentation of all stakeholder engagement is included in the ESIA, which includes discussion on loss of land, structures, and livelihoods as well as Project impacts, perception, and benefits, among others. Stakeholder Engagement Plans (SEP) have been also prepared for the four ULBs, as part of the ESIA, highlighting the steps for the succeeding consultations. Information dissemination sessions will be held at major intersections and different channels to raise awareness and encourage participation. The ESMPF, RPF, and ESIA have been disclosed on the government's website. The executive summary of ESIA and the entitlement matrix of RPF/RLRP have been translated in Bengali. These documents have also been disclosed on the Bank's website. Printed documents will be made available in the Project area.

64. **Grievance Redress Mechanism (GRM).** A four-tier GRM will be established to receive, acknowledge, evaluate, and facilitate the resolution of the complaints relating

to Project E&S issues with corrective actions. This GRM covers the following levels: ward/local level, district level, Project management unit and the ministry levels. The GRM also includes steps to address complaints and issues related to procurement and construction quality. This will be undertaken using understandable and transparent processes that are gender-responsive, culturally appropriate, and readily accessible to all segments of the affected people. Records of grievances received, corrective actions taken, and their outcomes shall be properly maintained and regularly monitored and reported by the Project. A dedicated workers GRM will also be established.

65. **Project-Affected People's Mechanism (PPM).** The PPM has been established by the Bank to provide an opportunity for the independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by the Bank's failure to implement its ESP in case when their concerns cannot be addressed satisfactorily through the Project-level GRM or the processes of the Bank's Management. Information on AIIB's PPM is available at: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

66. **Climate Change.** Bangladesh is among the most vulnerable countries to climate change and disasters. Several major risks that can pose impacts to Project sites, including flooding due to extreme rainfall events, cyclone and storm surges, and increase in annual average temperature. To reduce the devastating consequences of extreme weather events requires improving systems of planning and implementing climate-smart and disaster resilient infrastructure, including SWM infrastructure.

67. The Project aims to reduce climate change vulnerability by incorporating appropriate adaptive measures into the Project design. Both the ESMPF and PIM will help to ensure that the investments are designed considering the climate and disaster resilience aspects. Technical design guidelines for climate-smart and disaster resilient SWM infrastructure in the PIM will guide the flood mitigation or planning structural design to protect life and increase the Project's capacity to reduce exposure to natural hazards. Potential positive impacts from the Project activities also include addressing increased leachate treatment needs and waste collection around waterways with flooding risks, preventing waste from blocking drains and causing flooding. Therefore, this Project is considered contributing to climate adaption financing. The Project also contributes to climate mitigation finance.[38] GHG impact will be assessed for the construction of: (i) decentralized household composting systems for bio-degradable waste; (ii) centralized composting or anaerobic digestion facilities; (iii) material recovery and resource recovery facilities; (iv) regional sanitary landfill facilities for the disposal of the inert; and (v) remediation and rehabilitation of existing dumpsites.

[38] GHGs from waste are one of key contributors to climate change. The World Bank report on waste management and climate change estimates that current waste management methods, specifically emissions from landfill, account for almost five percent of total global GHG emissions and 12 percent of the world's emissions of methane (CO^4), a GHG with an impact over 20 times that of carbon dioxide (CO^2).

E. Risks and Mitigation Measures

68. The overall Project risk is rated "*High*". Despite the government's strong support, commitment, and ongoing efforts in improving the SWM conditions, there are: (i) significant potential E&S risks, including possible delays due to impacts on surrounding local communities, Project benefits not flowing to informal SWM workers; and (ii) potential delays due to implementation capacity at state and local levels. Potential implementation risks foreseen are manageable and appropriate mitigation measures have been considered and incorporated in the Project design.

Table 2. Summary of Risks and Mitigating Measures

Risk Description	Assessment (H/M/L)	Mitigation Measures
Political and Governance Risks Uncertain political environment, fraud and corruption risk	Medium	Political risk will be mitigated through a broader set of stakeholder engagement, dissemination and Information, Education and Communication (IEC) activities on the merits (health, environmental) of a SWM system. High fiduciary standards and incorporating necessary checks will also prevent corrupt practices.
Macroeconomic risks GoB increasing external debt and economic situation might pose a risk	Medium	The Bangladesh economy has experienced strong growth [39] and is expected to remain robust over the next five years. [40] The GoB's balance sheet remains healthy with public debt of 37.5 percent of GDP in FY2022. However, uncertainty over the pandemic, geopolitical conflict in Europe along with rising commodity prices, and slow growth in key export destinations may impinge upon growth in near-term. The microeconomic and debt situations will be monitored in coordination with IMF and relevant partners.
Institutional Capacity for Implementation and Sustainability Weak institutional capacity of ULBs	High	The Project provides robust institutional and capacity building programs that support the PMU and Project ULBs for carrying out all the investment activities and undertake institutional reforms for long-term sustainability of the Project. In addition, they will be supported by a PMC firm in coordinating and overseeing all Project activities. Individual experts will be appointed under the Project to strengthen the PMU and PIUs.
Fiduciary risk Delay in release of adequate counterpart funds, capacity constraint	Medium	Additional fiduciary oversight and support shall be provided by the PMC firm. In addition, PIM will be adopted, and an external accounting/auditing firm shall be hired for internal audit services.

[39] GDP growth rate between FY2010-2022 averaged over 6 percent despite the growth slowed down to 3.4 percent in FY2020.
[40] According to International Monetary Fund (IMF) data.

of finance/accounts staff at ULBs, weak internal control environment at ULBs.		
Environmental and Social Complex subprojects in SWM Negative environmental and social impacts from the project such as loss of livelihood of waste pickers. Land acquisition	High	The E&S framework documents have been prepared and will provide necessary technical guidelines to avoid long-term irreversible impacts on sensitive areas, select interventions based on SWM planning. Subprojects would be subject to proper E&S due diligence and follow regulations and best practices. The Project design and implementation arrangements are also supported by technical assistance and project management support for monitoring of E&S risks and mitigation actions. When selecting the ULBs, priority was given to ULBs with sufficient land available for Project activities. All batch 1 ULBs have committed to using the identified land, which is owned by the government, for this Project.
Stakeholder risks Opposition from local communities and other key stakeholders could have a negative impact on the achievement of the Project's objective.	Medium	Particular attention shall be given to local communities through extensive stakeholder consultations. Dedicated SEP shall be prepared for the Project as part of ESMPF that elaborates the stakeholder engagement and community mobilization procedures to be followed for adequate consultation and transparency.
Counterpart funds Given the economic situation, GoB may be unable to contribute the required counterpart funds.	Medium	GoB is fully committed to supporting the Project. AIIB Project team has been regularly interacting with both central level and local level government officials. As per GoB procedure, the Project will also be approved by a high-level committee chaired by the Prime Minister reflecting the commitment to support the Project at the highest level.

4. Next steps

69. The major milestones are projected as follows:

Milestones	Actual or Expected Completion Dates
Screening	April 8, 2020
Concept Review	February 1, 2023
Final Review	August 30, 2023
Negotiation	December 5, 2023
President Approval	January 16, 2024
Loan Signing	March 2024
Effectiveness	April 2024
First Disbursement	May 2024

Annex 1: Results Monitoring Framework

Project Objective:	To improve solid waste management (SWM) system in selected Urban Local Bodies (ULBs) in Bangladesh.									
Indicator Name	**Unit of measure**	**Baseline** (2023)	**Cumulative Target Values**					**End Target**	**Frequency**	**Responsibility**
			YR1	**YR2**	**YR3**	**YR4**	**YR5**			
Project Objective Indicators:										
1. Number of people with access to improved SWM services (gender disaggregated)	Number (Thousand)	0.0	0.0	-	-	1,200	2,400	4,312	Annual	PMU*
2. Solid waste (a) recycled and (b) composted	Metric tons/year (cumulative)	0.0	-	-	21,900 / 43,800	73,200 / 127,750	147,095 / 230,680	147,095 / 230,680	Annual	PMU
3. Solid waste is safely disposed in the engineered landfills**	Metric tons/year (cumulative)	0.0	-	-	147,895	419,950	864,502	864,502	Annual	PMU
Intermediate Results Indicators:										
1. Door-to-door collection of segregated solid waste from households (gender disaggregated)	Percentage	30	-	-	45	60	75	75	Annual	PMU
2. By-products from waste treatment (outputs of compost plant and MRF) (a) inorganic recyclables and (b) compost	Tons/year	0	-	-	17,520 / 8,760	58,560 / 25,550	117,676 / 46,136	117,676 / 46,136	Annual	PMU
3. Number of cities with landfills (with climate resilient designs adopted) constructed and operational	Number	0	-	-	6	12	20	20	Annual	PMU
4. Number of regional landfills operational	Number	0	-	-	1	2	3	3	Annual	PMU
5. Number of ULBs that adopted revenue enhancement plan for SWM cost recovery	Number	0	-	-	4	12	20	20	Annual	PMU
6. Number of ULBs with long-term contracts with the private sector for the partial or complete value chain SWM services	Number	0.0		4	8	14	20	20	Annual	PMU
7. Number of ULBs who have conducted health and safety training for workers in solid waste collection and treatment provided using PPEs	Number	0.0	-	4	8	14	20	20	Annual	PMU

8. Greenhouse Gas (GHG) reduction	Tons of CO_2/year	-	-	-	-	30,000	70,000	100,000	Annual	PMU
9. Improvements in ambient air quality following the operation of integrated SWM facility	PM 10 (µg/m$^{3)}$ PM 2.5 (µg/m$^{3)}$ SOx (µg/m$^{3)}$ NOx (µg/m$^{3)}$ CO (ppm)	257-1000 209-1000 126-5434 50-1027 16-247	-	-	-	150 (24hr) 65 (24hr) 80 (24hr) 80 (24hr) 20 (1hr)	150 (24hr) 65 (24hr) 80 (24hr) 80 (24hr) 20 (1hr)	150 (24hr) 65 (24hr) 80 (24hr) 80 (24hr) 20 (1hr)	As per ESMP	PMU
10. Share of registered complaints resolved within 30 days	Percentage	0.0	-	-	50	60	80	80	Annual	PMU
11. Number of ULBs in which beneficiary satisfaction survey is conducted	Number	0.0	-	-	8	12	20	20	Annual	PMU

* Based on inputs from ULBs with data generated from MIS.

** Excluding 25 percent recycled and composted in the community-based facilities.

Annex 2: Detailed Project Description

1. Bangladesh is one of the most populous and densely populated countries in the world. Around 40 percent of its 169.4 million people live in the urban areas of the country. During the period between 1991 – 2020, the urban population increased by 3 times and is projected to increase by 1.5 times between 2021 – 2040. By 2040, 95 million people are expected to reside in urban areas. Rapid urbanization, appreciable economic development, and improved lifestyles are contributing to increased solid waste generation.

2. The estimated waste generated was 40,000 tons per day in 2022 and is expected to increase to 57,000 tons per day by 2030 and 118,000 tons per day by 2040.[1] The average per capita waste generation varies between 0.2 – 0.56 kg/day for households. The waste generation is found to be higher in the wet season and lower in the dry season, per capita waste generation is estimated to be 0.5 kg in the wet season and 0.35 kg in the dry season. There are 340 ULBs (12 city corporations[2] and 328 Pourashavas) responsible for providing basic urban services and infrastructure such as SWM, roads, drains, streetlights, public markets etc. In about 200 ULBs, solid waste generation is up to 20 tons per day. In 19 percent, waste generation is between 21-60 tons per day, while in 6 percent, solid waste generation is between 61-100 tons per day. 7 percent of the ULBs generate more than 100 tons per day. The solid waste in Bangladesh consists primarily of food and vegetable waste (79 percent), plastics (8 percent), and rags/textile waste (2 percent). Solid wastes have a high moisture content (60 – 70 percent) and low calorific value (670 kcal/kg). The waste composition is presented in the table below.

Table A2-1: Waste composition

No.	Component	At source (%)	At landfill (%)
1.	Food and vegetable waste	83	79
2.	Bone	0.3	0.1
3.	Paper	3	1.8
4.	Plastic	9.5	7.7
5.	Rags, textiles, jute	2.3	0.4
6.	Glass	0.85	0.67
7.	Leather, rubber	1.3	0.5
8.	Glass / tube lights / LED	0.1	-
9.	Medicine strips and medicine box	0.09	0.03
10.	Soft drink bottles	0.04	-
11.	Foam	0.31	0.05
12.	Diaper	1.32	0.24
13.	Clay pots	0.66	0.45
14.	Bamboo baskets	0.26	-
15.	Coconut shells	4,67	1.55

- Source: Waste Concern, 2022

[1] Assessment of SWM Investment Opportunities in Bangladesh, 2021 – based on the assumption that the amount of waste generated is proportional to the population and the average income of the people. In addition, other factors such as climate, level of education, social and public attitude also may affect the amount and composition of waste.
[2] Dhaka North, South, Narayanganj, Gazipur, Chittagong, Khulna, Rajshahi, Barisal, Sylhet, Comilla, Rangpur, and Mymensingh

3. In Bangladesh, early waste management practices followed indiscriminate open dumping, burning, disposal into water bodies, and disposal on agricultural lands. Recycling and composting of wastes began in 1980 and 1990 and sanitary landfill with gas recovery was initiated in 2010. A series of initiatives has been taken to comply with relevant national and international frameworks. Despite these efforts, SWM performance is far from desirable with 40 – 60 percent of the waste not collected. Improper waste disposal has resulted in serious environmental issues including air, water, soil and posing a great threat to public health, and undermining climate risks. The uncollected waste in waterways is causing flooding and ended up in the ocean that poses a risk to the marine ecosystem (given that 80 percent of marine waste is land-based).

4. Key issues include: (a) lack of required SWM infrastructure - old fashioned and inefficient waste collection, transportation, and disposal system (e.g., ageing trucks, limited no. of waste bins/containers) and improper choice of technology; (b) absence of waste segregation, lack of awareness regarding 3Rs and environmental problems; (c) multiple handling; (d) minimal processing (e.g., unprocessed biodegradables due to poor composting capacity and missing composting markets - only 5 percent of the collected waste is composted, whereas 79 percent of the generated waste is organic); (e) crude dumping – many with already exceeded capacity; (f) inadequate policies, guidelines, and standards; (g) lack of partnership between public sector, private sectors and community groups; (h) land availability for waste disposal; (i) technical and financial capacity (e.g., designing and operation of disposal facility at local level is limited); and (j) lack of waste data management system (e.g., transportation does not synchronize with the capacity of collection points).

5. Waste collection and disposal capacity at the local-level has not kept up with the current and future demand for SWM services. Current SWM practice at ULBs is conventional and focuses on end-of-the-pipe solutions, i.e., waste collection, transportation, and final disposal. There has been little attention to segregation, reusing, recycling, and reducing waste.

Table A2-2: Waste management situations for each Project ULB

No	Project ULBs	Primary Collection	Secondary Collection and Transportation	Waste Processing	Disposal	Recycling and Resource Recovery
1	**Raishahi**	• The door-to-door collection of waste is almost 90% and only 10% of waste remains uncollected and unmanaged. • No source segregation of waste practiced at household levels. • Waste from the households is collected with the help of Primary Collection Service Providers (PCSPs) from the NGOs. • At present, around 270 rickshaw vans are used to collect the garbage from the HHs. • The Rickshaw vans (length 0.91 m x width1.06 m x height 0.76 m) can accommodate approximately 160 of kg waste per trip. • Approximately 86 MT of waste collection per day through the rickshaw vans per trip.	• The ULB has no covered secondary waste storage area. • The waste collected from HHs are disposed at the designated Secondary Transfer Stations (STSs). • At present there are 10 STSs currently in operation in different parts of the city. • The collects waste from these Secondary Waste Storage facilities	• At present there is no treatment facilities in the. Waste is dumped into open areas/dumping sites.	• Collected solid waste by the Collection crew (240 MT) is disposed of at at Nawdapara which is about 8 km from the City Centre. • The total area of the site is aroud 10.385 acres. • The site is currently used as a waste	• There is no compost or biogas plant available in the city area.

			through Garbage trucks (25 in number) with varying capacities of 3 ton.		disposal facility using crude dumping methods.	
2	**Rangpur**	• Approximately 21,000 households are covered by door-to-door waste collection services. • The entire city is not covered by door-to-door collection system. • No source segregation of waste practiced at household levels. • Waste from the households is collected with the help of Primary Collection Service Providers (PCSPs) from the NGOs. Waste is collected between 7 AM to 2 PM. • On average, the City Corporation collects 25 tons of solid waste daily. • Around 144 rickshaw vans (length 1.07 m x width 0.76 m x height 0.85 m) are currently used for primary waste collection. • There are 49 slums in the City Corporation area with approximately 6282 households, about 4% of the total households of the City Corporation area. • The City Corporation provides no waste collection service in the slums.	• After collecting household wastes, van drivers accumulate waste at transfer stations or open waste collection points. • One designated Secondary Transfer Stations (~ 225 sq. Feet with roof and walls) exist. • The City Corporation collects waste from these Secondary Waste Storage facilities through Garbage trucks (number-18) with the capacity of 3-ton. • It is also observed that the majority of these vehicles in possession of the City Corporation are old.	• At present, there are no treatment facilities in the City Corporation. Waste is dumped into open areas/dumping sites. • A private operator operates a 20 TPD capacity compost plant in the City Corporation.	• An existing landfill (6 acres) site is present; however, simple dumping is practiced at present.	• The City Corporation has one composting plant and can compost 20 TPD of organic waste. • The plant was established by DoE as a CDM project.
3	**Chattogram**	• The door-to-door waste collection covers all the city wards. • It was found that 1995 number of waste collectors were engaged for door-to-door waste collection using rickshaw vans. • No source segregation of waste practiced at household levels. • Recently, the city has started a pilot source segregation program in three city wards. • Waste from households is collected with the help of Primary Collection Service Providers (PCSPs) or from NGOs. • Around 857 rickshaw vans are used to collect the waste from the HHs. The Rickshaw vans (length 1.82 m x width 1.21 m x height 0.76 m) can accommodate approximately 400 kg of waste per trip. • About 1,028 tons of waste collection per day through rickshaw vans • No waste collection services are available in the slums/low-income communities within the City Corporation area.	• There are 888 waste collection points found within the city limits, out of which 263 are concrete bins, 514 are open collection points, 70 are container spots, 5 are plastic spots, and 6 are secondary transfer stations. • Current transfer stations and collection points are inefficient and a source of environmental pollution. • The waste is transported through garbage trucks with capacities-7-ton, 5 tons, and 3-ton. The city has 189 waste collection trucks, of which 48 are out of order. • Currently, 17 container carrier trucks, 13 compactors, and 104 open dump	• At present, there are no treatment facilities in the City Corporation. Waste is dumped into open areas/dumping sites. • A private operator operates a 20 TPD capacity compost plant in the City Corporation.	• Currently, there are two landfill sites in the Chattogram CC area located at Halishahar and Arifin Nagar. • Halishahar and Arefin Nagar landfill site has a total area of 14.39 acres and 19.56 acres respectively. • Currently, crude dumping methods are used in both landfill sites without any environmental protection.	• There is a compost plant of capacity 20 TPD and a FSTP in the Halishahar landfill site of CCC.

			trucks are operational. • The maximum waste-carrying capacity of the current fleet is 370 trips per day.			
4	**Kushtia**	• Approximately 50% households in the old wards are covered by door-to-door waste collection services. • No source segregation of waste practiced at household levels. • Most residents dispose of their solid waste in vacant spaces and open drains. • Waste from the households is collected with the help of PCSPs from the NGOs. Waste is collected between 9 AM to 5 PM. • The municipality collects 63 tons of solid waste daily. • Around 48 rickshaw vans are used to collect the garbage from the HHs. • Rickshaw vans (length 1.2 m x width1.06 m x height 0.76 m) can accommodate approximately 350 kg to 400 kg of waste per trip • Approximately 16.8 tons of waste collection per day through the rickshaw vans per trip. • Currently, no waste collection service is provided by the Municipality in the slums.	• After collecting household wastes, van drivers accumulate waste at transfer stations or open waste collection points • Waste transportation is done through a total of 9 trucks with capacities-5-ton,3-ton, 2-ton and 1.5 ton • The maximum waste-carrying capacity of the current fleet is 15 trips per day. This results in a total carrying capacity of 38 tons per day.	• At present, there are no treatment facilities in the Municipality. • Waste is dumped into open areas/dumping sites. • Only a small 5 TPD capacity compost plant is operational in the municipality. • The plant is operated by a private operator.	• Currently, the solid waste by the Municipality is disposed of at Majhidanga Mouza under the Kara Para union situated in Ward No. 14. (15.12 acres) ~2.75 km north of the core commercial and residential areas.	• There is a compost plant and a FSTP in the landfill site. • The plant can compost 5 tons of organic waste and 18 cubic meters of fecal sludge daily. • Municipality provides 5 tons/day of municipal waste to the plant at no cost to the private sector. • AID Foundation supplies fecal sludge of 18 cubic meters per day to the FSTP.
5	**Munshiganj**	• Approximately 5,880 households are covered by door-to-door waste collection services. • No source segregation of waste practiced at household levels. • Waste from the households is collected with the help of PCSPs from the NGOs. • On average, the municipality generates 34 tons of solid waste daily. Currently, around 23 rickshaw vans are used to collect the garbage from the HHs. • The Rickshaw vans (length 1.2 m x width1.06 m x height 0.76 m) can accommodate approximately 350 kg to 400 kg of waste per trip. • Approximately 13.08 tons of waste collection per day through the rickshaw vans per trip. • The Municipality provides no waste collection service in the slums.	• After collecting household wastes, van drivers accumulate waste at transfer stations or open waste collection points. • Waste transportation done through garbage trucks (number-7) with capacities- 5-ton, 3-ton, 2-ton and1.5-ton. • The maximum waste-carrying capacity of the current fleet is 6 trips per day. This results in a total carrying capacity of 17 tons per day.	• At present, there are no treatment facilities in the Municipality. Waste is dumped into open areas/dumping sites.	• Currently, the Municipality's solid waste is has a open waste dumping site. • The total site area is 4.67 acres. • The site currently used as a waste disposal facility using crude dumping methods. • An estimated 20 tons of waste are disposed per day in an uncontrolled manner.	• It is observed that the Municipality doesn't have any provision to recycle or recover waste.
6	**Bhola**	• Approximately 7,109 households are covered by door-to-door waste collection services. • The door-to-door collection of waste is almost 55%.	• After collecting household wastes, van drivers accumulate waste at transfer stations	• At present, there are no treatment facilities in the	• Currently, the Municipality's solid waste is dumped into an open	• The Municipality doesn't have any provision to recycle or

		• No source segregation of waste practiced at household levels. • Waste from the households is collected with the help of PCSPs from the NGOs. • Waste is collected between 9 AM to 5 PM. Currently, around 17 rickshaw vans are used to collect the garbage from the HHs. • The Rickshaw vans (length 1.2 m x width1.06 m x height 0.76 m) can accommodate approximately 350 kg to 400 kg of waste per trip. • Approximately 7 tons of waste collection per day through the rickshaw vans per trip. • There are 3 slums in the Municipality area with approximately 3,000 households which are about 23% of the total households of the Municipality area. • Currently, no waste collection service is provided by the Municipality in the slums.	or open waste collection points. • The Municipality collects waste from the collection points using waste collection trucks (number-2) with with capacities of 3-ton and 1.5-ton. • The maximum waste-carrying capacity of the current fleet is 8 trips per day. • This results in a total carrying capacity of 12 tons per day.	Municipality. All of the collected Waste is dumped into open areas/dumping sites.	waste dumping site. • The total site are is 5.89 acres. • The site currently used as a waste disposal facility using crude dumping methods. • An estimated 12 tons of waste are disposed per day in an uncontrolled manner.	recover waste after the composting plant installed under the Second Urban Governance and Infrastructure Improvement Project (UGIIP-II) is not operational due to lack of manpower and repair work.
7	**Kishoreganj**	• The municipality provides primary waste collection services. Approximately 4,702 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality as recommended under the SWM Rules 2021. Lack of awareness-raising programs by the Municipality or by CSOs regarding segregation of waste. • Waste from households is collected with the help of PCSPs. Waste collection time - from 8 am to 11 am and 3 pm to 5 pm. • 22 Rickshaw vans (length 1.52m x width 1.22m x height 0.76m) are used for primary waste collection. Around 350 kg of waste can be accommodated in the rickshaw van per trip. Approximately 7.7 tons of waste collection per day through both the rickshaw van. • Waste collected from households is disposed at 30 dustbins. • No waste collection service is available in 5 slums located within the municipal area. The total number of households in the slums is estimated at 90 which is 0.41% of the total households • Solid waste collection efficiency is at 65%. • ~35% of waste remains uncollected and unmanaged. Indiscriminately disposed of in low-lying areas resulting in water logging during the monsoon season.	• Waste transportation is done through trucks with capacities of 1.5 ton and 3 ton. The total number of trucks used for waste collection is 8. • The waste carrying capacity of the current fleet: Maximum 17 trips per day. The capacity of carrying a total of 33 tons per day. Fuel consumption per day for solid waste collection is 60 liters. •	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• There is a new waste disposal site in the municipality. • The total site area is 3.8 acres. All the due processes related to land acquisition are complete. • The new site is still under construction. All the collected waste is disposed of currently using uncontrolled dumping in low-lying areas.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced. •
8	**Chapai Nawabganj**	• Municipality provides primary waste collection services. Approximately 18,620 households are covered by the door-to-door waste collection service.	• Waste transportation is done through trucks with capacities- 5-ton,	• There is one 2-ton-per-day compost plant in the municipality	• There is a new waste disposal site in the municipality	• It is observed that the Municipality has no

		• No source segregation of waste is practiced at household levels in the Municipality as recommended under the SWM Rules 2021. Lack of awareness-raising programs by the Municipality or by Civil Society Organizations regarding the segregation of waste. • Waste from households is collected with the help of PCSPs. Waste collection time - from 6 am to 1 pm. • 15 rickshaw vans (length 1.22 m x width 0.91 m x height 0.91 m) currently used for primary waste collection. Around 253 kg of waste is accommodated in the rickshaw van per trip—approximately 11.35 tons of waste collection per day through rickshaw vans. • Waste collected from households was disposed of at 3 designated Secondary Storage (~ 30'x25'x6' with brick walls). • No waste collection services in the 9398 slums households within the Municipal Area, with approximately 31,953 population comprising of 14% of the total population of the city. • Solid waste collection efficiency is at 68%. • ~32% of waste remains uncollected and unmanaged. Indiscriminately disposed of in low-lying areas resulting in water logging during the monsoon season.	2-ton. Total number of trucks used for waste collection is 7. • Waste Carrying Capacity of the current fleet: Maximum 14 trips per day. Capacity of carrying a total of 64 tons per day.	which is currently non-operational. The main reason is the lack of manpower and non-segregation of waste. • No facility for recycling plastic/paper waste.	which is situated in Ward No. 11 ~3.1 km west of the core commercial and residential areas. • The total site area is around 6 acres. • The site is currently unused as a waste disposal facility using crude dumping methods. •	composting plant to recycle the organic waste. No proper method of processing waste is practiced. •
9	**Faridpur**	• Approximately 7,863 households are covered by the door-to-door waste collection service. • No source segregation of waste practiced at household levels • Waste from households is collected with the help of PCSPs. Waste collection time - 7 AM to 1 PM. • 23 rickshaw vans (length 1m x width 1m x height 0.76 m) are currently used for primary waste collection. Around 200 kg of waste is accommodated in the rickshaw van per trip. • Approximately 9.2 tons of waste collection per day through rickshaw vans. • No waste collection services in the 64 slums within the Municipal Area, with approximately 12000 households comprising 26.66% of the total households of the city • Solid waste collection efficiency is estimated at 62%. • 38% of waste remains uncollected and unmanaged. Indiscriminately disposed of in low-lying areas resulting in water logging during the monsoon season.	• Waste transportation done through trucks with capacities- 5-ton,3-ton and 1.5-ton . • Waste carrying capacity of current fleet: Maximum 13 trips per day. The capacity of carrying a total of 34 tons per day.	• No facility to recycle the organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste	• Solid waste was disposed of at Machar cour Mouza in Ward No. 5. • Total site area -10 acres. The site was acquired as a landfill site in 2018-2019. • The site is currently used as a waste disposal facility using crude dumping methods. 34 tons of waste are disposed of per day in an uncontrolled manner.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced

10	**Magura**	• Approximately 21,650 households out of a total of 33,488 households are covered by the door-to-door waste collection service. • Shortage of manpower and lack of waste collection system is the main problem of door-to-door collection. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time - from 10 am to 3 pm. • Rickshaw van (1.5mx1.1mx0.76m) and trolley (0.91mx0.61mx0.55m) are currently used for primary waste collection. About 314 kg and 76 kg of waste can be accommodated in rickshaw vans and trolleys per trip, respectively. • Approximately 20.4 tons of waste collection per day through the primary collection vehicle. • Waste collected from households is disposed of in one secondary storage area and 50 community bins. • There are 22 slums within the municipal area, having a total household of 2,257. This represents 6.96% of the total households of the municipality. • Solid waste collection efficiency is at 54.88%.	• Waste transportation is done using trucks of 1.5, 3.0-ton capacity. Currently, the municipality has 4 trucks in its fleet. • Waste Carrying Capacity of the current fleet: Maximum 12 trips per day. The capacity to carry a total of about 22.5 tons per day.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• Solid waste is disposed of at Shimulia Mouza under ward no.03 of Magura Pourashava. • The total site area is around – 3 acres and waste is disposed of in this site for 25 years. • The site is currently used as a waste disposal facility using crude dumping methods. 22.5 tons of waste are disposed per day in an uncontrolled manner. • A new land fill site selected by the Magura situated in the Shimulia Mouza. • The total area of the new landfill site is 3 acre.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
11	**Brahmanbaria**	• Approximately 2,722 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. • 10 rickshaw vans (length 1.22 m x width 0.76 m x height 0.91 m) are currently used for primary waste collection. • Around 300 kg of waste is accommodated in the rickshaw van per trip. Approximately 6 tons of waste collection per day through the rickshaw vans by 2 trips. • No waste collection services in the 334 slums households within the Municipal Area, with approximately 1670 slum peoples comprising of 0.73% of the total population of the city. • Solid waste collection efficiency is at 30%.	• Waste transportation is done through trucks with capacities- 3-ton, 1.5-ton, 1-ton. • Waste Carrying Capacity of the current fleet: Maximum 22 trips per day. • Capacity of carrying a total of 30 tons per day. • Fuel consumption per day for solid waste collection is 77 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste	• There is a waste dumping site in the municipality • Total site area -3.16 acres. All the due processes related to land acquisition are complete.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.

12	**Moulavibazar**	• Approximately 3,200 households are covered by the door-to-door waste collection service. • No source segregation of waste practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time - from 9 am to 5 pm. 3 nos trucks are currently used for waste collection. Approximately 24 tons of waste collection per day through the trucks.No waste collection services in the 28 slums households within the Municipal Area. Waste is disposed of in low-lying areas or in natural drainage canals near the slums. • Solid waste collection efficiency at 82%.	• Waste transportation done through trucks with capacities- 1.5-ton, 3-ton. • Waste carrying Capacity of the current fleet: Maximum 9 trips per day. The capacity to carry a total of 24 tons per day. • Fuel consumption per day for solid waste collection is 32 liters.	• No facility to recycle the organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• There is a waste dumping site in the municipality. • Total site area around – 4.5 acres. All the due processes related to land acquisition are complete. • Site currently unused crude dumping site.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
13	**Manikganj**	• Approximately 3,055 households covered by the door-to-door waste collection service. • No source segregation of waste practiced at household levels in the Municipality • Waste from households collected with the help of PCSPs. Waste collection time - from 7 am to 2 pm. • 25 rickshaw vans (length 1.22 m x width 0.91 m x height 0.78 m) currently used for primary waste collection. • Around 220 kg of waste is accommodated in the rickshaw van per trip. Approximately 5.5 tons of waste collection per day through the rickshaw vans. • No waste collection services in the 84 slums households within the Municipal Area, with approximately 420 slum people comprising of 0.21% of the total city population. • Solid waste collection efficiency is at 40%	• Waste transportation done through trucks with capacities- 3-ton, 5-ton. • Waste carrying Capacity of current fleet: Maximum 4 trips per day. • Capacity of carrying a total of 14 tons per day. • Fuel consumption per day for solid waste collection is 14 liters.	• No facility to recycle the organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• There is a waste dumping site in the municipality. • Total site area around – 3 acres. All the due processes related to land acquisition are complete. • The site currently used as a waste disposal facility but not following crude dumping methods.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
14	**Lalmonirhat**	• Approximately 872 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time - 10 AM to 2 PM. • 08 rickshaw vans (length 1.07m x width 0.91 m x height 0.76 m) are currently used for primary waste collection. Around 220 kg of waste is accommodated in the rickshaw van per trip. Approximately 5.2 tons of waste collection per day through the rickshaw vans. • No waste collection services in the 18 slums within the municipal area, with approximately 2,101 households comprising 16.2% of the total households of the city. • Solid waste collection efficiency is at 26%	• Waste transportation is done through trucks with capacities of 1.5-ton. • Waste carrying capacity of current fleet: Maximum 4 trips per day. Capacity of carrying a total of 6 tons per day. • Fuel consumption per day for solid waste collection is 14 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• There is a landfill site in the municipality. • The total site area is of the site is 3 acres. All the due processes related to land acquisition are complete. • The site is currently used as a waste disposal facility using crude dumping methods.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.

15	**Joypurhat**	• Approximately 14,890 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time – 7 am to 1 pm.. • Rickshaw van (1.22mx0.85mx0.69m size) and trolley(1.0mx0.76mx0.61m size) are currently used for primary waste collection. About 179 kg and 116 kg of waste can be accommodated in the rickshaw van and trolley per trip, respectively. Approximately 13.1 tons of waste collection per day through the primary collection vehicles.• There are 22 slums in the municipality with approximately 1470 households which represent 5.03%. • Solid waste collection efficiency at 66.67%.	• Waste transportation is done by 2 and 3-ton trucks. • Capacity of carrying a total of 20 tons per day. • Fuel consumption per day for solid waste collection is 32 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• Solid waste is disposed of at Khonjonpur Mouza under ward no. 02 of Joypurhat Pourashava. • Total site area is around – 2.9 acres. • The site is in use for the last 15 years.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
16	**Netrokona**	• Approximately 1,650 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time - 10 AM to 7 PM. • 09 rickshaw vans (length 0.91m x width 0.76m x height 0.76m) are currently used for primary waste collection. Around 131 kg of waste is accommodated in the rickshaw van per trip. Approximately 3.5 tons of waste collection per day through rickshaw vans. • No waste collection services in the 10 slums within the municipal area with approximately 686 households comprising 3.8% of the total households of the city. • Solid waste collection efficiency at 55%.	• Waste transportation is done through trucks with capacities of 1.5 tons and 3 tons. • The waste carrying capacity of the current fleet: Maximum 12 trips per day. • The capacity to carry a total of 30 tons per day. • Fuel consumption per day for solid waste collection is 42 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste	• There is a new waste disposal site in the municipality. • The total site area is 3.25 acres.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced
17	**Naogaon**	• Approximately 13,731 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels in the Municipality. • Waste from households is collected with the help of PCSPs. Waste collection time - 7 AM to 2 PM. • Rickshaw vans (0,91mx0.76mx0.76m) and mechanized vans (1.83mx1mx0.76m) are currently used for primary waste collection. About 131 kg and 348 kg waste can be accommodated in rickshaw vans and mechanized vans per trip, respectively. Approximately 13.1 tons of waste were collected using	• Waste transportation is done by 3 and 5 ton trucks. • Capacity of carrying a total of 30 tons per day. • Fuel consumption per day for solid waste collection is 39 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• Solid waste is disposed of at Charpathuria Mouza under ward no.03 of Naogaon Municipality as a temporary dumping site.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.

		the aforementioned motorized and non-motorized vehicles. • No waste collection services in the 60 slums within the municipal area with approximately 14,624 households comprising 26.77 % of the total households of the city. Solid waste collection efficiency is at 44.12%.			• The total site area is around – 2 acres. This site is used as landfill for the last one year.	
18	**Chandpur**	• Approximately 14824 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels. • Waste from households is collected with the help of PCSPs. Waste collection time - 10 AM to 7 PM. • 50 rickshaw van (length 1.1m x width 0.91m x height 0.91m) and 30 trolley (1.1mx0.76mx0.46m) are currently used for primary waste collection. Around 228 kg and 96 kg of waste can be accommodated in the rickshaw van and trolley per trip. Approximately 25.7 tons of waste collection per day through both the rickshaw van and trolley. • No waste collection services in the 90 slums within the municipal area. • Solid waste collection efficiency is at 29.51%	• Waste transportation is done through trucks with a capacity- 1.5-ton with 6 nos. per trip. • Waste carrying capacity of the current fleet: Maximum 24 trips per day. The capacity to carry a total of 36 tons per day. • Fuel consumption per day for solid waste collection is 47 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• Solid waste is disposed of at Bishnudi Mouza under the Chandpur Municipality in Ward No. 09. • The total site area is around – 5 acres.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
19	**Noakhali**	• Approximately 13,154 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels. • Waste from households is collected with the help of PCSPs. Waste collection time - 10 AM to 4 PM. • 25 rickshaw vans (length 1.5 x width 0.76m x height 1m) are currently used for primary waste collection. Around 285 kg of waste is accommodated in the rickshaw van per trip—approximately 20 tons of waste collection per day through the rickshaw vans. • No waste collection services in the 53 slums within the municipal area with approximately 12,309 households comprising 40.35% of the total households of the city. • Solid waste collection efficiency at 55.36%.	• Waste transportation is done by 3.0, 4.0 & 5.0 tons capacity trucks. • The capacity to carry a total of 31 tons per day. • Fuel consumption per day for solid waste collection is 37 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste	• Solid waste is disposed of at Poura Bazar under Laxminarayanpur Mouza. Dag no-1493,1494,1495 under the Noakhali Municipality in Ward No. 05. • The total area of the current landfill site is 2.34 acres.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.
20	**Dinajpur**	• Approximately 10,232 households are covered by the door-to-door waste collection service. • No source segregation of waste is practiced at household levels. • Waste from households is collected with the help of PCSPs. Waste collection time - 7 AM to 2 PM. • 40 rickshaw vans (length 1.21 m x width 0.91 m x height 0.91 m) are currently used for primary waste collection. Around 250 kg of waste is accommodated in the rickshaw van per trip. Approximately 10 tons	• Waste transportation is done by 2-ton trucks. • The capacity to carry a total of 24 tons per day. • Fuel consumption per day for solid waste collection is 24 liters.	• No facility to recycle organic waste, which is the largest component of the waste collected. • No facility to recycle plastic/paper waste.	• There is an open waste dumping site in the municipality. The site is outside ward number 13. • The total site area is of the site is 8.69 acres.	• It is observed that the Municipality has no composting plant to recycle the organic waste. No proper method of processing waste is practiced.

		of waste collection per day through rickshaw vans. • No waste collection services in the 70 slums within the municipal area with approximately 13,565 households comprising 33% of the total households of the city. • Solid waste collection efficiency at 25%.				

6. **Bangladesh SWM rules and regulations.** The City/Municipality Act (2009), National Environmental Policy (2018), Environment Conservation Act (1995), Environment Conservation Rules (1997), and National 3R Strategy for Waste Management (2010) are the primary guidelines used for SWM in Bangladesh. Recently, SWM Rules (2021) has been approved under the environment conservation act by the Ministry of Environment, Forest and Climate Change. Figure A1-1 below presents the Policies, Laws, and Regulations related to Waste Management in Bangladesh. Currently, there is no specific guideline approved by the local government regarding SWM.

Figure A1-1: Bangladesh SWM rules and regulations

Regulatory Documents	Approving agency
• Local Govt. (City Corporation/ Pourashava) Acts, 2009 Amended 2011	• The Parliament
• Environmental Conservation Act 1995	• The Parliament
• Environmental Conservation Rules 1997	• DoE, MoEFCC
• Medical Waste Management Rules, 2008	• DoE, MoEFCC
• Solid Waste Management Rules, 2021	• DoE, MoEFCC
• National Policy for Safe Water Supple and Sanitation,1998	• LGD, MoLGRDC
• Environment Policy, 2018	• DoE, MoEFCC
• National 3R Strategy for Waste Management, 2010	• DoE, MoEFCC
• National Strategy for Water Supply and Sanitation, 2021	• LGD, MoLGRDC
• 8th Five Year Plan	• Planning commission, Ministry of PLanning
• Perspective Plan for Bangladesh 2021-2041	• Planning commission, Ministry of PLanning

(i) *Local Govt. (City Corporation/ Pourashava) Acts, 2009 Amended 2011.* This Act guides ULBs to be responsible for SWM, including collection and disposal of waste from all the roads, drains, structures, and areas under their jurisdiction. ULBs are to arrange to place waste collection containers or other types of bins at different locations and inform the occupiers of houses, structures, and spaces to dump wastes into these containers or bins.

(ii) *Environmental Conservation Act, 1995.* This Act is provided for environmental conservation, environmental quality and control, and pollution mitigation. It authorizes the Department of Environment (DoE) to take necessary measures and publish guidelines to control, abate, and mitigate environmental pollution to improve the environment.

(iii) *Environmental Conservation Rules, 1997.* These rules provide guidelines for: (a) categorization of industries and development projects, including multi-storied buildings based on actual and anticipated pollution load; (b) requirement for undertaking Environmental Assessment and Plan; (c) procedure for obtaining environmental clearance certificate; (d) environmental quality standards for ambient air, surface water,

groundwater, drinking water, emissions, noise, and vehicular exhausts. Landfilling of solid wastes by industries, households, and commercial institutions is categorized as Red Category. Undertaking any landfill project for waste disposal will need an environmental clearance certificate from DoE. Incineration is also classified as Red Category, while composting is categorized as Green Category.

(iv) *Bio-Medical Waste Management Rules, 2008.* The rules apply to waste management facilities and operators involved in medical waste transportation, treatment, and disposal. Institutions engaged in collecting, transporting, and storing must obtain authorization permits from DoE. The rules have classified medical waste classes with detailed guidelines to operationalize segregation.

(v) *Solid Waste Management Rules, 2021.* It is focused on necessary detailing across the SWM value chain from waste collection to final disposal. It narrates how waste should be segregated, collected and treated by ULBs. Most importantly, the rules state that the ULBs will have to collect house-to-house waste either by their employees or by engaging contractors. It emphasizes landfill site selection criteria and also provides instructions regarding the treatment of waste including standards for aerobic and anaerobic digestion, and energy recovery. It recommends free delivery of organic waste to the private sector for recycling and resource recovery.

(vi) *National Policy for Safe Water Supply and Sanitation, 1998.* According to this policy, the government shall maximize the adoption of waste recycling measures and use organic waste materials for compost and biogas production. In particular foreign-aided projects where specifically required as a component of the overall infrastructure development package, LGED may also undertake water supply and sanitation-related activities.

(vii) *National Environment Policy, 2018.* Considering the environmental challenges, biodiversity conservation, and management, the government adopted this policy to develop the overall environmental conservation management of the country with recommendations for the 3R approach and sanitary landfill and waste to biogas.

(viii) *National 3R Strategy for Waste Management, 2010.* The main features of the strategy are: (a) prioritizing waste avoidance/reduction over recycling and recycling over all other forms of environmentally sound disposal; (b) reusing non-avoidable waste as far as possible; (c) promoting environment-friendly raw materials; (d) maintaining hazardous content in the waste at the lowest possible level; (e) guaranteeing an environmentally sound residual waste treatment and disposal as a fundamental prerequisite for human existence, environmental conservation, and protecting biodiversity; (f) public awareness campaigns for the segregation of waste at source; and (g) following a regional landfill approach.

(ix) *National Strategy for Water Supply and Sanitation, 2021.* The strategy addresses strengthening sector governance, emphasizing resource recovery and recycling (instead of disposal) to improve urban sanitation. The recommendations include, among others; (a) improving SWM based on the principles of 3R; (b) establishing a coordination

mechanism between line ministries and institutions; (c) ensuring development, implementation and continuation of social mobilization campaign; (d) developing an inventory, pollution scenario and conducting solid waste mapping; and (e) establishment of Integrated Waste Treatment Facility at least in 50 percent of Pourashavas by 2025.

(x) *8th Five-Year Plan. 8th Five Year Plan.* The recommendations include: (a) complete solution should consist of an integrated waste management system that provides a transfer station, compost plant, biogas plant, and controlled landfill cell; (b) treating SWM C as a system as it is tied to many problems such as waterlogging, GHG emissions, and water and land pollution; (c) awareness building; and (d) promoting composting and biogas to electricity.

(xi) *Perspective Plan for Bangladesh 2021-2041.* It emphasizes: (a) private participation in disposal of solid waste; (b) adequate capacity development of the ULBs, including the reformation of their organogram to plan, guide, and monitor SWM; and (c) cost recovery mechanism for urban services including SWM.

(xii) *Bangladesh's Nationally Determined Contributions (2021).* It focuses on improved municipal waste management, ensuring the 3R principle. Actions to be achieved by 2030 include establishing an incineration plant in 3 cities, establishing wastewater treatment plants in several cities, and expanding regional Integrated Landfill and Resource Recovery facilities in other cities.

7. The Project design is consistent with relevant policies and requirements. In particular, the SWM Rules lays down clear criteria for construction of storage and specifications for disposal facilities and the proposed facilities under the Project would be fully aligned with those requirements. The Project is also based on 5R principles (reduce, reuse, recycle, recover and remove) supporting the National 3R Strategy for Waste Management, 2010.

8. **Institutions for SWM delivery.** The Local Government Division (LGD under the Ministry of Local Government Rural Development and Cooperatives (MoLGRDC) is responsible for planning, identification of investment projects, monitoring and observance of rules governing ULBs, Local government engineering department (LGED), Department of Public Health Engineering (DPHE), private sector and non-governmental and community-based organizations (NGO/CBOs). Besides, Ministry of Environment, Forest and Climate Change, Ministry of Agriculture, Ministry of Finance and Ministry of Information are also involved in SWM.

Table A2-3: Institutions for SWM Service Delivery

Institutions	Responsibility in SWM
Local government division (LGD)	All municipalities, city corporations, Department of Public Health Engineering (DPHE) and Local Government Engineering Department (LGED) work under the Local Government Division. LGD is responsible for preparing and disseminating relevant acts, rules, and government ordinances. LGED and DPHE provide technical support to city corporations to safely manage solid waste.
Ministry of Environment, Forest and Climate	MoEFCC is responsible for preparing and enforcing the country's environmental rules and regulations, including the national 3R strategy for solid waste management and solid waste management rules. The Department of Environment

Change (MoEFCC).	also provides environmental clearances and renewal of environmental clearance certificate needed for operation.
Ministry of Agriculture (MoA).	MoA is the nodal ministry for developing compost standards and certification of compost. The Department of Agriculture under MoA provides license for operation of compost plants and sale of compost.
Ministry of Finance (MoF	MoF provides financial support and subsidy to waste recycling projects. Current incentives include: (a) 5 – 10 years tax holiday for all waste treatment and recycling plants; (b) low custom or excise duties on equipment for waste treatment; and (c) No VAT/ Sales tax on sale of compost.
Ministry of Information (MoI)	MoI raises awareness on the need and benefits of source segregation and compost through campaigns in print, radio, and television. It also encourages the use of organic products as part of corporate social responsibility.

9. **Technical options for improved SWM.** In line with the SWM rules and the national 3R strategy the following options are suggested for improvement of SWM along its entire value chain: (i) segregation at source; (ii) primary and secondary waste collection; (iii) recycling and resource recovery; (iv) treatment; and (v) sanitary Landfilling.

(i) *Segregation at source and primary waste collection.* Households will be encouraged to segregate their wastes to dry (inorganic; recyclable), wet (organic; compostable) and hazardous wastes. The services of NGOs/CBOs will be availed to raise awareness and sensitize households on the need and benefits of segregating the waste.

As the SWM rules recommends collection of segregated wastes from households and therefore a cycle rickshaw with six to eight containers for collection of segregated wastes is proposed. The improved rickshaw van with containers can directly discharge waste into covered containers and reduce multiple handling of waste. Green containers can be used for organic waste, while bags can be used for the collection of recyclables. The improved rickshaw has the capacity to carry 500 kg of waste and can do three trips in a day. The waste generated from markets and commercial establishments will be collected through these vans or dumped directly into secondary storage facilities or community demountable bins at the market areas. Further, using demountable container vehicles, waste collected will be carried to the secondary transfer station or directly taken to the landfill site.

Figure A2-2: Recommended rickshaw van with containers and bags for inorganic waste

(ii) *Waste storage for secondary collection of waste.* Rickshaws which collect wastes from households will dispose of the collected wastes in storage containers (1.5 – 5 m^3) placed at strategic locations to reduce travel times. Depending on the population at least one container is suggested for each ward. The proposed intervention will reduce multiple handling of waste and improve efficiency (reduced manpower, time to unload and collect).

(iii) *Waste transportation.* Depending on the road width, different type of demountable container trucks will be required for secondary transfer of waste. There may be need for transfer stations should the distance to the treatment and disposal facility be considerable. The waste from the bins and transfer stations will be transferred to the waste processing facility by containerized waste collection vehicles. Geospatial planning tool has been used to design routing of waste transfer from the secondary collection points (bins and transfer stations) to the waste processing facility. Network analyst tool was employed to determine the shortest route from the secondary collection point to the waste processing unit.

(iv) *Integrated landfill and resource recovery facility.* An integrated resource recovery facility, which will include a composting, pyrolysis plant, material recovery facility and landfill cells, is proposed. The pyrolysis plant will help recover oil from single use plastic and the material recovery facility will help salvage materials of value (paper, plastics, glass, etc). The organic fraction or the wet waste will be composted and the suggested process includes sorting to remove inorganics, mixing fresh organic waste with residue from the first screening, pre-composting in compost boxes with forced aeration for 3 weeks followed by screening, maturing and final screening. The inerts generated during the process of composting will be disposed in the landfill.

Besides, the landfill is also designed, where practical, as regional landfill to cater to inerts from the towns and villages within a radius of 15 – 20 kms for which they will be required to pay to use the facility. The legacy waste will be compacted and capped in a cell while the remaining land will be used for the proposed integrated resource recovery facility. In order to minimize leachate, adequate soil cover, impermeable material at base and leachate collection system. The leachate generated will be treated through aeration, facultative and polishing pond and the treated leachate used for spraying in the cells. It is proposed to incentivize the operator to maximize waste for composting and/or minimize waste to the landfill. This will not only increase the life of the landfill, but also reduce greenhouse gas emission (organic material to the landfill) and revenue from end products (revenue from increased compost).

10. The Project will provide a combination of financial assistance as well as capacity building support to the participating ULBs with the overall objective to improve SWM services in the town. To improve the overall SWM service delivery, interventions will be provided along the full value chain of SWM. Further, to encourage sustainable service delivery, the Project will support improving institutional systems and organizational capacity of the participating ULBs. The Project will support up to 20 ULBs which have been selected based on robust and objectively verifiable criteria developed after a series of detailed discussions with the GoB and relevant stakeholders.

11. The selection criteria considered: (i) demand for improved SWM services; (ii) project readiness, including land availability; (iii) institutional and financial capacity of municipalities; (iv) commitment for private sector involvement; and (v) readiness to launch waste separate at source programs. Against of the selection criteria, quantifiable description and indicators were developed to score the ULBs. The Table A2-4 shows the criteria, indicators, and the scores used for the ranking and prioritization of the ULBs. Using this, individual scores for each ULB located in 64

district headquarters has been prepared. After assigning score for each criterion summation of scores has been calculated and the ULB receiving the highest score has been prioritized for investment.

Table A2-4: ULB Selection Matrix

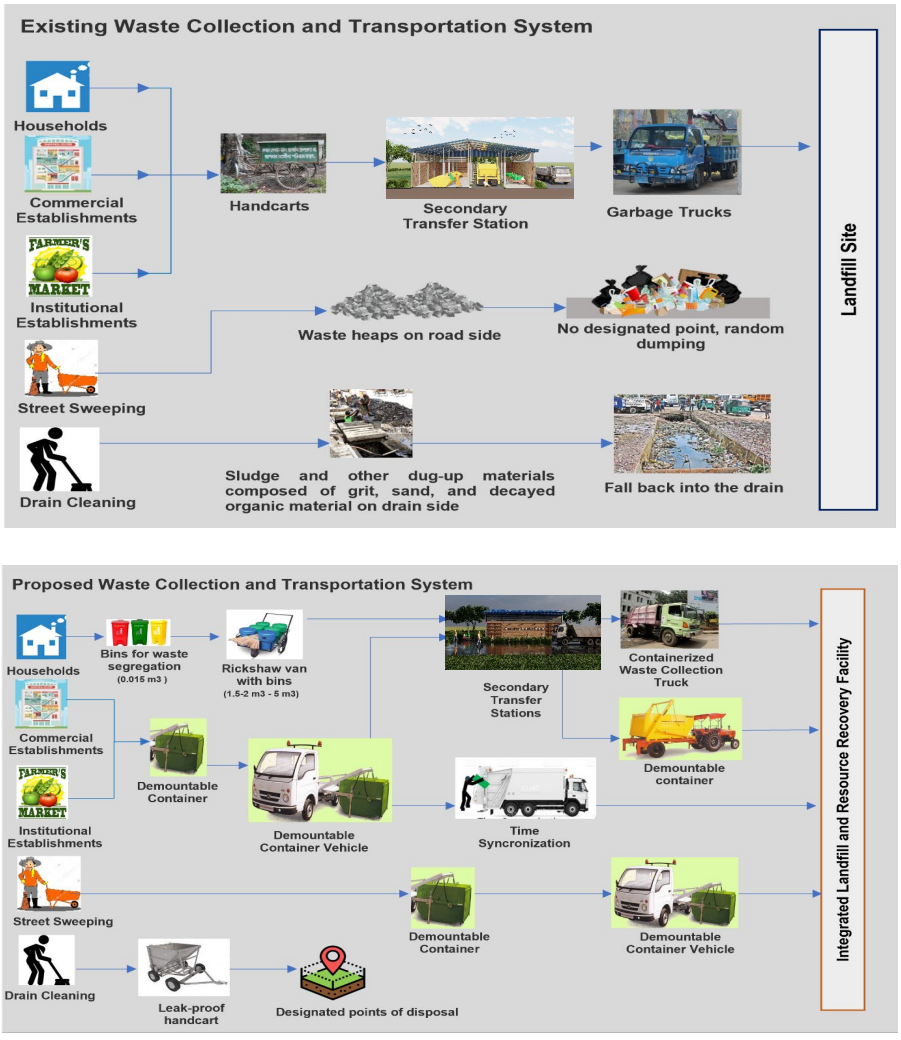
Selection criteria	Quantifiable description	Indicator	Score
Demand for Improved Solid Waste Management	Amount of current waste generation (tons/day)	>1000 tons	5
		500-1000 tons	4
		100-499 tons	3
		50-99 tons	2
		<50 tons	1
Project Readiness	Availability of demarcated land for waste treatment facility	20 acres and above	5
		>15 acres	4
		10-15 acres	3
		5-10 acres	2
		3-5 acres	1
	Land available to accommodate waste for minimum 20 years based on the projected population and per capita waste generation rate	>20 years	3
		20 years	2
		<20 years	1
	Land meeting DoE site selection criteria as per SWM Rules 2021	Yes	2
		No	1
	Non- existence of ongoing or approved project on same location to avoid duplication	Yes	2
		No	1
Institutional Capacity	Full conservancy section supervisory staff available as per the approved organogram	Yes	2
		No	1
	Full engineering section staff available as per the approved organogram	Yes	2
		No	1
Financial Capacity	Municipality/City Corporation able to recover 65% of the operational costs of SWM through conservancy tax in the last three years	Yes	2
		No	1
Private Sector Involvement	Municipality/City Corporation willing to sign binding agreement for PPP based SWM project for the entire value chain	Yes	2
		No	1
Source Separation of Waste	Municipality/City Corporation confirming initiation of sustainable source separation program within three months of confirmation as per the SWM Rules 2021	Yes	2
		No	1

12. The Project will support investments covering the entire SWM value chain - waste collection and transfer systems, disposal facilities including dump site closure, sanitary landfills rehabilitation and development, establishment of material recovery and compositing facilities. Since each ULB has unique infrastructure gaps, the Project will adopt a flexible approach for each ULB while selecting the infrastructure investments with the overall objective to improve SWM

service delivery. The Project will also support regional treatment and recycling facilities at the waste-shed area level wherever economically and technically feasible. Through institutional and capacity development support, the Project will help strengthen the regulatory framework in the sector and build capacity among national, regional and local actors; facilitate development of 'private sector' model for SWM in the country; deepen efforts to encourage waste minimization, recycling and source separation; and support vulnerable groups through development of appropriate social inclusion and economic transition.

13. **Component 1: Waste Collection and Transportation (USD30.59 million, of which USD24.07 million AIIB financing).** This component will improve and optimize solid waste collection and transport services in selected ULBs. This component will include investments in (i) expansion of primary waste collection using covered vehicles; and (ii) improvement of primary and secondary waste storage facilities. The proposed system of waste collection, residents would be required to segregate the waste in color coded bins. It is proposed to engage the services of NGO/CBO to help educate and sensitize residents on the need to segregate waste.

Figure A2-3: Existing and Proposed Waste Collection and Transportation System



14. The segregated waste would be collected using container vans which will take the waste to transfer stations. From the transfer stations, the segregated waste would be taken in container trucks to the integrated waste treatment facility for recycling, composting and finally disposing in the landfill. The entire route planning of the vehicles will be done through GIS based system to ensure optimum deployment of vehicles with the objective to reduce overall cost. The vehicles will also have GIS systems to ensure live tracking and monitoring. The Project will finance procurement of container vans for primary collection, demountable containers for transfer of secondary waste, community containers and trucks for transportation of waste. The indicative summary of the equipment and vehicles planned for procurement is as follows:

Table A2-5: Indicative List of Vehicles and Containers to be procured under the Project

City	Collection equipment				
	RV with 6 bins	**Containers 2-5 cu.m**	**Container Carrier Truck**	**Dump Truck**	**Tractor & Trailer**
Rajshahi City Corporation	312	167	27	10	6
Rangpur City Corporation	144	55	13	10	
Chattogram City Corporation	500	142	37	10	
Munshiganj	40	16	4	2	
Kushtia	65	101	20		
Bhola	25	8	2	2	
Magura	34	18	3	1	
Kishoreganj	60	48	8	2	
Manikganj	31	15	3	1	
Faridpur	38	20	4	2	
Lalmonirhat	19	10	2	1	
Chapainawabganj	75	45	9	2	
Brahmanbaria	94	35	8	3	
Moulavibazar	25	12	2	2	
Karimganj	12	-	-	2	
Mirkadim	16	-	-	2	
Mirpur	10	-	-	1	
Naohata	20	-	-	2	
Katakhali	14	-	-	2	
Hargacha	20	-	-	2	
Sirajganj			-		
Dinajpur	110	38	7	5	
Noakhali	68	30	6	3	
Netrokona	60	30	6	3	
Naogoan	75	40	8	3	
Chandpur	80	40	8	3	
Total	**1,947**	**870**	**177**	**76**	**6**

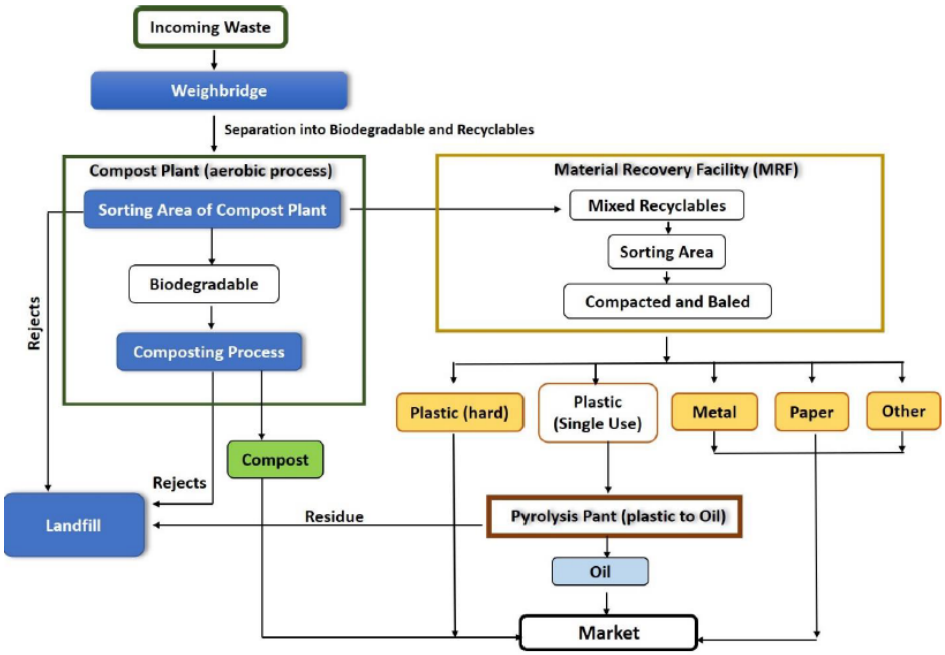
17. **Component 2: Waste Processing and Disposal (USD186.91 million, of which USD165.62 million AIIB financing).** This component will finance (i) construction and rehabilitation of transfer stations; (ii) prioritized waste processing facilities related to composting and resource recovery; and (iii) disposal infrastructure, including closure and/or rehabilitation of polluting waste dump sites and construction and/or rehabilitation of engineered sanitary landfills.

(i) **Sub-component 2.1 (Construction and/or rehabilitation of transfer stations)** will construct new transfer stations and rehabilitate the existing ones. The transfer stations will be fully mechanized with very minimal manual intervention for safe handling of waste. Each town might have 2-5 transfer stations depending on the waste generation, population density, geographical spread and vehicle deployment. The transfer stations are proposed to use solar power to reduce overall emissions.

Figure A2-4: Design of Proposed Transfer Station

(ii) **Sub-component 2.2 (Waste processing facilities related to composting and resource recovery)** will set up composting and resource recovery facility. Generally, these facilities will be part of the integrated landfill and waste resource recovery facility. However, for each town the selection of waste management process and technology will be based on a decision tool for Best Practicable Options (BPO).[3] The BPO is a suggestive strategy that the ULBs of various population sizes may refer to draw ULB-specific action plans for efficient processing and disposal of waste. It further outlines packages and combinations of technologies and approaches to be adopted and maintaining environmental standards. All incoming waste to this facility shall be digitally weighed and shall be inspected for proper segregation. The segregated organic waste will be used for compositing while other waste such heavy plastics and metals shall be used for recycling and rejects will be landfilled.

Figure A2-5: Diagram Showing Waste Processing and Treatment



The composting process will be of static pile with forced aeration in a closed shelter with leachate collection and reuse. The composting process will consist of the followings:

a) *Receiving:* The waste received at the reception area of the composting plant will be visually inspected for presence of inorganic substances which will be manually removed and stored in a container. This will be further screened in a trammel and

[3] In designing and implementing new waste management systems and optimizing existing ones, the Project also considers the aspects of resource recovery, environmental soundness, financial sustainability, stakeholder involvement, and institutional capabilities, in addition to the technical and technological appropriateness of systems for managing the waste.

structural material (residue from 1st screening) will be added before initiating the composting process. The quantity of structural material to be added will depend on the composition of the waste received.

b) *Pre-composting:* This will be carried out in pre-composting cells with space to handle 3 – 4 days of waste with the adequate number of cells with controlled forced aeration. The pre-composting process will take three weeks and monitoring the temperature aeration will be controlled to optimize pre-composting process. Forced aeration will ensure control of pathogens.

c) *Intermediate process:* After three weeks of pre-composting the partially composted product will be processed in a drum screen which will separate to two fractions, one which is 60 mm and less and other which is greater than 60 mm. The fraction with particle size 60 mm and less will be taken for maturing and that greater than 60 mm or use as structural material,

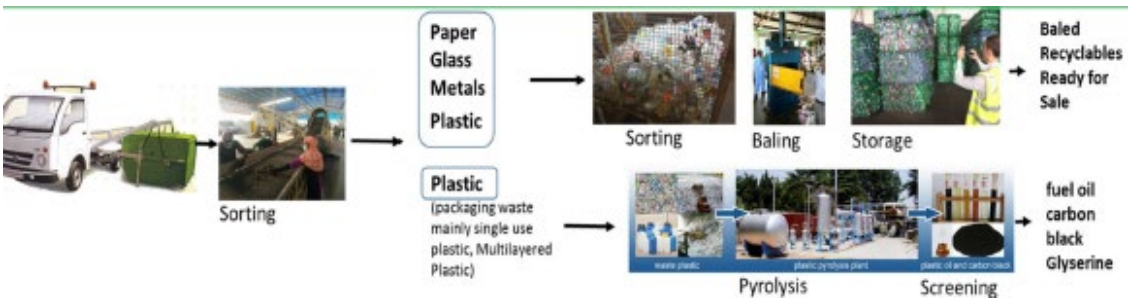
d) *Maturing process:* This process is similar to pre-composting and will take place in cells with forced aeration. The process takes about four weeks.

e) *Final screening:* After maturation, the end product will be screened to separate into two fractions, one with particle size of 10 mm and below and the other greater than 10 mm and under 60 mm. The fraction with particle size under 10 mm will be stored in storage cells for enrichment and packaging. The fraction greater than 10 mm will be mixed with screened material from intermediate stage for 4 -5 weeks processing in the maturing area.

f) *Packaging and marketing:* After analysis and confirmation of product to Bangladesh Compost Standards the product will be sold in bulk or packaged and sold.

The Material Recovery Facility (MRF) will help recover paper, plastic, glass and metal. A mechanical type material recovery facility and pyrolysis plant is proposed. While the recovered material will be shredded, compacted and baled, single use and multi-layered plastics will be processed in a pyrolysis plant to recover fuel oil, glyserine and carbon black.

Figure A2-6: A Schematic of Material Recovery Facility



(iii) **Sub-component 2.3 (Disposal infrastructure, including closure and/or rehabilitation of polluting waste dump sites and construction and/or rehabilitation of engineered sanitary landfills)** will provide safe waste disposal with minimal effect on the environmental components such as soil, groundwater, surface water, air, and people. The cells will maximize waste disposal quantity within the available space of the selected site.

The key design considerations include the following:

a) *Expected waste input:* The current and projected amount of waste to be collected and disposed of in the landfill cells must be known. These will determine the size of the cells and the eventual lifespan of the facility that will be constructed in the selected site.

b) *Target landfill life:* Disposal facilities are usually planned for a 20-year period, with the individual cells lasting for 5 to 7 years.

c) *Geology:* The foundation for the landfill should have sufficient bearing capacity. A geotechnical survey has been conducted on the proposed landfill site. It was found from the geotechnical survey that the soil up to 4.5-meter depth is clayey silt with low plasticity. The soil is sandy silt between 6 to 10 meters in depth and silty sand between 12 to 19 meters. The soil has low plasticity. The bearing capacity of the soil was found to be between 1.1 to 1.5 tons per square foot.

d) *Hydrogeology:* The proximity of the groundwater to the surface affects the extent of excavation needed to generate the space for the landfill cells. As a rule, the base of the cell should be min. 2 m above the water table.

e) *Hydrology:* Surface water draining towards the landfill area could potentially increase leachate and bring about local flooding during major rain events. The design will incorporate peripheral drainage systems, diverting water from the landfill cells.

f) *Availability of cover materials:* Landfill cover will be sourced from the excavation to be made for the cells and related facilities.

g) *Ground conditions and prevention of seepage:* The ground where the landfill will be developed must be impermeable (rock without cracks or clay of min 1 m thickness to avoid leachate seeping uncontrolled into the ground and thus polluting the groundwater. If these conditions are not met, a liner must be established. SWM Rules 2021 has recommended an HDPE liner of 1.5mm or clay liner of 90 cm thickness with a permeability coefficient of 1x10cm-9/sec.

h) Leachate quantities must be minimized through strict and planned separation of clean rain surface water and polluted seepage. The treatment has the best effect on concentrated leachate. The treatment plant will be designed for leachate from the initial cell with 5-7 years of operation, and the input will be average rainfall in average max. Month over the last 10 years. This is because the landfill will represent a substantial

retention volume, distributing the water volumes from rain over time. Observations from other landfills indicate that the retention will even flow to approx. a month's average. The following design criteria are used for the treatment of leachate:

- The water volume will be equal to the average maximum rainfall per month multiplied by the landfill cell area; Aeration Pond: The retention time in the Aeration Pond will be 1 day at the maximum flow, and it will be equipped with aerators. The depth of this pond is 2 m;
- Facultative Pond: The retention time in the Facultative Pond will be 4-5 days in maximum flow. The depth of this pond is 2.5 m;
- Polishing Pond: The retention time in the polishing pond with plants will be 1 day in maximum flow. The depth of this pond 0.8;
- The ponds have a 2 mm HDPE liner at the bottom;

i) *Layout:* A landfill site will comprise of the area in which the waste will be filled as well as an additional area for support facilities. Within the area to be filled, work may proceed in phases, with only a part of the area under active operation. The following facilities must be located in the layout: (a) access roads; (b) equipment shelters; (c) digital weighing scales; (d) office space; (e) compost plant; (f) material resource recovery facility; (g) waste to oil facility; (h) boundary of the landfill areas and areas for stockpiling cover material and liner material; (i) drainage facilities; (k) leachate treatment facilities; and (l) location of monitoring wells.

j) The landfill will be built with a design period of 20 years. The landfill will be developed with due consideration of the local site conditions.

Figure A2-7: Proposed Design Layouts – the Integrated Landfill and Resource Recovery Facility in Kushtia

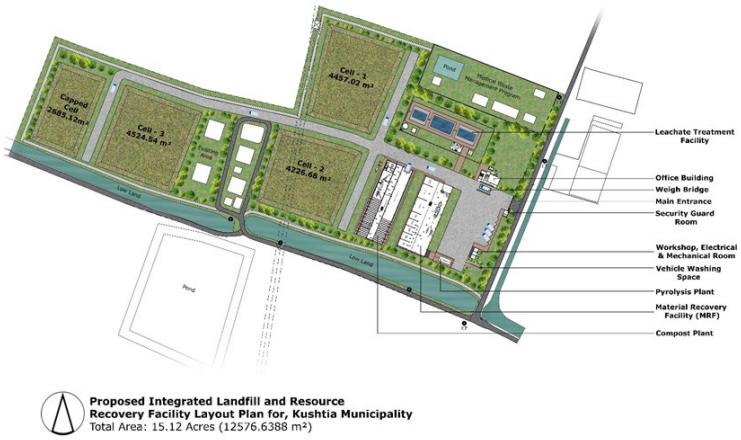
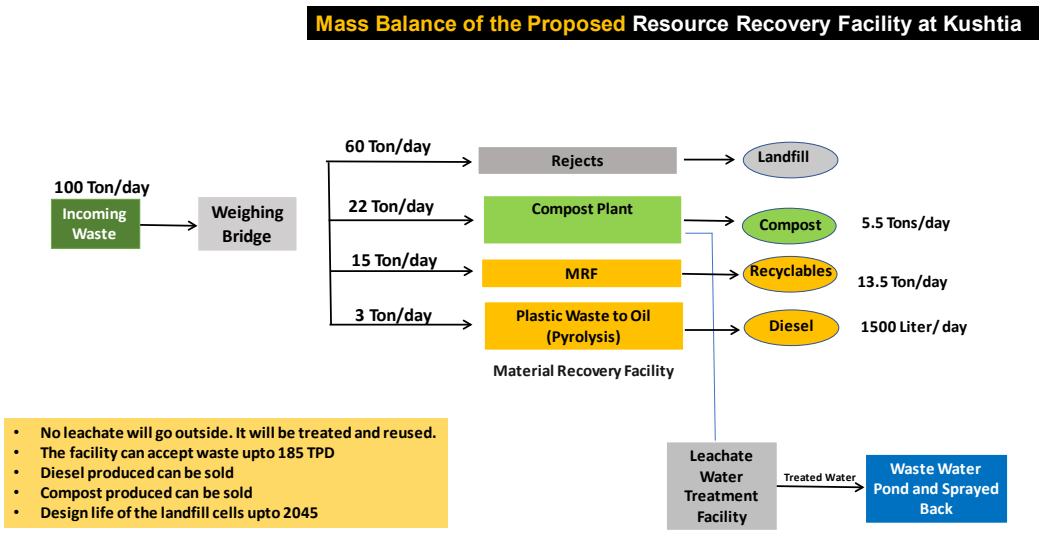


Figure A2-8: Mass Balance of the Proposed Integrated Landfill and Resource Recovery Facility in Kushtia



15. **Component 3: Project Management Support, Institutional Development, Capacity Building (USD17.5 million, of which USD10.31 million AIIB financing).** This component will support key areas of institutional development and capacity building for relevant central and local agencies in SWM such as LGED and participating ULBs. Institutional weakness of the ULBs have been found to be a major challenge in delivering SWM services. Hence, this component will support these institutions in enhancing their capacity, providing necessary trainings in the safe handling of solid waste, supporting them in devising appropriate cost recovery mechanism, raising awareness and handling Behavioral Change Communications (BCC) to promote proper source segregation of waste. Further, this component will provide project management monitoring and evaluation, environmental and social (including public awareness campaign and public consultation, support for informal waste pickers), procurement, financial management, and provide necessary support with respect to supervision and maintenance of infrastructure investments.

(i) **Subcomponent 3.1 (Project management, coordination and monitoring support).** This subcomponent will strengthen project management capacity of PMU and PIUs by hiring consultants in relation to technical, fiduciary, environmental and social aspects of the project, monitoring and evaluation (including third party monitoring), stakeholder engagement and communications, and coordination among all stakeholders including relevant central government agencies and ULBs. It will provide contract management and construction supervision support (including final review of engineering drawings; procurement procedure; construction oversight and supervision works, to ensure compliance of works with contractual specifications, E&S requirements and budget; and handover of works from contractors to respective ULBs). In addition, it will also support preparation of feasibility studies, engineering designs, subproject-level E&S instruments, and carry out other necessary preparatory activities for the remaining ULBs (but not limited to the Project ULBs).

(ii) Subcomponent 3.2 (Institutional strengthening and capacity building). This subcomponent will support strengthening the regulatory framework, sector monitoring, and regulatory oversight mechanisms (including waste services monitoring and accounting) and guideline development related to waste minimization and recycling, private sector participation (including capacity building in strategic planning, operational finance, regulatory oversight and contract management to promote private sector engagement), inclusion of informal waste workers and wider communities, multi-jurisdictional waste management, and cost recovery and operational sustainability (including developing municipal revenue enhancement plans). This will also provide institutional strengthening at the central and local-levels, including NGOs/CBOs, and private players in the SWM sector and conduct public awareness campaigns for waste minimization and separation, recycling and reuse, and IEC activities.

16. The Project shall cost USD231 million, comprising the Bank's and the GoB's contributions. The breakdown of costs by Project components is presented in the Table A2-6.

Table A2-6: Breakdown of Costs by Project Component (Indicative)

Component	Project Cost (USD in million)	Financing (USD in million)	
		AIIB	GoB
Component 1: Waste Collection and Transportation	**24.25**	**19.65**	**4.60**
Procurement of goods and equipment (such as collection containers and fleet, mechanical cleaning equipment, safety gears kits)	24.25	19.65	4.60
Component 2: Waste Treatment and Disposal	**168.00**	**147.36**	**20.64**
Integrated Landfill & Resource Recovery Facility	161.58	141.74	19.84
Community or household-level solutions for treatment and disposal including reuse/recycling, composing	6.42	5.62	0.80
Component 3: Institutional Capacity Building and Project Management Support	**17.53**	**13.46**	**4.07**
Project management, supervision, monitoring and evaluation	7.82	5.71	2.11
Policy development and institutional strengthening	0.35	0.25	0.10
Capacity building, community empowerment, public awareness raising and IEC activities	4.42	3.23	1.19
Individual Consultants	0.88	0.64	0.24
Project Management Support	4.06	3.63	0.43
Base Cost	**209.78**	**180.47**	**29.31**
Contingencies (Physical and Price)	21.52	19.53	1.99
Percentage	100%	86.5%	13.5%
Total Project Cost	**231.30**	**200**	**31.30**

17. **Project Implementation Arrangements.** The Local Government Engineering Department (LGED) under the Local Government Division (LGD) of the Ministry of Local Government, Rural Development & Cooperatives (MoLGRDC) will be the primary Project Implementing Entity for this Project. A dedicated Project Management Unit (PMU) will be established at LGED headed by a Project Director and supported by a full-time deputy Project Director and a team of core technical staff. The PMU will be responsible for overall Project management. It will play an important role in coordinating with all agencies involved in Project implementation, ensuring overall quality and timeliness of investments. It will be also responsible for all fiduciary and E&S requirements under the Project, and for Project Monitoring and Evaluation (M&E). All the participating ULBs will be required to constitute a Project Implementation Unit (PIU). PIUs, under the supervision of the PMU, will also be responsible for carrying out all the activities for Project implementation at the local-level and reporting it to the PMU.

18. The PMU and PIUs will be supported by a Project Management Consulting firm (PMC), hired by LGED, for technical support in carrying out subproject specific planning, design and implementation activities including preparation of all technical documents duly incorporating climate and disaster resilience, environment and social impact assessment, procurement, contract management and implementation supervision. Detailed Project implementation arrangements, including compositions, roles and responsibilities of Project stakeholders are included in the Project Implementation Manual (PIM).

Table A2-7: Summary of Roles and Responsibilities of Project Implementation Entities

Agencies	Roles and Responsibilities
LGED	(i) oversee overall project implementation and administration; (ii) coordinate with AIIB, stakeholders, and other agencies at central level for Project implementation; (iii) approve subproject proposals against subproject selection criteria; (iv) ensure compliance with Project covenants, including E&S measures; and (v) establish and strengthen PMU and ensures its adequate staffing.
PMU (Project Director, Deputy Project Director, Municipal Engineers, SWM Specialist, Environmental Specialist, Social Development Specialist, Structural Engineer, among others)	<u>Project management and administration</u> (i) responsible for overall Project management, implementation and monitoring; (ii) responsible for signing of participation agreement with each implementing agency, setting out the roles and responsibilities of all parties; (iii) liaise with implementing agencies and PIUs; (iv) liaise with AIIB, maintains Project documents, and submits timely reports to AIIB by consolidating inputs from PIUs, and submits quarterly Project progress reports to AIIB; (v) monitor and ensures the compliance of legal covenants; (vi) undertake budgeting and financial planning and management; (vii) open and maintain advance accounts in US dollar and Project accounts (sub-advance accounts) in local currency for AIIB loan; (viii) assist each PIU in opening subproject accounts; (ix) ensure auditing of loan proceeds and maintenance of all accounts; (x) submit external auditor report to AIIB; (xi) consolidate accounts and submits withdrawal applications to AIIB for reimbursement;

Agencies	Roles and Responsibilities
	(xii) hire, onboard and supervise consultants, including firms and individuals, for the Project; (xii) ensure adequate counterpart funds; (xiii) establish, maintain and update the Project performance monitoring system; (xiv) prepare Project completion report; and (xv) assists in knowledge management and sharing, and disclosure of information generated by the Project. <u>Procurement of Goods, Works, and Services</u> (i) Procure goods for PMU and multiple PIUs; (ii) assist PIUs in preparation of tender documents; (iii) provide PIUs with evaluation report templates; (iv) review evaluation reports and process for further approval; (v) send draft tender documents and evaluation reports to AIIB for review and approval (if prior review is required); (vi) support PIUs in advertisement of all procurement packages; (vii) recruit consulting services and manages their contracts; (viii) prepare updated procurement plan and submits to AIIB for review and approval; (ix) provide support and guidance to PIUs during procurement and contract management process; and (x) submit annual contract award and disbursement projections to AIIB. <u>Technical Oversight and Support</u> (i) provide technical support and overall guidance to PIUs; (ii) assist project steering committee in approval of subproject proposals against subproject selection criteria; (iii) conduct reviews and approves detailed engineering designs and cost estimates; (iv) approve any variation during execution of work contracts; (v) carry out periodic quality control of civil work contracts; and (vi) support and monitors PIUs in implementing subprojects. <u>E&S Compliance</u> (i) overall responsibility for E&S issues by monitoring and ensuring compliance with AIIB's E&S Policy as applicable, and government requirements; (ii) prepare and submit initial environmental examination reports and resettlement plans; (iii) coordinate for obtaining the right of way clearances; (iv) ensure integration of E&S safeguards, including land acquisition and gender aspects, as required in all documents, particularly in bidding documents and contracts; (v) prepare and submit to AIIB semi-annual E&S monitoring reports; (vi) ensure grievance redressal mechanisms are established and functioning in all PIUs; (vii) address grievances related to the Project; and (viii) provide capacity support to PIUs on E&S issues. <u>Institutional and Community Capacity Development</u> (i) approve and coordinate training and capacity building program; and (ii) oversee public relations and knowledge management;

Agencies	Roles and Responsibilities
ULBs	(i) implement subprojects, including procurement and supervision of works; (ii) ensure compliance with covenants, including E&S measures; and (iii) participate in capacity development programs conducted under the Project.
PIUs (Mayor, CEO or Secretary, Chief Engineer or Executive Engineer, Social Development Specialist, Environment Specialist, Engineers; among others)	<u>Project Management and Administration</u> (i) Manage day-to-day project implementation; (ii) liaise with PMU on project implementation; (iii) open and maintain one subproject account for AIIB loan and one subproject account for government funds each; (iv) make payments to contractors and goods vendors, the latter for the procurement of goods, not part of works packages; (v) submit contractor invoices and supporting documents for PMU review and concurrence; (vi) submit quarterly reports to PMU in agreed format and as required by PMU; and (vii) maintain subproject and contract-level accounting. <u>Procurement of Goods and Works</u> (i) Prepare bidding documents for works with consultant support and submit to PMU for review and approval; (ii) advertise NCT packages; (iii) establish tender opening and evaluation committees for civil works contracts; (iv) evaluate tender and submit evaluation reports to PMU; and (v) sign and manage all NCB civil works contracts (with support from PMU). <u>Technical Support</u> (i) supervise contractors and ensure quality of works; (ii) work closely with consultants; (iii) facilitate collection of data for detailed engineering designs; and (iv) prepare progress reports on each contract and include them in quarterly reports to PMU. <u>E&S Compliance</u> (i) Implement and monitor E&S compliance including consultations and disclosure; (iii) obtain right of way clearances as needed; and (iv) prepare quarterly safeguard monitoring reports and submit them to PMU. <u>Institutional and Community Capacity Development</u> (i) propose and participate in training and capacity building programs; and (ii) ensure public outreach
Project Steering Committee	(i) meet at least once a year or more frequently if necessary; (ii) provide strategic guidance and policy level support to the Project; (iii) ensure smooth project implementation and resolves critical implementation issues; (iv) ensure compliance with covenants as agreed with AIIB; and (v) facilitates inter-agency and inter-ministerial coordination.
Project Implementation Committee	(i) meet as and when required; and (ii) provide guidance to PMU and PIUs for smooth Project implementation and resolves implementation issues.

19. **High-level coordination arrangement.** A high-level Project Steering Committee[4] will be established, chaired by the Secretary of LGD to provide overall guidance and policy directions[5]. In addition, a Project Implementation Committee will be set up, chaired by the Chief Engineer of LGED to provide guidance and direction on key Project issues.

20. **Procurement.** The Project will support up to 20 ULBs which have been pre-identified. The project will adopt an integrated service delivery approach including segregation, collection and transportation, processing, and safe disposal. At time of this Appraisal, the feasibility study and activities in 8 ULBs have been identified and they are included in the Procurement Plan. However, activities under the remaining ULBs will be identified and approved during the Project implementation, and the following processing will be applied:

(i) All proposals of subproject to be approved by PMU, including the assessment whether the PIUs have the adequate capacity on carrying out procurement of simple works. If PMU determines additional capacity (such as a deployment of a procurement consultant) is required, PMU will include such capacity development measures in its approval document. The PMU approved document should also (i) identify any potential procurement risks along with their mitigation measures, and (ii) contain the Procurement Plan for each ULBs, and the proposed revision of the Project Procurement Plan.

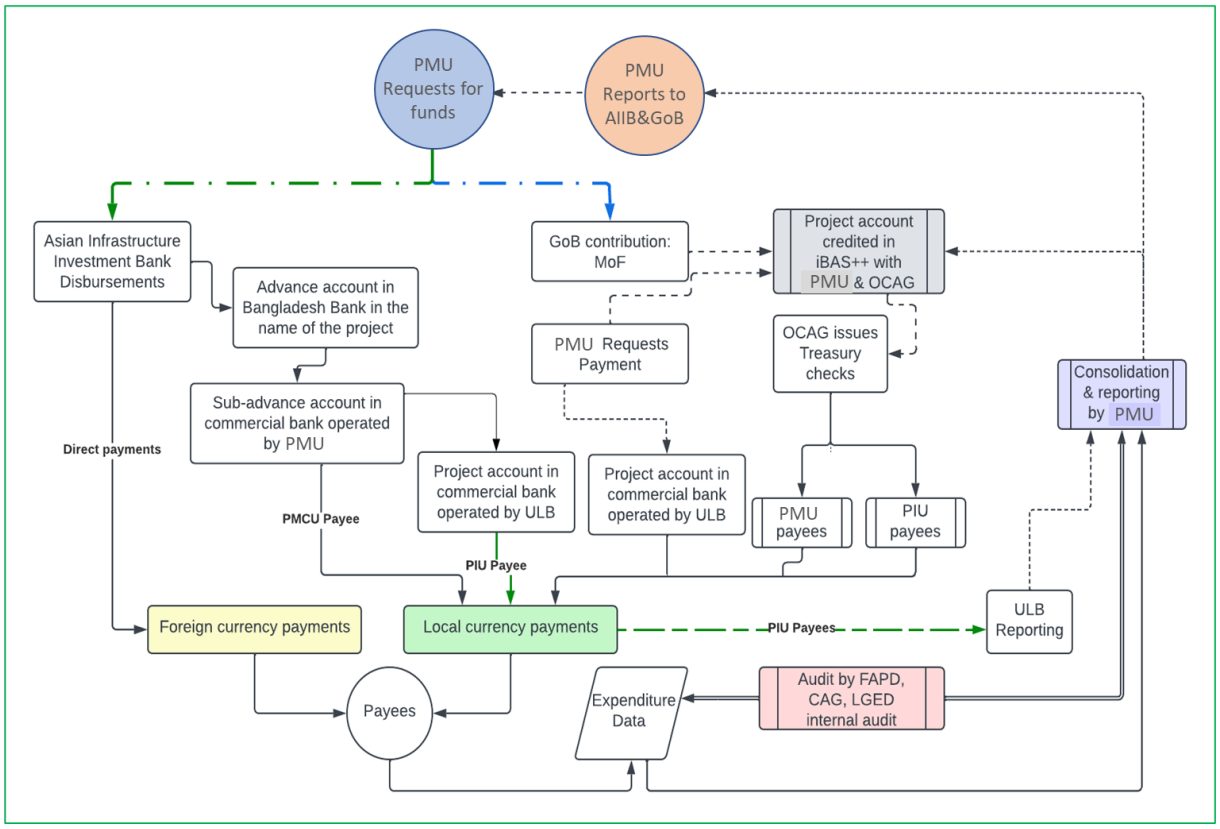
(ii) The PMU approval document will be submitted to the Bank for its review and approval.

(iii) During supervision, the Bank will review the project procurement implementation, and would advise the necessary improvement as necessary to ensure that the procurement reach its objective.

21. **Fund Flow Arrangements.** The loan proceeds will be disbursed in accordance with the AIIB's Loan Disbursement Policies as amended from time to time, and detailed arrangements agreed upon between the government and the AIIB. The PMU will be responsible for: (i) preparing annual contract awards and disbursement projections; (ii) requesting budgetary allocations for counterpart funds; (iii) collecting supporting documents; and (iv) preparing and sending withdrawal applications to the AIIB. Advance accounts will be established and maintained by the PMU for the AIIB loan. The PMU is responsible for the liquidation and replenishment of the advance funds. The currency of the advance account is in US dollars. The advance account is to be used exclusively for the AIIB's share of eligible expenditures. The PMU, who established the advance account in its name, is accountable and responsible for proper use of advances to the advance accounts.

[4] It will include representatives from the Ministry of Finance, relevant Ministries and government agencies.
[5] The committee will also help, as necessary, coordinate with relevant ministries such as the Ministry of Local Government, Rural Development and Co-operatives (for local governance and inter-government fiscal transfer); the Ministry of Environment, Forest and Climate Change (relating to sector policies and guidelines, oversight and monitoring, environmental regulations/rules and permits, climate change); the Ministry of Power, Energy and Mineral Resources (for waste-to-energy regulations); the Ministry of Agriculture (relevant guidance and requirements for composting); and the Ministry of Information (for promoting awareness raising).

Figure A2-9: Fund Flow Diagram



22. The PMU will submit to AIIB, annual contract awards and disbursement projections before the start of each calendar year using the AIIB's standard format. The PMU, in consultation with LGED, will prepare the annual budget based on the policy of the medium-term expenditure framework of the government. For reimbursing eligible project expenditure to the government, the reimbursement procedure will be followed. For the Project, the MoF will allocate counterpart funds to PMU and PIUs through budgetary allocation.

Annex 3: Economic and Financial Analysis

Economic Analysis

1. The economic analysis has been carried out on a cost-benefit framework, a methodology that compares scenarios '*with*' and '*without*' the project. The analysis considered various cost components, including capital investments, operations and maintenance costs, and anticipated benefits. The benefits encompassed cost savings derived from avoiding landfills, public health benefits associated with reduced incidents of waterborne diseases through effective solid waste management, cost implications of substituting chemical fertilizer with composts and quantification of reduced greenhouse gas (GHG) emissions. Benefits like improved living standard, well-being, environmental quality are intangible and difficult to measure and thus not included in the analysis. To arrive at the economic value, the stream of financial costs was adjusted to exclude applicable Value-Added Tax (VAT) and was also considered for the shadow price of labor, using an estimated Conversion Factor (CF) of 0.93.[6] All prices were expressed in constant values of the base year 2023. A discount rate of 12 percent[7] was applied, representing the Social Opportunity Cost of Capital (SOC).

2. **Data Collection.** For the economic analysis, a feasibility study was conducted for the Project to collect data on various aspects, including investment requirements, potential O&M costs, and revenue sources. In addition to the ULB data, the analysis also incorporated relevant information obtained from environmental and social impact assessments and ULB's budgetary statements. To ensure the accuracy and consistency of the analysis, key assumptions were made based on the arithmetic mean of the metrics observed in the targeted ULBs. This approach helps to provide a comprehensive and informed assessment of the project's economic viability.

3. **Assumptions.** The implementation of the Project will cover 20 Urban Local Bodies (ULBs), benefitting a significant population of more than seven million individuals by offering enhanced Solid Waste Management (SWM) services. The major portion of the investment, approximately 93 percent, is allocated to Components 1 and 2, which involve interventions in waste collection, transportation, treatment, and disposal. The Economic Analysis (EA) thus primarily assesses these two components. While Components 3, involving capacity building and project management support, may yield considerable economic advantages, they have not been included in the analysis. The EA is based on key assumptions, which are detailed in Table A3-1, providing a foundation for the evaluation of the Project's economic aspects.

[6] Due to interruptions in international supply chain and volatility in export and import volumes as an impact of the pandemic, shadow price of labor has been used instead of SCF.
[7] The rate is used by the GoB to apprise projects; which is a conservative number, considering the commercial lending rate is ~9 percent and MDB's interest rate ranges from 3.5-6.5 percent.

Table A3-1: Key assumptions used in EA

Items	Estimates
Targeted ULBs for SWM interventions	20
Number of peripheral ULBs included in the project	6
Population growth rate in urban areas (WB)	3.20%
Average household size in urban areas (HEIS 2022)	4.18
Poverty headcount ratio: percentage of population (WB)	24.3%
Average Per capita waste generation (Kg/person/day)	0.56
Avoided landfill by per ton waste recycling (square feet)	4.5
Average land price in urban areas(USD/Decimal)	7,282
Avoided incidents of diarrhea by SWM (percent)	23.9
Price difference between chemical fertilizer and compost (USD/Kg)	0.13
Price of carbon emission USD/tCO2eq (lower bound, 2023)	43
Price of carbon emission USD/tCO2eq (upper bound, 2023)	86
Estimated project life (Years)	20
Social Opportunity Cost of Capital (SOC)	12%

4. **Economic benefits.** The impact of SWM interventions on welfare is multi-faceted, some being easily identifiable and quantifiable (e.g., recyclables, public health benefits, avoided landfills) and others being more intangible and difficult to measure (e.g., living standards, well-being, and environmental quality). The benefits of the Project interventions included in the analysis are the following:

(i) Public health benefits: unmanaged solid waste poses a significant threat to public health, leading to the spread of various diseases. For example, a study[8] conducted in Nigeria found a link between unmanaged solid waste and diseases such as Malaria, Diarrhea, Cholera, and Lassa fever. The study indicated a statistically significant association between the unmanaged solid waste and diarrheal incidents by 23.9 percent.[9] Similarly, a study[10] conducted in Low-Income Communities (LICs) in Dhaka, Bangladesh, reported similar findings regarding the public health impacts of improper waste management. The study revealed that households residing in LICs and experiencing inadequate waste management had to spend between BDT1,000-5,000 on treating family members. Furthermore, the feasibility study conducted among waste workers of Project ULBs highlighted a high incidence of diseases within the past year.

[8] Omang DI, John GE, Inah SA, Bisong JO. Public health implication of solid waste generated by households in Bekwarra Local Government area. Afr Health Sci. 2021 Sep;21(3):1467-1473. doi: 10.4314/ahs.v21i3.58. PMID: 35222612; PMCID: PMC8843296.

[9] A meta-analysis carried out by Waddington et al. (2009) on the Impact Evaluations of WASH interventions reveals that improved water and sanitation can reduce diarrheal incidents by 39 and 37 percent correspondingly. A 23.9 percent reduction of diarrheal incidents due to improved SWM found in the Omang et al. (2001) study seems comparable.

[10] Health Impact of Solid Waste Management in Four Slums of Dhaka City, USAID, Dhaka Calling Project, 2022

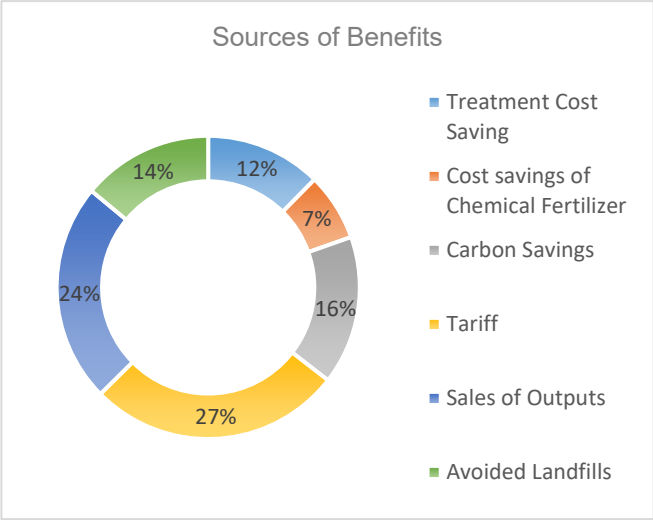
(ii) Compost production from the organic wastes: composting reduces the need for chemical fertilizers, which can be costly for farmers. By utilizing compost as an organic fertilizer, farmers can significantly reduce their input costs while improving soil fertility and crop productivity. In a country like Bangladesh, this cost-saving aspect is particularly beneficial for small-scale farmers who may have limited financial resources.

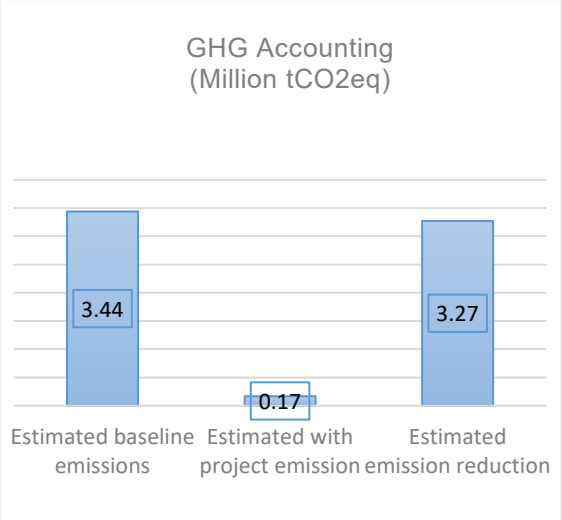
(iii) Avoiding landfills: composting organic waste reduces the burden on landfill sites and associated costs. Landfilling waste requires significant land acquisition, construction, and maintenance expenses. By diverting organic and recyclable waste from landfills and converting it into compost and through Material Recovery Facilities (MRFs), ULBs can save on landfill management costs and extend the lifespan of existing landfill sites.

(iv) Environmental benefits: treatment of solid waste along with composting organic waste in a controlled plant will contribute to environmental sustainability by reducing GHG emissions. When organic waste decomposes in landfills, it produces methane, a potent GHG that contributes to climate change. An estimated 6 percent of the world's emissions of methane are released from landfills (Beede and Bloom, 1995). The proposed waste segregation and composting organic waste under the Project aim to minimize methane emissions, thereby aiding to mitigate climate change impacts and potential associated costs.

5. **GHG accounting.** The Project is expected to reduce the net GHG emission compared to the "*without*" Project scenario. The total net reduction of carbon emissions is estimated to be 3,271,736 tCO2eq, which translates into 163,587 tCO2eq per year on average over the Project period.

Figure A3-1: Sources of Project benefits and GHG accounting





6. **EA results and implications for supervision.** The Project's economic net benefit is significant in the base case at a 12 percent social opportunity cost of capital—with a positive ENPV of USD102 million and an EIRR of 19 percent. The base case was stress tested for capital expenditures (CAPEX) costs overrun, increase in O&M costs, reduced expected benefits (see

Table A3-2). The results show the Project will produce net economic benefits even under potential high-risk scenarios; which indicates the Project's robustness and ability to deliver positive economic outcomes.

Table A3-2: EA results and sensitivity analysis

Scenario	Change	NPV (Mil. USD)	IRR (%)
Base case		102	**19%**
Increase in capital costs	20%	70	16%
Increase in O&M costs	20%	95	19%
Decrease in benefits	20%	42	15%
Increased cost + decreased income	20%	2	12%

Financial Analysis

7. The financial analysis of the Project delved into the Project's financial aspects, including revenue generation, cost management, funding requirements, and financial projections. By incorporating projected cash flows, revenue streams, operating costs, and capital investment in the model, the key financial indicators such as the Internal Rate of Return (IRR), Net Present Value (NPV), and Benefit-Cost Ratio (BCR) were assessed to infer the Project's ability to generate sufficient cash flows, and its financial viability.

8. **Capital expenditure.** The capital investment comprises of procurement of municipal waste management equipment's, construction of the landfill facility, construction of the recovery facilities and infrastructure for waste transportation. These capital investment components ensure the necessary infrastructure, equipment, and facilities are in place for effective waste management and the successful execution of the Project.

Table A3-3: Project capital investment

Capital Investment	Million USD
(i) Civil works including STS	87.06
(ii) Equipment (Landfill)	28.76
(iii) Equipment (Others)	20.34
(iv) MWM equipment	4.00
(v) Improvement of access roads	23.48
(vi) Workshop/Truck Shed	1.70
(vii) On site SWM	6.37

9. **O&M costs.** The O&M costs for operating and maintaining the facilities under the Project is estimated to be USD6.99 million per year on average. O&M costs for primary waste collection consist of activities such as door-to-door waste collection from households. Secondary collection and transportation costs include the operation and maintenance of waste transfer stations, the utilization of specialized vehicles for waste transportation, and the coordination of logistics to

ensure efficient and timely waste transfer. Facility operations included the management of compost plants, MRF, landfill sites, or any other waste treatment infrastructure and safety measures. The indicative distribution of O&M costs amongst these broad categories is summarized in Table A3-4.

Table A3-4: estimated O&M costs across SWM value chain

O&M Costs	Bhola	Chattogram	Kushtia	Munshiganj	Rajshahi	Rangpur	Average
Facility Operations	44.93%	34.13%	34.28%	45.21%	24.55%	32.43%	35.92%
Primary Waste Collection	40.54%	41.24%	41.14%	43.19%	61.07%	43.44%	45.10%
Secondary Collection and Transportation	14.53%	24.63%	24.57%	11.61%	14.38%	24.13%	18.97%

10. **Revenues streams.** The Project will generate revenues from tariff collection from improved SWM services and from the sale of outputs from resource recovery facilities such as compost, recyclable plastics and metals. The Pyrolysis plant is also proposed in some ULBs which would provide additional revenue stream from sale of diesel. The averages of the data collected from 20 ULBs are presented in the following table.

Table A3-5: Arithmetic Mean of Parameters from 20 ULBs

Waste/Tariff Collection	Average waste generation	Kg/day/person	0.59
	Average tariff rate(household/month)	BDT	103
	Average tariff collection efficiency	Percent	54%
	Average waste collection efficiency for the 20 ULBs (2023)	Percent	37%
Waste Segregation	Waste for Landfill	Percent	53%
	Waste for Compost Plant	Percent	29%
	Plastic Waste	Percent	2%
	Recyclable Waste	Percent	16%
Total Plant Capacities in 20 ULBs	Land fill	Tons	1,753
	Compost Plant	Tons	687
	MRF	Tons	375
	Pyrolysis	Tons	53
Recyclable Outputs	Waste to Compost	Percent	25%
	Pyrolysis to Diesel	Ton to litter	33%
	Valuable Recyclables	Percent	80%
Price of Recyclable Outputs	Compost	BDT/ Ton	10,000
	Diesel	BDT/Litter	70
	Valuable Recyclables	BDT/Ton	8,000

11. **The financial viability of the Project.** The assessment of financial viability is based on data collected on the current (2023) conditions and practices prevailing in the targeted ULBs. The analysis utilized arithmetic means of relevant parameters found in 20 ULBs to assess key financial indicators over a Project lifespan of 20 years. In the base case scenario, the Project demonstrates a significant net income, especially when considering the potential financing support from Multilateral Development Banks (MDBs) at a 6 percent interest rate. The analysis resulted positive NPV over the 20-year period, indicating that the Project is expected to generate financial returns that exceed the initial investment even in high-risk scenarios (see Table A3-6).

Table A3-6: FA results and sensitivity analysis

Scenario	Change	NPV (Mil. USD)	IRR (%)
Base case		381	15%
Increase in capital costs	20%	206	13%
Increase in O&M costs	20%	223	15%
Decrease in benefits	20%	144	12%
Increased cost + decreased income	20%	98	10%

12. **Financial capacities of ULBs for SWM interventions.** Through analysis of ULB's budget allocation data, the revenue budget allocated for SWM is significantly low. For the Project ULBs assessed, the budget allocation for SWM ranged from 5 percent to 37 percent of the total budget. A significant portion of the allocated budget was directed towards waste collection, covering expenses such as personnel costs and vehicle maintenance. The analysis also highlighted a concerning aspect regarding waste treatment. Only about 10 percent of the allocated budget for SWM was allocated for waste treatment, resulting in open dumping or burning of waste. This underscores the need for greater investment in waste treatment infrastructure and processes to ensure sustainable and environmentally-friendly waste management practices.

13. Drawing from past experiences of solid waste projects supported by development partners, it is evident that ULBs often struggle to meet the operational costs due to a lack of financial resources and institutional capacity. As a result, ULBs face challenges in financing capital investments required for robust SWM infrastructure. To bridge this gap, it is necessary to provide capital subsidies to ULBs, enabling them to deliver efficient and sustainable SWM services to the citizens.

14. **Operational Sustainability in case of Capital Subsidy.** Considering capital subsidy to the ULBs due to their weak financial capacity, the operational sustainability of the proposed project has also been assessed. The operational sustainability of Project relies on a meticulously designed business model that encompasses private sector engagement, cost recovery mechanisms, revenue generation from end products/recyclables, and potential government support. By carefully balancing financial viability with environmental and social objectives, the project aims to establish a sustainable and efficient SWM system that benefits both the community and the environment. Based on estimates, the Project's annual operating cost is projected to be USD6.9 million. To ensure long-term financial sustainability, this cost will be covered through

various sources, including user charges, revenue generated from the sale of end products, and potential government subsidies in case of any shortfall. A comprehensive business model was developed to assess the project's financial feasibility, with a focus on engaging the private sector in SWM operations.

15. The assessment involved analyzing data collected during the feasibility study conducted for the Project. The business model took into account factors such as door-to-door waste collection coverage, tariff rates for individual households, and tariff collection efficiencies in the targeted ULBs. The analysis considered the parameters of the least efficient ULBs to ensure that the business viability of the selected ULBs accurately reflects the operational sustainability in other ULBs where the parameters may be more favorable. The analysis incorporated the following parameters to evaluate the operational sustainability:

(i) Waste collection efficiencies. The waste collection coverage within the jurisdiction of each ULB plays a critical role in ensuring a sufficient supply of waste as raw material for the compost plant, MRF, and Pyrolysis plant, which are the primary revenue sources for the SWM plants. The study identified the three ULBs with the weakest door-to-door waste collection efficiency. Among the 20 Project ULBs, the lowest waste collection efficiency was reported to be in Lalmonirhat, where waste collection was as low as 6 percent. On the other hand, Rajshahi had the highest waste collection efficiency, reaching 90 percent. For the analysis, the average waste collection efficiency of the worst three ULBs was considered as the base case.

(ii) Tariff collection efficiencies. Tariff collection efficiencies are a crucial element for covering the O&M costs of the SWM facility. A portion of the O&M costs will be covered through household user tariffs at ULB levels. The feasibility study revealed significant variations in tariff collection efficiencies among the targeted ULBs. Some ULBs showcased exemplary tariff collection efficiency, with rates as high as 94 percent (Chapainawabganj). For the analysis, the base case considered the average tariff collection efficiencies of the worst three ULBs in terms of tariff collection efficiency.

(iii) Tariff rates. Tariff rates also play an important role in compensating for the O&M costs of the SWM plant. Among the examined ULBs, the lowest tariff rate was found in Chattogram, Brahmanbaria, and Moulvibazar, charging 50Taka (USD0.46) per month per household. Conversely, the highest tariff rate was observed in Bhola, charging BDT175 (USD1.62) per month per household.

Table A3-7: Worst cases in waste collection, tariff collection efficiency, and tariff rates

Worst Three Cases					
Waste Collection	Rate	Tariff Collection	Rate	Tarif Rate	BDT
Lalmonirhat	6%	Kushtia	28%	Chattogram	50
Netrokona	9%	Kishoreganj	30%	Brahmanbaria	50
Brahmanbaria	12%	Manikganj	31%	Moulvibazar	50
Average	9%	Average	30%	Average	50

16. **Revenues from outputs.** The business model, moreover, explores potential revenue streams from the sale of end products derived from waste. This includes the sale of recyclable materials, compost, and fuel from plastic-to-energy conversion processes. These revenue estimates are crucial components of the financial analysis, providing insights into the potential income generated from the sale of these end products. By considering the efficiency rates and market prices associated with each output, the analysis aims to assess the financial viability and attractiveness of the SWM project.

17. In the analysis, the efficiency of the compost plant is estimated to be 25 percent. This indicates that for every 4 kilograms of organic waste processed by the compost plant, 1 kilogram of high-quality compost can be produced. The market price for compost is considered to be BDT8 (USD0.07) per kilogram. Regarding the MRF, an efficiency rate of 80 percent is assumed. This means that out of the total waste processed by the MRF, 80 percent can be effectively recovered as valuable materials that can be sold. These recovered materials, such as plastics, metals, or paper, are considered to have a market price of BDT6 (USD0.06) per kilogram. The Pyrolysis plant, on the other hand, operates at an efficiency rate of 33 percent. This indicates that only a portion of the waste processed by the Pyrolysis plant can be converted into valuable output, which in this case is diesel fuel. The market price for the Pyrolysis output, specifically diesel, is considered to be BDT70 (USD0.65) per liter.

18. **Operational Sustainability Analysis.** The business viability analysis explores key financial indicators, namely the Internal Rate of Return (IRR) and Net Present Value (NPV), to thoroughly evaluate the operational sustainability of the project. The IRR represents the rate of return that the project is expected to generate, while the NPV measures the net value of the Project's cash flows in present terms. These indicators play a crucial role in assessing the financial feasibility and long-term viability of the Project.

19. The analysis takes into consideration the projected revenues generated from the sale of compost, recovered materials from the MRF, and diesel fuel from the Pyrolysis plant. Additionally, user tariff collection is factored in as households' contribution to the O&M costs. In order to calculate the financial indicators, a discount rate of 10 percent is applied, which represents the average lending rate in commercial banks. This discount rate accounts for the time value of money and adjusts future cash flows to their present value. The assessment of the financial indicators incorporates the following assumptions.

Table A3-8: Key assumptions to assess financial indicators

Item	Estimates
Average Waste Generation (Kg/person/day)	0.59
Waste Collection Efficiency (2023)	9%
Tariff Collection Efficiency (2023)	30%
Output Sales Efficiency (2023)	40%
Target Efficiencies (2033)	70%
Household Tariff Rate (USD, Monthly)	0.46
Waste to Compost Efficiency	25%
Waste to Diesel Efficiency	33%
Waste to Material Recovery	80%

Yearly O&M Costs (Full capacity, Million USD)	6.99
Discount Rate	10%
Inflation rate (2021, WB)	4.1%
Project Life (Years)	20

20. **Results.** The Project's financial indicators are significant in the base case at a 10 percent discount rate—which is the cost of capital—with a positive NPV for 20 years and an IRR of 38 percent. The analysis also provides insights into the Project's financial performance under various scenarios, indicating its sensitivity to changes in costs, income, and market conditions. The base case was stress tested for an increase in O&M costs, reduced expected income and a sale drop of plant outputs by 50 percent (see Table A3-9). The results show the Project will produce positive net income under potential high-risk scenarios and offers business viability even in the least efficient ULBs.

Table A3-9: FA Results and sensitivity analysis

Scenario	Change	NPV (Mil. USD)	IRR (%)
Base case		70	38%
Increase in O&M costs	20%	56	30%
Decrease in income	20%	42	28%
Cost increase + income decrease	20%	28	21%
50 percent sales of outputs		33	29%

Annex 4: Paris Agreement Alignment and GHG emissions Assessment

1. The assessment of the Project's alignment with the Paris Agreement (PA) has been carried out in accordance with the Joint MDB guideline. This assessment suggests that the Project not only adheres to the stipulations set forth by the PA but also exhibits alignment with its principles and objectives. Bangladesh's vulnerability to extreme weather events, highlighted by its ranking as the seventh most affected nation in the Global Climate Risk Index, further underscored the importance of aligning with the PA through climate change mitigation and adaptation activities.

2. The Project aims to reduce climate change vulnerability by incorporating appropriate mitigation and adaptation measures into the Project design. Both the ESMPF and ESIA will help to ensure that the investments are designed considering the climate and disaster resilience aspects. Technical design guidelines for climate smart and disaster resilient SWM infrastructure will guide the climate mitigation or adaptive design and increase the Project's capacity to reduce exposure and to be resilient to natural hazards.

A. PA Alignment in Climate Mitigation (BB1)

3. Joint MDB approach presents an assessment approach by using uniform assessment criteria that identify operations or activity types which are universally considered to be aligned. According to the Joint Multilateral Development Bank (MDB) Universally Aligned or Not Aligned List, the proposed Project activities are in line with waste sector eligible operation types including separate waste collection, recycling, composting and anaerobic digestion of biowaste, material recovery, and landfill gas recovery from closed landfills.

(i) **Separate waste collection (in preparation for reuse and recycling):** The Project intends to Implement efficient and comprehensive waste collection systems that encourage the separation of different waste streams, such as recyclables, organic waste, and hazardous materials. This reduces the amount of waste sent to landfills and promotes recycling and resource recovery.

(ii) **Material recovery and recycling:** The Material Recovery Facilities (MRFs) under the Project will maximize the recovery and recycling of valuable materials from the waste stream. This reduces the demand for raw materials, decreases energy consumption and greenhouse gas emissions associated with extraction and manufacturing and promotes circular economy principles.

(iii) **Composting and anaerobic digestion of biowaste**: The compost plants are designed for the composting and anaerobic digestion of organic waste, diverting it from landfills and reducing methane emissions. The process would minimize the release of potent greenhouse gas (GHG) during waste decomposition.

(iv) Landfill Gas Recovery from Closed Landfills: Considering the capacity of the landfill facility across the Project ULBs, they do not meet the necessary waste generation threshold to establish an economically viable landfill gas recovery facility. As a result, the

proposal for landfill gas recovery was not included in the Project plan. Instead, the Project incorporated provision of flaring landfill gases after the landfill cells are closed. The engineering design has also included a provision for future landfill gas recovery, should it become economically feasible.

4. The Project interventions align with the national strategy documents, including the Nationally Determined Contributions (NDCs)[11], aimed at diminishing GHG emissions. By integrating recommended mitigation measures, the Project is designed to fulfill Bangladesh's NDC commitments and align with its Long-Term Strategy (LTS), all the while contributing to an overarching reduction of GHG emissions within the waste sector.

(i) **Implementation of the 3R Principle for Waste Management:** The project is aligned with National 3R Strategy for Waste Management stipulated in the NDCs and also endorsed by the Department of Environment under the Ministry of Environment and Forest to eliminate waste disposal on open land, rivers, and flood plains. The 3R strategy of waste management is a comprehensive approach that emphasizes the principles of Reduce, Reuse, and Recycle in the management of waste materials. The 3R strategy operates on the premise that waste should be viewed as a potential resource rather than an end-of-life burden. By adopting this approach, nations can make significant strides in reducing waste volumes, conserving resources and minimizing GHG emissions.

(ii) **Establishing Regional Integrated Landfill and Resource Recovery Facility:** Aligned with the Nationally Determined Contributions, the project has incorporated a regional SWM approach. Notably, the designated landfill site and material recovery facilities within the 20 ULB) will function as a regional hub, extending their services to an additional six ULBs. This regional perspective underscores the project's commitment to optimizing resource utilization and enhancing waste management efficiency across a broader geographic scope.

(iii) **Minimizing Energy and Fuel Consumptions**: The Project has undertaken steps to minimize energy and fuel consumption at all stages, including construction and operations through meticulous plans and guidelines. For example, the optimization transportation routes of waste collection system by identifying shortest paths between waste collection points and landfills will reduce the GHG generated from waste collection vehicles. A portion of the site's nighttime lighting system utilizes a renewable energy source, specifically solar energy. Further, the establishment of the broader Project infrastructure has provisioned GHG reduction measures over the life of the concession.

(iv) **Monitoring and reporting:** By introducing a robust monitoring and reporting mechanisms in the Result Monitoring Framework (RMF), the Project will track the progress and impacts of the SWM Project through a set of verifiable indicators. The RMF

[11] Bangladesh submitted the updated NDCs in August 2021 with the enhanced GHG reduction targets of 21.85 percent below Business As Usual scenario (6.73 percent reduction in the unconditional scenario and additional 15.12 percent reduction in the conditional scenario with external financial and technology support).

includes collecting data on the amount of waste collected, the rate of recycling, and the greenhouse gas emissions avoided through recycling initiatives.

5. The Project is also consistent with the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) under the theme to mitigation and low carbon development as proper urban waste management is being sought to lower GHG emission while ensure livable cities. The Project will primarily cater for integrated SWM and therefore will not compete with any existing more efficient alternative modes.

B. PA Alignment in Climate Adaptation (BB2)

6. The Joint MDB methodology for assessing the investment's climate adaptation alignment with the Paris Agreement consists of three steps:

(i) Criterion 1: The Climate Risk and Vulnerability Context is established: identify and assess physical climate risk to determine whether the SWM infrastructure, its ancillary facilities and its users are vulnerable to climate hazards;

(ii) Criterion 2: Adaptation measures for managing material risks are identified and integrated into project design: Propose measures to address the identified physical climate risks and support the delivery of climate-resilient SWM and other ancillary infrastructure, and contribute to build urban climate resilience, when possible; and

(iii) Criterion 3: The operation and its components are not inconsistent with the sectoral or national priorities for climate resilience: Ensure that the SWM infrastructure operation is consistent with the policies/strategies/plans for climate adaptation and resilience at the national, regional, local, city level.

7. Criterion 1: In preparing the design of the Project, the consultant undertook climate risk and vulnerability assessments in the feasibility study and ESIA that analyzed various potential risks, including precipitation, geology & earthquakes, flooding, and sea level rises. (Waste Concern, 2023). Two major risks that can pose impacts to Project sites, namely: (i) flooding due to extreme rainfall events especially during monsoon periods and (ii) increase in annual average temperature. Such risks could have adverse impacts. The most significant disaster and climate change risks associated with the sub-projects are during operation. Landfill sites can be impacted by heavy rain and flooding. Surface water draining towards the landfill area could potentially increase leachate and bring about local flooding during major rain events. Detailed analysis for climate risk associated with each project component is provided in the table below.

Table A4-1: Sensitivity of Project components to climate and weather conditions

Project Component	Climate Sensitivity	Risk & Impact
A. Waste Collection	Higher Temperatures	• Result in need for increased level of collections for mixed waste containing putrescible and segregated biodegradable waste collections due to increased rate of decomposition with results odour and insect infestation potential and bioaerosol releases.

		• Reduce outdoor workers' productivity. In some cases, extreme temperatures could adversely affect outdoors workers at risk from heat stress. • Give rise to situations where there is a greater risk of disease being transmitted where putrescible waste is handled. • Impact on the selection of waste collection containers if adverse impact is to be avoided.
	Increased precipitation in winter	• Lead to disruption to transport infrastructure from increased flooding and hence collection and delivery of waste • Require provision of containers designed to keep waste dry.
	Increased storminess	• Lead to increased incidences of windblown litter and debris. In severe cases this could increase risk of injury from flying objects for collection workers.
	Rising sea level	• Lead to disruption of collection rounds on the coast
B. Waste Transfer	Higher Temperatures	• Reduce outdoor and indoor workers' productivity. In some cases, extreme temperatures could adversely affect outdoors workers at risk from heat stress. • Give rise to situations where there is a greater risk of disease being transmitted where putrescible waste is handled. • Lead to odour impacts due to increased rate of decomposition requiring sophisticated odour and bioaerosol control measures at the transfer station and a reduction in the volume of waste that may be stored on site for a reduced time.
	Reduced precipitation in summer	• Reduce water availability for site management e.g. dust suppression.
	Increased precipitation in winter	• Increase flooding occurrences on site due to inundation of site facilities e.g. weighbridge, roads and offices depending on site location. • Lead to disruption to transport infrastructure due to floods and hence delivery of waste to site and transport off site.
	Reduced cloud cover and Increased UV radiation	• Require the provision of shaded areas over skips and waste reception containers.
	Increased storminess	• Lead to increased incidences of windblown litter and debris. In severe cases this could increase risk of injury from flying objects, mainly for site workers. • Lead to damage to buildings and site closure. Procedures exist for addressing these problems, but they may become more frequent. • Require more sophisticated buildings than currently provided.
	Rising sea level	• Lead to inundation of sites near to the coast • Lead to increased damage from storm surge for sites near to the coast
C. Disposal/Landfill	Higher Temperatures	• Alter waste decomposition rate. This would have implications for the amount of landfill gas generated, length of active gassing phase, site settlement, closure and completion etc. • Lead to reduce water availability, alter site hydrology and hence leachate production • Lead to reduced water availability and hence increased strength of leachate due to reduction in dilution • Reduce outdoor workers' productivity. In some cases, extreme temperatures could adversely affect outdoors workers at risk from heat stress.

		• Give rise to situations where there is a greater risk of disease being transmitted e.g. water borne and food poisoning types ailments due to increased pathogen activity, bioaerosol releases • Give rise to increased vermin e.g. flies • Give rise to increased risk of odor nuisance • Increased stress to vegetation and planting in landscaping and screening areas
	Reduced precipitation in summer	• Alter the waste decomposition rate (higher temperatures and less moistures could reduce decomposition rate. Higher temperatures and adequate moisture could increase decomposition rate.) • Alter site hydrology • Increase leachate strength • Reduce water availability for site management e.g. dust suppression • Increase the risk of shrinkage in clay lining and capping layers
	Increased precipitation in winter	• Increase flooding occurrences on site due to saturated waste and raising ground water. This could result in increased risk of offsite pollution from leachate and gas migration (depending on nature of site) and inundation of site facilities e.g. weighbridge, roads, offices, leachate treatment equipment, gas extraction equipment, offices etc. depending on site location. This could have periodic implications for environmental protection. • Alter waste decomposition rate • Increase leachate production in winter months (increased treatment and disposal costs) • Lead to disruption to transport infrastructure (road and rail) due to flooding and hence delivery of waste • Increase slope stability risks • Increase risk of erosion of bunds and capping layers
	Reduced cloud cover and Increased UV radiation	• Increase the risk to outdoor workers from sunburn and other skin conditions associated with over exposure. • Have an adverse impact on the life of exposed materials e.g., High-Density Polyethylene liner, plastic pipework and drainage ducts etc. • Increase the risk of damage to the High-Density Polyethylene liner due to solar gain requiring additional protection measures during installation
	Increased storminess	• Lead to disruption of water-based waste transport • Lead to increased incidences of windblown litter and debris. In severe cases this could increase risk of injury from flying objects, mainly for site workers • Lead to damage to buildings and site closure.
	Rising sea level	• Lead to inundation of sites near to the coast • Lead to increased damage from storm surge for sites near to the coast

8. Criterion 2: Climate adaptation and resilience measures. To limit the impact of a potential precipitation increase, the consultant has integrated into the Project design a comprehensive drainage system, access road above flood levels, and embankments around the landfill to ensure the Project is better adapted to potential climate changes. In designing the drainage system and related infrastructure, the consultant utilized historical rain data over the last 50-years to forecast, with appropriate modelling techniques, future precipitation increases. Further, the PIA designed the drainage structure and system based on an assessment of potential sea level rise, noting the

design may withstand sea level rises to at least a hundred-year period (based on current forecasts of potential sea level rise).

9. Considering risks identified, the Project carefully incorporated climate responsive design to adapt to such extreme weather events. The design will incorporate peripheral drainage systems, diverting water from the landfill cells. Elevated plinth and finished ground and embankment around the landfill have been introduced to mitigate flooding risks. The high rainfall standards have been considered in the design of leachate collection and rewater discharge system. These adaptation measures to address climate risks ensure that the Project is PA aligned on climate adaptation.

10. **Incorporating Climate Resilience Measures in the Detailed Design.** This Project supports climate resilience by introducing the following measures:

- The finished ground level of all the construction is considered to be above the flood level with a return period of 50-100 years[12];
- The plinth level of all construction is kept above flood level;
- Embankments around the landfill have been considered;
- All sidewalls and roofs are specially designed to withstand high wind velocity and storm up to 260 km/hr;
- Concrete roads are introduced to avoid waste penetration in the ground and to avoid attracting rodents and other pests to the facility;
- The highest rainfall amount considering records of last 50 years has been considered in the design of leachate collection and the rainwater discharge system. For enhancing safety, volume in the design has been increased by 25 percent to accommodate any additional volume of leachate due to any extreme events;
- The landfill site shall have HDPE lining and clay layer to avoid percolation of leachate water into the groundwater;
- To save the landfill area, around 18 percent of the inorganic waste shall be recycled;
- Staff and worker restrooms with bathing and toilet facilities are provided to provide comfort to the workers during extreme weather with increasing temperature;
- The landfill site shall have boundary walls, drainage facilities, and a drinking water facility.

11. The cost of drainage system and flood protection structure is representing approximately between 12 percent to 30 percent of the estimated project cost among different municipalities. Based on the climate adaptation measures incorporated into the Project, Criterion 2 is met and aligned.

12. Criterion 3: The final step in the joint methodology is ensuring that the SWM operations are consistent with the national policies and strategies for climate adaptation and resilience.

[12] The Project technical design has considered 1988 as the highest flood level. The return period of the 1988 flood is 50-100 years.

Notwithstanding, the Project has ensured that adaptation measures integrated into the design of the Project are aligned with the national policies of the GoB. The Project align with the priorities of Bangladesh for improving municipal solid waste management infrastructure and services that are designed with green technologies.

13. Bangladesh's National Adaptation Plan (NAP) (2023-2050) contains a comprehensive climate change adaptation strategy with prioritized measures across 10 key sectors (GoB 2023). One such adaption preference is to promote integrated waste and urban drainage management that can create a holistic solution for both issues, supported by standard guidelines, manuals and modelling. The Project activities fall under adaptation interventions by NAP, by integrated solid waste and urban drainage management for sustainable drainage system development following 3R (reduce, recycle, recovery) principles. The adaptation measures integrated into the Project, including the drainage system and flood protection structure, are aligned with the NAP. As the design has incorporated adequate climate adaptation measures into the Project and ensured that the Project design and SWM operations are aligned and consistent with national strategies on climate adaptation, the Project does meet all three steps under the joint methodology. As such, together with the mitigation measures previously discussed, ensures the Project is fully aligned under PA.

Table A4-2: Project's alignments with national policies and strategies for climate adaptation and resilience

Policy	Assessment of inconsistency	Justification
Bangladesh NDC	The Project clearly aligned with stated priorities	The Project does not impact the country's climate adaptation. This is a waste management project and the NDC clearly highlights the need for possible mitigation actions to improve solid waste management.
Sector Adaptation Policy: Towards a Multisectoral Action Plan for Sustainable Plastic Management in Bangladesh and National 3R Strategy for Waste Management	No evidence in policy that the Project is inconsistent	The Project focuses on integrating solid waste management infrastructure which is in line with strategy to capture, sort and recycle plastic across sectors to divert plastic from landfill.
National Adaptation Plan for Bangladesh (2023-2050)	The Project is consistent with stated adaptation preference	The Project is investing in integrated SWM and the NAP clearly states that integrated SWM is a suitable adaptation measure for urban areas.

14. Three-Step Method were applied to determine eligible adaptation activities in the Project. See Table A4-3. The detailed climate adaptation cost estimates are listed in Table A4-4.

Table A4-3: Three-step method for determine eligibility as climate adaptation finance

Step	1. Climate Vulnerability Context	2. Statement of Intent	3. Link Between Project Activities and Identified Climate Vulnerability

Flood responsive design adopted with site improvement, and facilities enhanced	High temperature, variant precipitation pattern, might result in flooding especially when the infrastructures are impacted by saturated waste and raising ground water.	Enhancing the adaptation ability of landfill and other disposal facilities against flooding and heavy rains.	The application of flood protection practices, including elevated ground level, plinth and embankment in the construction of landfills will enhance climate adaptation and reduce impacts of floods.
Access road above flood level applied	High Intensity and quantity of precipitation will result in flood and pose negative impacts to operations, especially when the infrastructures are located in the flood-prone areas.	Maintaining the accessibility of roads to SWM facilities through applying flood responsive standards.	The improved access road with embankment will strengthen operation stability by enhancing accessibility to facilities and reducing impacts by flooding.
Sidewalls and roofs specially designed to withstand high wind velocity and storm applied	Increased frequency of storms and cyclones due to higher temperatures and uneven precipitation.	Improvement of designs for roof and sidewalks and management measures on storms and cyclones	The construction of reinforced roofs and sidewalls will weather winds with higher speed and more intense storm to maintain SWM facilities functional.
Leachate collection and treatment ponds strengthened	The uneven precipitation distribution might cause additional leachate production.	Improvement of drainage and leachate infrastructures can take additional wastewater in case of extreme events.	Activities including enhancing leachate collection and strengthening treatment ponds to be resilient to projected changes in rainfall.

15. The climate change adaptation and disaster risk reduction measures will result in the following incremental costs to the Project:

Table A4-4: Climate adaptation plans within the Project

Incremental Climate Adaptation Costs (Million USD):Construction of SWM Plants												
Sl.	**ULBs**	**Site Improvement**	**Road embankment**	**HDPE liner**	**Non-woven geotextiles**	**Drainage layer**	**Uni Block**	**Labor Safety**	**Labor Shed**	**Plantation and Turfing**	**Roof**	**Total**
1	Ranjpur City Corporation	0.16	0.01	0.09	0.05	0.10	0.00	0.01	0.00	0.01	0.02	0.45
2	Rajshahi City Corporation	0.44	0.01	0.09	0.05	0.10	0.01	0.01	0.00	0.01	0.05	0.76
3	Chattogram City Corporation	1.05	0.03	0.26	0.12	0.29	0.02	0.03	0.01	0.03	0.14	1.96
4	Munshiganj Municipality	0.24	0.01	0.06	0.03	0.06	0.00	0.01	0.00	0.01	0.01	0.44
5	Kushtia Municipality	0.58	0.01	0.12	0.07	0.14	0.03	0.01	0.00	0.01	0.03	1.01
6	Bhola Municipality	0.07	0.00	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.13
7	Magura Municipality	0.16	0.00	0.04	0.02	0.04	0.00	0.00	0.00	0.01	0.02	0.30
8	Kishoreganj Municipality	0.19	0.00	0.05	0.02	0.05	0.00	0.01	0.00	0.01	0.02	0.35
9	Manikganj Municipality	0.18	0.00	0.05	0.02	0.04	0.00	0.00	0.00	0.01	0.02	0.33
10	Faridpur Municipality	0.18	0.00	0.05	0.02	0.04	0.00	0.00	0.00	0.01	0.02	0.34

11	Lalmonirhat Municipality	0.07	0.00	0.02	0.01	0.02	0.00	0.00	0.00	0.00	0.01	0.13
12	Chapainawabganj Municipality	0.35	0.01	0.09	0.04	0.09	0.01	0.01	0.00	0.02	0.05	0.65
13	B.Baria Municipality	0.39	0.01	0.10	0.04	0.09	0.01	0.01	0.00	0.02	0.05	0.72
14	Moulavibazar Municipality	0.11	0.00	0.03	0.01	0.03	0.00	0.00	0.00	0.00	0.01	0.20
15	Joypurhat Municipality	0.28	0.01	0.07	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.53
16	Dinajpur Municipality	0.30	0.01	0.08	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.56
17	Chandpur Municipality	0.30	0.01	0.08	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.56
18	Naogoan Municipality	0.30	0.01	0.08	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.56
19	Noakhali Municipality	0.30	0.01	0.08	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.56
20	Netrokona Municipality	0.30	0.01	0.08	0.03	0.07	0.00	0.01	0.00	0.01	0.04	0.56
	Totals	**5.95**	**0.15**	**1.51**	**0.69**	**1.53**	**0.11**	**0.17**	**0.07**	**0.21**	**0.69**	**11.08**

16. The Project activities are considered 100 percent in line with climate mitigation that promote efforts to reduce, avoid, and sequester the GHG emissions.

17. **GHG Accounting**. The GHG accounting of the proposed Project has considered a project life of 20 years, aligning with the Economic Analysis carried out. The Project aims to provide improved SWM facilities to 20 ULBs. The assumptions used for the GHG accounting are summarized in Table A4-5.

Table A4-5: General assumptions used in GHG Accounting

Description	Estimates
Population growth rate, urban (WB)	3.14
Average household size in urban areas (WB)	4.18
Average per capita waste generation (Kg/day)	0.59
Total Capacity of Compost Plants (tons)	687
Total capacity of Material Recovery Facilities (tons)	375
Total capacity of pyrolysis facility (tons)	53
GEF (tCO2eq/MWh)	0.73
Shadow price of carbon emission USD/tCO2eq (lower bound, AIIB Guideline)	42.8
Shadow price of carbon emission USD/tCO2eq (upper bound, AIIB Guideline)	85.5
Estimated project life (years)	20

18. **Model for GHG Accounting.** The analysis utilized the methodological tool for solid waste disposal sites, which was prepared by the United Nations Framework Convention on Climate Change (UNFCCC). This tool is a comprehensive and standardized framework designed to assess and quantify the greenhouse gas emissions associated with different waste management practices, particularly those related to waste disposal in landfills. The UNFCCC's methodological tool takes into account various factors that contribute to greenhouse gas emissions from solid waste disposal sites. It considers parameters such as waste composition, waste treatment technologies, landfill design, and waste degradation processes. By incorporating these crucial variables, the tool provides a systematic and rigorous approach to estimating the emissions of

methane and other greenhouse gases released during waste decomposition and degradation. The model uses the following formulae to calculate GHG emission:

$$BE_y = BE_{CH4,SWDS,y}$$
$$= \phi * (1 - f) * GWP_{CH4} * (1 - OX) * 16/12 * F * DOC_f * MCF$$
$$* \sum_{x=1}^{y} \sum_{j=A}^{D} W_{j,x} * DOC_j * (1 - e^{-k_j}) * e^{-k_j(y-x)}$$

And, $ER_y = BE_y - (PE_y + LE_y)$

Where:

ER_y = Emission reduction in the year y (tCO2e)
BE_y = Baseline emissions in the year y (tCO2e)
PE_y = Project emissions in the year y (tCO2e)
LE_y = Leakage emissions in year y (tCO2e)

19. **Waste Composition in the ULBs.** The average waste generation by the citizens of ULBs varies significantly due to various factors, such as income levels, consumption patterns, and cultural customs. Individuals with higher disposable incomes often engage in more purchasing and consumption activities. Moreover, some communities may have different preferences for packaging, disposable items, and single-use products, leading to varying waste volumes. Cultural customs and practices also influence waste generation.

Table A4-6: Estimated solid waste composition by category (percentage of total waste)

Waste Items	Bhola	Chattogram	Kushtia	Munshiganj	Rajshahi	Rangpur	Average
Waste for Landfill	40%	50%	55%	50%	55%	70%	53%
Waste for Compost Plant	40%	29%	27%	30%	25%	22%	29%
Plastic Waste	0%	3%	3%	0%	3%	2%	2%
Recyclable Waste	20%	19%	15%	20%	17%	7%	16%

20. **Grid Emission Factor (GEF).** The GEF for Bangladesh refers to the amount of GHG emissions produced per unit of electricity generated by the national power grid. It is a critical indicator used to quantify the environmental impact of electricity generation and assess the carbon intensity of the country's energy sector. The grid emission factor is influenced by several factors, including the energy mix used for power generation, the efficiency of power plants, and the type of fuel used. In Bangladesh, the energy mix primarily comprises fossil fuels such as natural gas, coal, and oil, along with a smaller share of renewable energy sources like hydropower and solar energy. The GEF for Bangladesh, as recommended by the UNFCCC, is 0.726 ton CO2eq/MWh for 2022.

21. **Carbon Emission from Vehicles Using Fossil Fuels**. The Project's primary and secondary waste collection and transportation involves the use of motorized vehicles that rely on fossil fuels. In an effort to mitigate GHG emissions from these vehicles, transportation routes have been optimized to enhance cost-effectiveness and collection efficiency. For the GHG analysis,

the Net Calorific Value (NCV) of fuel and Emission Factor of diesel used in the vehicles have been taken into account. Additionally, the analysis considers the daily average kilometers of travels and fuel efficiencies of the vehicles.

22. **Reducing Methane Emission from Organic Waste.** To ensure responsible waste treatment and reduction of methane emission, the compost plant employs an aerobic treatment method. This method involves the utilization of oxygen during the decomposition process. This composting process will efficiently break down the organic materials, promoting the growth of aerobic microorganisms that facilitate the composting process. To contain methane emissions effectively, the plant implements proper aeration systems, maintaining optimum moisture levels, and implementing temperature controls, all of which play a crucial role in controlling methane production during composting.

23. **Results.** The Project is expected to reduce the net GHG emission compared to the without Project scenario. The total net reduction of carbon emission is estimated to be 3,271,736 tCO2eq, which translates into 163,587 tCO2eq per year on average over the Project period of 20 years.

Table A4-7: ULB-wise GHG emission accounted for the 20-yer Project life (tons of CO2eq)

Sl. No	ULBs	Estimated baseline emissions	Estimated *'with project'* emission	Estimated emission reduction
1.	Raishahi	279,146	14,916	-264,230
2.	Rangpur	223,191	11,775	-211,416
3.	Chattogram	990,765	16,628	-974,137
4.	Kushtia	116,072	6,137	-109,935
5.	Munshiganj	61,393	5,345	-56,048
6.	Bhola	41,856	3,488	-38,368
7.	Kishoreganj	83,712	6,137	-77,575
8.	Chapai Nawabganj	334,850	14,916	-319,934
9.	Faridpur	83,712	6,137	-77,575
10.	Magura	61,393	5,345	-56,048
11.	Brahmanbaria	251,137	14,916	-236,221
12.	Moulavibazar	61,393	5,345	-56,048
13.	Manikganj	116,072	6,137	-109,935
14.	Lalmonirhat	41,856	5,345	-36,511
15.	Joypurhat	41,856	5,345	-36,511
16.	Netrokona	83,712	6,137	-77,575
17.	Naogaon	116,072	6,137	-109,935
18.	Chandpur	251,137	14,916	-236,221
19.	Noakhali	83,712	6,137	-77,575
20.	Dinajpur	116,072	6,137	-109,935
	Totals	**3,439,109**	**167,373**	**-3,271,736**

Annex 5: Implementation Support Plan

1. The implementation support plan, supported by AIIB's supervision capacity, has been developed in view of the complex nature of the Project. The plan aims to enhance project supervision, while mitigating the identified risks and effectively responding to issues and challenges as they arise. It will include a concerted plan of technical, fiduciary, and environmental and social (E&S) support needed to ensure due diligence over the course of Project implementation. AIIB will engage locally-based experts including experts in waste management, social development, stakeholder engagement, capacity building, and M&E.

2. AIIB will carry out implementation support missions three times a year, including review and support of procurement processes. Missions' frequency will be adjusted based on the speed of the activities and the performance of the Project. In addition to formal missions, AIIB will conduct smaller and more targeted missions, when required, to resolve specific matters related to finalization of designs, procurement and financial management matters, and the review and improvement of engineering supervision and implementation plans. After Project completion, an independent assessment of the Project will be undertaken to draw lessons to inform future or similar operations.

3. AIIB will provide intensive implementation support during the first year of Project implementation in the following areas to ensure a smooth start to Project implementation.

- *High-level planning and donor coordination.* AIIB, together with LGED, will coordinate with relevant ministries and local governments to ensure their planning and budgeting consistent with the Project. AIIB will closely coordinate and/or collaborate with relevant donor partners to increase impacts of the Project, including climate co-benefits, and scale up SWM interventions using the Project framework developed. Such coordination would be directed towards ensuring the most advantageous allocation of donor support to the Project. To facilitate improved dialog and cooperation, it is envisaged that donor coordination meetings in waste sector for Bangladesh would take place a minimum of twice a year.

- *Technical design of the Project.* At the technical level, AIIB will assemble the appropriate technical skills mix and experience needed to support implementation of this complex operation. AIIB will engage a local consultant to coordinate Project activities, monitor frequently Project progress, and provide just in-time technical support when required. Support to technical designs of the Project have started as part of Project preparation and will continue throughout implementation. In addition, AIIB will provide on-demand technical advice, especially with respect to: (i) climate resilience; (ii) private sector engagement; (iii) regional-level approach for waste disposal; (iv) municipal finance, operational and financial sustainability; (v) 3Rs and public awareness raising; and (vi) capacity building of ULBs, local communities, and other relevant stakeholders to improve SWM services.

- *Environmental and Social.* AIIB will support LGED and participating ULBs in implementing the agreed E&S instruments and reviewing compliance during implementation support

missions. AIIB will: (i) periodically carry out field supervision, (ii) review the periodic monitoring reports furnished by LGED and (iii) provide E&S training and guidance to LGED and Project ULBs for the implementation and monitoring of ESMP and RAP. Particularly, AIIB will closely monitor implementation of SWM facilities to minimize adverse E&S risks and impacts, including inclusion of informal waste pickers. AIIB will also consult with LGED on corrective measures to rectify any failures, when identified, to comply with its E&S obligations.

- *Procurement.* Procurement support involving (i) prior review of procurement documents, (ii) individual consultant support and coaching of procurement staff and detailed guidance on AIIB's procurement policy and (iv) monitoring of procurement progress against the detailed procurement plan and contract management. Process of familiarizing the LGED with AIIB's policy has already begun and will be continued during Project implementation.

- *Financial Management (FM).* AIIB will ensure that adequate training on FM is provided to relevant LGED and ULBs. FM reviews will be regularly conducted by AIIB to ensure that FM capacity and system remain adequate during Project implementation in accordance with AIIB's standard. The reviews may include: (i) review of annual project budget, together with PDS and procurement plan; (ii) review and verification of specific transactions; (iii) review of internal controls of FM; (iv) analysis of the financial statements in relation to the funds disbursed by AIIB; (v) physical verification of existence of structures and others and (vi) review of the Project Financial Reports and internal and external audit reports.

Table A5-1: Implementation Support Plan and Resource Requirements

Time	Focus	Skills Needed	Resource Estimate (# Staff Weeks per year)
First 24 months	Team Leadership	PTL/Co-PTL (2)	14
	Waste management	Infrastructure, O&M, engineering (2)	18
	Environment monitoring	Environmental specialist (1)	8
	Social monitoring	Social and gender specialists (2)	10
	Procurement	Procurement specialist (1)	4
	Financial Management (FM)	FM specialist (1)	4
	Monitoring and Evaluation (M&E)	M&E specialist (1)	8
	Capacity building	Capacity building, governance (1)	10
	Administrative support	Project assistant (1)	4
After the first 24 months	Team Leadership	PTL/Co-PTL (2)	10
	Waste management	Infrastructure, O&M, engineering (2)	16
	Environment monitoring	Environmental specialist (1)	6
	Social monitoring	Social and gender specialists (2)	8
	Procurement	Procurement specialist (1)	4
	Financial Management (FM)	FM specialist (1)	4
	Monitoring and Evaluation (M&E)	M&E specialist (1)	6
	Capacity building	Capacity building, governance (1)	8
	Administrative support	Project assistant (1)	4

Annex 6: Project Implementation Readiness

Please check all boxes that apply to the project and provide required explanation.

Policy and institutional arrangements

a) Key policy and institutional reforms, if critical to the successful completion of the project, are implemented or being implemented within a realistic timetable.
☒ Yes

☐ No, provide status quo, time-bound actions:

b) Provision of budget/counterpart fund for project implementation in first financial year is confirmed, e.g. in the government's annual budget, written commitments from partners with clear timetable for the funds availability.
☒ Yes

☐ No, provide status quo, time-bound actions:

c) The systems of oversight, financial management, fund flow arrangement, auditing arrangement and data collection / monitoring are established.
☒ Yes

☐ No, provide status quo, time-bound actions:

d) Institutional structure for project implementation is confirmed between government and AIIB.
☒ Yes

☐ No, provide status quo, time-bound actions:

Project Implementation Plans and Project Administration Manual.

a) Overall Implementation Plan, Procurement Plan, Contract Awards & Disbursement Projections of the project are finalized and agreed between government and AIIB.
☒ Yes

☐ No, provide status quo, time-bound actions:

b) Project Administration Manual/ Memorandum covering scope, organization and its Terms of Reference (TOR), procurement, budgeting, disbursement, ES monitoring, data collection/reporting and auditing arrangement has been finalized.
☒ Yes

☐ No, provide status quo, time-bound actions:

Project Management Office (PMO)/Project Implementation Unit (PIU)

a) Designation of core PMO/PIUs staff have been identified, especially key roles such as project director, procurement and contract, financial management, technical, environment and social (ES), data collection and monitoring, capacity building etc.
☒ Yes

☐ No, provide status quo, time-bound actions:

b) Request for Proposal (RFP) for all critical consultancy contracts e.g. Project Management consultants (institutional set-up, ES aspects, M&E aspects and capacity building), procurement agency, construction supervision etc. have been issued.
☐ Yes

☒ No, provide status quo, time-bound actions:

Procurement and ES activities

a) Procurement plan of the project detailing contract packages, modes of procurement, pre-requisites for awarding the contracts, approval flow chart, decision making structure and schedule for each contract has been finalized.
☒ Yes

☐ No, provide status quo, time-bound actions:

b) Bidding documents for all contracts, to be awarded during first 18 months of project implementation have been finalized, especially when involving advance procurement/retroactive financing.
☐ Yes

☒ No, provide status quo, time-bound actions:

c) Land acquisition and resettlement plans are ready, where relevant.
☒ Yes

☐ No, provide status quo, time-bound actions:

d) Budgeting for at least 30% of land acquisition & resettlement requirements has been made. Land acquisition/pre-construction activities, where relevant, are in progress.
☒ Yes

☐ No, provide status quo, time-bound actions:

e) Relief & Resettlement (R&R) Plan, where relevant, for the first two years of the project implementation has been finalized and confirmation that R&R activities are aligned with the Procurement Plan, has been conveyed.
☒ Yes

☐ No, provide status quo, time-bound actions:

f) Environmental Management Plan (EMP) for the first two years of project implementation has been finalized with technical assistance for its execution in place if required. Initial Environment Examination (IEE) /Environment Impact Assessment (EIA) and approval of AIIB have been completed/secured.
☒ Yes

☐ No, provide status quo, time-bound actions:

Required Clearances/Approvals for Project Implementation

a) All Statutory clearances like environmental/forest, water, land clearances, if applicable, are obtained.
☐ Yes

☒ No, provide status quo, time-bound actions:

b) Administrative clearances for temporary use of land are taken.
☒ Yes

☐ No, provide status quo, time-bound actions:

c) Administrative approvals for shifting of utilities are taken.
☒ Yes

☐ No, provide status quo, time-bound actions:

Annex 7: Member and Sector context

A. Country context

1. Prior to the pandemic, Bangladesh experienced robust economic performance growing at an average annual rate of 6.6 percent between FY2010 and FY2019. The growth has been propelled by strong macroeconomic fundamentals, rise in agricultural productivity, strong growth of exports and remittances and insulated financial markets.[13]

2. The textile and the ready-made garment (RMG) sectors have played a vital role in the improved economic performance with the sectors accounting for 12.4 percent of GDP and more than 80 percent of exports while providing direct employment to 4 million workers, including many women workers. Bangladesh emerged as a crucial player in the textile and RMG global value chain. The success of the textile and RMG sector is driven by low labor cost and a supportive policy environment. Remittances have also played an important role in fostering growth and sustaining macroeconomic stability.

3. The strong growth was associated with healthy creation of wage employment and poverty reduction. Overall employment grew at an average annual rate of 2.4 percent between 2000 and 2016, with female employment growing at nearly twice the rate. Wage employment experienced an average annual growth of 5.7 percent during this period. The increase in women's labor force participation was associated with narrowing of gender wage differentials. The robust growth also aided in poverty reduction, which halved from 48.9 percent in 2000 to 24.3 percent in 2016. However, poverty reduction did not occur in a uniform pattern across the country. Between 2010 and 2016, the pace of poverty reduction slowed down despite the economy growing at a higher rate. The slowdown was largely a result of very little poverty reduction in urban areas, even as rural poverty fell. Bangladesh has also made significant human development gains during the last three decades, especially in the areas of child and maternal health, access to primary education and gender equity at primary and secondary education levels.

4. Growth weakened during the pandemic, owing to lockdowns and decline in export orders. Given the high informality in Bangladesh's labor force, COVID-19 led to job losses, mainly in relatively poor areas of Dhaka, Chittagong, and Cox's Bazaar.[14] The loss in income and unemployment was unequal across gender with women being mostly employed in directedly affected sectors, especially RMG manufacturing.

5. Growth recovered to 6.9 percent and 7.1 percent in FY2021 and FY2022, respectively aided by the stimulus package and resumption of economic activity as lockdown measures were eased. However, the recovery was interrupted by the war in Ukraine as rising commodity prices and slowing external demand resulted in (a) high inflation, (b) widening of the current account deficit, (c) depreciation of the domestic currency and (iv) decline in reserves.

6. Apart from overcoming the immediate challenges, Bangladesh needs to address long-standing structural issues. The policymakers' request for IMF's ECF/EFF program, indicates their

[13] Bangladesh - Country Partnership Framework for the period FY16-20. Washington, D.C.: World Bank Group.
[14] South Asia Economic Focus, Fall 2020: Beaten or Broken? Informality and COVID-19. Washington, DC: World Bank Group

willingness to undertake long pending economic reforms, apart from restoring macroeconomic stability in the short-term. The reforms under ECF/EFF include (a) creating fiscal space by raising revenue and rationalizing expenditure, (b) developing a monetary policy that will be guided by inflation outlook, (c) ensuring greater exchange rate flexibility to accumulate reserves, (d) strengthening monitoring and supervision of the financial sector and developing domestic capital market and (e) creating an enabling environment to diversify and expand trade and attract FDI.

7. Although these reforms are expected to strengthen Bangladesh's economic potential, Bangladesh will continue to face other development challenges in the medium term. These include generating new sources of growth, making growth more inclusive by creating jobs, easing the infrastructure constraints, and reducing vulnerabilities to climate change. These challenges will have to be overcome to achieve the Government of Bangladesh's vision to eradicate poverty on way to becoming a developed nation by 2041.[15]

8. Developing sustainable infrastructure is major pillar of Bangladesh's development strategy, as highlighted by both short-term and long-term plans. The Perspective Plan 2041 highlights the importance of instituting adequate supply of modern sewage facilities in all cities. The serious health risk from water pollution due to inadequate management of sewage and solid waste is unacceptable and must be addressed on a war footing. All City Corporations and larger municipalities will be equipped with Water supply and Sewerage (WASA) type institutions that will have accountability for piped water supply and sewage disposal. Similar institutional arrangement for solid waste management will also be established. Proper disposal of sewage and solid waste requires modern waste treatment facilities and Bangladesh intends to learn from global experience.

9. However, the state of current infrastructure is not conducive to achieve these goals. At 114 out of 140 countries, Bangladesh's ranking on overall quality of infrastructure can be significantly improved.[16] The relatively low ranking was a result of weak performance in transport infrastructure (rank of 100) and utility infrastructure (rank of 113).

10. Bangladesh has been rapidly urbanizing with nearly 63 million people or 38% of the country's population living in urban areas. The rapid urbanization has put significant pressure on urban infrastructure including waste collection and disposal. Approximately, 25,000 tons of solid waste are generated daily in urban areas of Bangladesh or around 170 kilograms per capita.[17] Per capita daily solid waste generation in urban areas is projected to increase from 0.49 kg in 1995 to 0.60 kg in 2025. Currently, about 55% of the solid waste remains uncollected in urban areas. Uncollected waste, particularly plastic and polythene items, end up in drainage system and water bodies, clogging water flow in drains, polluting surface and groundwater, soil and air.

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[15] Making Vision 2041 a Reality Perspective Plan of Bangladesh 2021-2041, General Economics Division, Bangladesh Planning Commission, Ministry of Planning, Government of the People's Republic of Bangladesh

[16] Global Competitiveness Report 2019

[17] Ahmed, N. (2019, October 7). When the garbage piles up. The Daily Star. Retrieved from https://www.thedailystar.net/opinion/environment/news/when-the-garbage-piles-1810375

B. Sector and Institutional Context

11. The Constitution of Bangladesh (Art 18A) mentions the need to improve the management of natural resources for future generations. The Environmental Pollution Control Ordinance establishes the Environmental Pollution Control Board, which is tasked with formulating policies for control, prevention and abatement of pollution of the environment. The Board is managed by the Department of the Environment and the Ministry of the Environment and Forest.

12. Bangladesh began reforms in solid waste management since 1983, with the adoption of the Dhaka City Corporation Ordinance, Establishing the Dhaka City Corporation, responsible for waste collection, removal and disposal. In 1992, the National Environmental Policy set ground rules for protecting and managing the environment in a sustainable manner. This is headed by the Ministry of Environment and Forest and a National Environment Committee. In 2010, the country adopted a national 3R (Reduce, Reuse, Recycle) strategy, as part of the Environment Conservation Act.[18] Finally, the National Urban Sector Policy (2011) called for reducing waste through emphasizing recycling and focusing on improvement of urban infrastructure.[19]

13. A 2016 assessment found that most of the waste is organic with high moisture content, showing that composting and recycling are extremely important in the city.[20] Despite this extensive set of legislation and regulations, as of 2022 – an estimated 40-60% of urban solid waste remained uncollected in urban areas.21 In 2021, the Government of Bangladesh adopted a series of rules and regulations, governing solid waste management, including managing hazardous waste.[22]

Institutional Context

14. The Ministry of Local Government and Rural Development acts at the central level as the controlling authority over urban local governments. The Ministry of Environment, Forest and Climate Change governs solid waste management rules, while the Ministry of Local Government, Rural Development and Co-operatives is responsible for leading the implementation of these at the local level. Under the Ministry of Local Government, Rural Development and Co-operatives, a number of city corporations have been formed, including for Dhaka North, Dhaka South, Chattogram, etc. These are responsible for implementing policy at the local level.

15. Local Government Corporations may then outsource waste collection to private firms. As elsewhere in the world, a large amount of recyclable material gets collected informally by waste pickers. Each municipality is required to have an action plan for managing solid waste, including hazardous waste.[23]

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[18] http://www.doe.gov.bd/site/publications/322bf6c9-e23e-401f-864a-73efb078cd29/National-3R-Strategy-for-Waste-Management
[19] https://www.sciencedirect.com/science/article/pii/S2405844022002067 (Table 1)
[20] https://www.uncrd.or.jp/content/documents/4288Presentation-Sinha-PS-7.pdf
[21] https://www.sciencedirect.com/science/article/pii/S2405844022002067
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Annex 8: Sovereign Credit Fact Sheet

Recent Economic Development

1. Bangladesh is a lower-middle income country with GDP per capita at USD 2731 and a population of 168.5 million in 2022.[24] Bangladesh's economy has performed well in the recent years, growing at an average rate of 7.1 percent between FY2016 and FY2019.[25] However, Bangladesh's growth in FY2020 declined to 3.4 percent, due to a sharp fall in domestic economic activity and a decline in exports of ready-made garments. Economic growth strongly recovered to 6.9 percent and 7.1 percent in FY2021 and FY2022, respectively aided by the stimulus package and resumption of economic activity as lockdown measures were eased. However, growth slowed down in the first half of FY2023 as high commodity prices, supply disruptions and slowing external demand resulting from the war in Ukraine, forced the government to undertake demand management measures like curtailing energy demand and imposing curbs on import of non-essential items.

2. According to IMF estimates, the fiscal deficit was contained to less than 4.0 percent in FY2021 and FY2022 as shortfall in revenue collection was offset by reprioritization of expenditure.[26] Current expenditure grew at a higher pace than originally targeted due to higher spending on subsidies and current transfers. In contrast, capital expenditure, including those under the Annual Development Program fell short of original target. Bangladesh remains at low risk of debt distress with debt to GDP ratio being modest and declining in the medium term.

3. Inflation accelerated to 6.2 percent in FY2022 mainly on account of robust domestic demand and rise in commodity prices globally. The depreciation of the domestic currency against the US Dollar also added to the inflationary pressures. Inflation steadily increased during the first nine months of FY2023 and averaged 7.4 percent, aided by continued weakening of the domestic currency and hikes in power tariffs and other administered prices of various fuel products. The central bank raised the repo rate by 125 basis points to 6.0 percent between July 2022 and December 2023 to contain inflationary pressures.

4. The trade deficit doubled from 5.4 percent of GDP in FY2019 to over 10.8 percent of GDP in FY2022 as the rise in imports outweighed the rise in exports. Remittances, after rising briefly in FY2021, have reverted to 4.6 percent of GDP in FY2022 as multiple exchange rates prompted the use of informal channels. A widening trade deficit and lower remittances resulted in the current account deficit widening to 4.1 percent of GDP in FY2022. With the current account deficit exceeding the surplus on the capital account, reserves declined by USD 4.0 billion during FY2022. Reserves further declined by USD 9.7 billion between July 2022 and May 2023. The government introduced several import restrictions, which resulted in the merchandise trade deficit during July

[24] The income group classification for fiscal year 2021 is based on World Bank criteria. The data sourced from World Economic Outlook April 2023 Database.
[25] In Bangladesh, the fiscal year starts on 1 July ending on 30 June. FY2022 started on 1 July 2021 and ended on 30 June 2022.
[26] According to Government of Bangladesh's most recent budget, fiscal deficit grew from 4.0 percent of GDP in FY2021 to 5.1 percent of GDP in FY2022.

2022 to January 2023 reducing by about 40 percent. Remittance inflows have remained stable compared to the previous year.

5. Macroeconomic stress in the form of a rapid slowing economy, rising inflation, widening of the current account deficit, depreciation of the Bangladeshi Taka and significant decline in foreign exchange reserves have resulted in Bangladesh signing up for a 42-month SDR 2.5 billion (USD3.3 billion) under IMF's Extended Credit Facility (ECF) and Extended Fund Facility (EFF) arrangements. Concurrently, Bangladesh has also signed for a SDR 1.0 billion (USD1.4 billion) under the newly created Resilience Sustainability Facility (RSF).

6. In May 2023, Moody's downgraded Bangladesh's rating to B1 from Ba3 due to deteriorating external position and government liquidity risks. Earlier, in August 2022, S&P affirmed a BB- to Bangladesh's sovereign long-term rating with a stable outlook. Fitch ratings in November 2022 also retained BB- and B for long-term and short-term ratings respectively with a stable outlook.

Economic Indicators

Table A8-1: Selected Macroeconomic Indicators - Bangladesh (FY2020-FY2024)

Economic Indicators	FY2020	FY2021	FY2022	FY2023*	FY2024*
Real GDP growth	3.4	6.9	7.1	5.5	6.5
CPI Inflation (average, % change)	5.6	5.6	6.2	8.6	6.5
Current account balance (% of GDP)	-1.5	-1.1	-4.1	-2.1	-4.2
General government overall balance (% of GDP)	-4.8	-3.6	-3.8	-5.6	-5.1
General government gross debt (% of GDP)	34.5	35.6	39.1	42.1	42.4
External public debt (% of GDP)	14.6	15.1	17.0	18.9	19.0
Gross international reserves (USD bil.)**	36.0	46.4	33.4	29.8	
Exchange rate (BDT/USD, EOP)**	84.3	84.8	86.20	104.5	

Note: FY2022 ran from July 2021 to June 2022.
* denotes projected figures.
** FY2023 reserves and exchange rate are from Bangladesh Bank and are as of May 2023.
An upward revision in nominal GDP with a new base year has resulted in lower current account and fiscal deficit ratios than previous years.
Source: IMF Report 23/66, IMF World Economic Outlook Database April 2023, and Bangladesh Bank

Economic Outlook and Risks

7. According to IMF's estimates, the economy is expected to slow down in FY2023 growing by 5.5 percent. Low remittances, high inflation and demand management pressures will dampen consumption growth. While an uncertain global environment may hurt exports, the concentration of low-value goods in Bangladesh's export mix is likely to provide some cushion from the volatility in global demand. Public investment is also likely to slow down due to the tightening measures announced by the government. Domestic energy shortages along with rising commodity prices will weigh in on the manufacturing sector. Excess rainfall and flooding damaged standing crops and will reduce agriculture growth. Growth is expected to revive to 6.5 percent in FY2024 as global environment stabilizes, agriculture sector recovers from unseasonal rains and government undertakes measures to resolve energy sector bottlenecks.

8. Fiscal deficit is expected to inch up to 5.6 percent of GDP in FY2023 due to lower tax revenues and elevated expenditures on subsidies and interest payments. Fiscal policy reforms under the IMF program are expected to raise revenues, rationalize subsidies and lower interest payments, helping to lower the deficit to 5.1 percent in FY2024. Bangladesh's debt profile is expected to remain favorable with majority of the public debt is denominated in domestic currency and held by residents. External public debt is also expected to remain around the current levels.

9. Inflation is expected to sharply increase in FY2023. Rising global commodity prices has resulted in increases in domestic administered prices of fuel products. The depreciation of the domestic currency by more than 15 percent since April 2022 will also stoke inflationary pressures. While the central bank has raised the repo rate by 125 basis points, the transmission might be limited due to the 9 percent cap on bank lending rates. Softening of commodity prices in FY2024 and steps taken to strengthen monetary transmission would help rein in inflation to 6.5 percent in FY2024.

10. After rising substantially in FY2022, the current account deficit is expected to moderate to 2.1 percent of GDP in FY2023 due to the import compression measures introduced by government. Export growth is likely to remain muted due to global uncertainty and weak demand from advanced economies. Greater exchange rate flexibility and a rebound in workers going abroad are expected to improve remittance flow through formal channels. The current account deficit is expected to increase to 4.2 percent of GDP in FY2024 as external financing under the IMF program ease the financing constraints thus normalizing imports.