

Dhaka North City Corporation
The People's Republic of Bangladesh
Japan International Cooperation Agency

FUTURE VISION OF SOLID WASTE MANAGEMENT IN DHAKA NORTH CITY

*Environmentally Advanced City with Integrated and Sustainable Solid
Waste Management: toward Zero-Waste*

NEW CLEAN DHAKA MASTER PLAN 2018–2032

EXECUTIVE SUMMARY

July 2019

EXECUTIVE SUMMARY

E-1 INTRODUCTION

Waste Management Department (WMD) of Dhaka City Corporation (DCC)¹ has established in July 2008 in place of the conservancy department for improving Solid Waste Management (SWM). For waste collection improvement, the conventional collection methods were modified into more efficient ones as well as the institution of DCC for waste collection was strengthened within the WMD. After the DCC established the system for SWM through the implementation of the first Clean Dhaka Master Plan (2005–2015), Dhaka City was administratively divided into two areas in 2011, and the DCC was also split into Dhaka North City Corporation (DNCC)³ and Dhaka South City Corporation (DSCC)⁴. However, a serious issue remained in that the capacities of both existing landfills in DNCC and DSCC were only two years, and no location would be available for waste disposal in the near future.

The previous Master Plan (2005–2015) aimed to improve the SWM of Dhaka City based on social acceptability and technical capacity to achieve Clean Dhaka status. The main outcome during the seven-year period at the interim evaluation is summarized as follows:

- (i) The SWM organization was strengthened by establishment of the WMD and introduction of the Ward Based Approach (WBA).
- (ii) The WMD Directives (2007–2012) was developed, and an administrative procedure book was drafted for enforcement of law and regulations.
- (iii) Community participation in SWM was encouraged through WBA 3, and Fixed-Time and Fixed-Place (FTFP) collection by compactors began with the support of the community. The FTFP collection contributed to close crowded unsanitary containers and dustbins on the road. In addition, the new collection system was strengthened by introducing 35 new compactors in corporation with Primary Collection Service Providers (PCSPs).
- (iv) Matuail landfill site (LFS)⁵, which was initially an open dumping site, was improved as a sanitary landfill including a leachate treatment facility. A Landfill Management Unit (LMU) was organized for successful landfill operation.

However, after the monitoring period and evaluation from 2014 to 2017, the progress of the Master Plan appeared to decrease, and several critical issues remained unresolved. For example, although the necessity of extending the lifespans of existing LFSs was known, no action was taken by DNCC to acquire new land nor to negotiate with surrounding cities to establish a regional treatment system. As a result, the need for this lifespan extension has become crucial.

E-2 PURPOSE OF THE MASTER PLAN

¹ “Dhaka” or “Dhaka City” in this Master Plan indicates the geographical area of Dhaka administered by the DNCC and DSCC, formerly by the DCC.

³ North Dhaka City Corporation (DNCC) is a public administrative body for the northern part of Dhaka City.

⁴ South Dhaka City Corporation (DSCC) is a public administrative body for the southern part of Dhaka City.

⁵ Matuail LFS is currently operational and used by DSCC.

In the the first Master Plan, implementation of proper waste collection was the first priority as it is most fundamental step to be taken for public health toward proper waste management. Now, DNCC regularly operates waste collection and waste disposal for keeping people’s healthy living as well as environmental protection. The new Clean Dhaka Master Plan (2018–2032) is developed as a subsequent Master Plan to overcome critical issues such as overflow of waste by newly introducing waste treatment including waste reduction and 3Rs with an integrated waste management facility compound known as “Eco-Town (Waste-to-Energy (WtE), composting, recycling etc.)” to seek sustainable society by resource management (Figure-1). Looking toward to the future of DNCC, this new Master Plan essentially includes administrative public awareness, WBA dissemination, efficient and hygienic waste collection, life extension of the existing LFSs, legal and institutional reform, and stakeholder’s capacity development, and newly introducing waste treatment system including waste reduction and 3Rs.

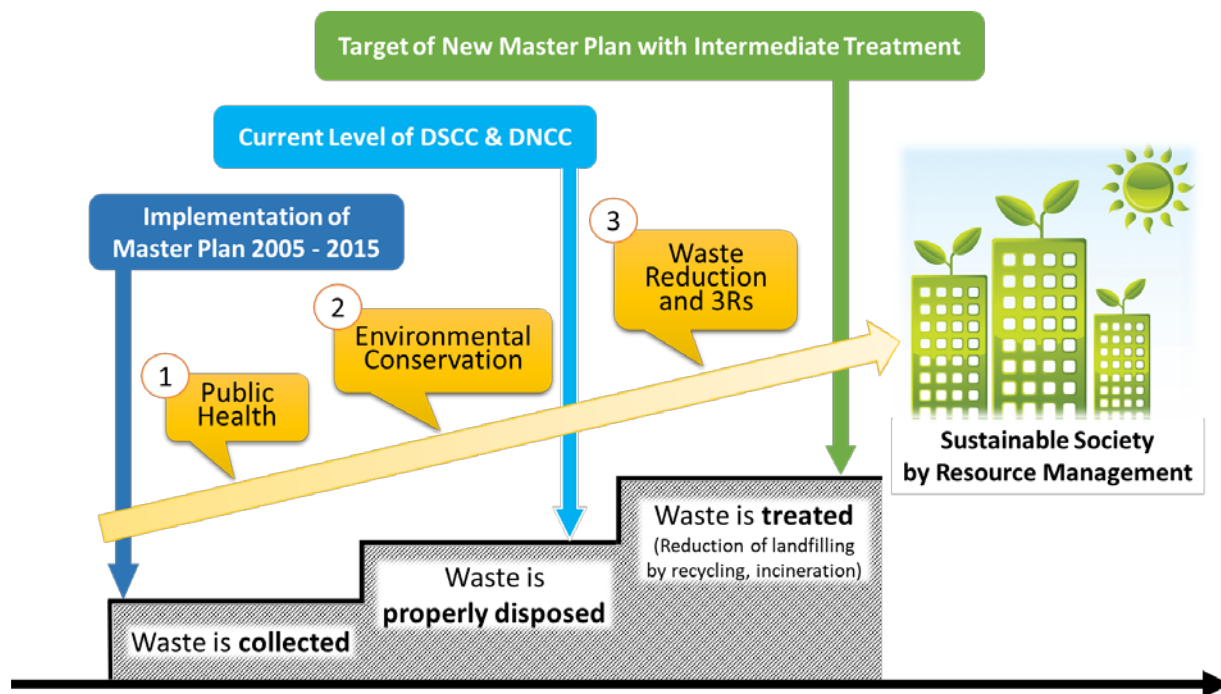


Figure-1 Framework of the Master Plan

E-3 TARGET AREA AND WASTE

The Master Plan covers the entire jurisdiction of DNCC as of 2018 including new DNCC area, which is composed of 54 wards in 10 zones. The total land area is approximately 197 km², including an expansion area of 114 km² in 18 wards.⁶ In addition, the Amin Bazar LFS and future LFSs in the adjacent area outside DNCC’s jurisdiction is included.

⁶ DNCC’s jurisdiction area is expanded in 2017.

The target waste in this Master Plan comprises three types of waste: municipal solid waste, business waste, and medical waste, as shown in Table-1.

Table-1 Target Waste in the Master Plan

Waste Category	Contents
Waste	“Waste” refers to any solid, liquid, gaseous, or radioactive substance, the discharge, disposal, and dumping of which may cause harmful changes to the environment
Solid Waste	Non-hazardous and non-poisonous waste (solid or partially solid) which may have value or no value
Municipal Solid Waste	Waste generated from residences and collected by local government
Household Waste	Solid waste collected from households
Street Waste	Solid waste collected from streets, including sludge from drainage
Industrial Waste	General term of waste from business properties, which sometimes includes chemical components, generated from business, commerce, agriculture, building construction, and other activities
Business Waste	Industrial waste collected from restaurants, hotels, markets, and offices
Construction Waste	Industrial waste collected from building construction
Other	Industrial waste collected from other businesses
Hazardous Waste	Waste having particular physical and chemical properties or that mixed with other waste and materials to cause poisonous effects, viral transmission, flaming, explosive effects, radioactivity, corrosiveness, and other destructive effect on the environment
Medical Waste	Waste emitted, generated, or accumulated from the treatment, vaccination, or diagnosis of diseases or research related to the diagnosis of human health
Non-hazardous Waste	Non-hazardous waste generated in HCE
Hazardous Waste	All other wastes apart from non-hazardous waste such as infectious, sharp, radioactive waste

: Target waste in this Master Plan

E-4 FRAMEWORK OF MASTER PLAN

E-4.1 Vision

This new Clean Dhaka Master Plan is designed for the next 15 years based on the vision envisaged for the next 30 years.

*Environmentally Advanced City with Integrated and Sustainable Solid Waste Management:
toward Zero-Waste*

E-4.2 Goals

Three goals to realize the vision of the Master Plan are set.

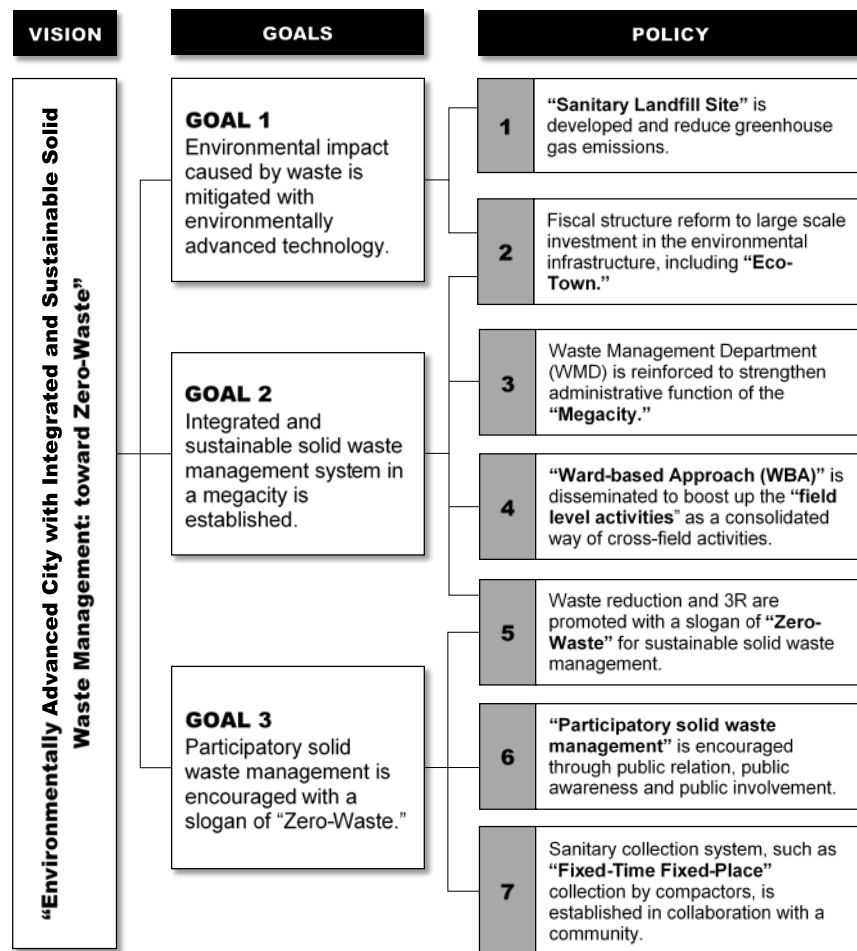
- (i) Environmental impact caused by waste is mitigated with environmentally advanced technology.
- (ii) Integrated and sustainable SWM system in a megacity is established.
- (iii) Participatory SWM is promoted with a slogan of “Zero-Waste.”

E-4.3 Policies

The Master Plan has seven policies for fulfilling the goals.

- (i) A “**Sanitary Landfill Site**” is constructed to reduce Greenhouse Gas (GHG) emissions.
- (ii) Fiscal structure reform to large scale investment is provided in the environmental infrastructure, including “**Eco-Town**.”
* Eco-Town: an intermediate treatment zone with various kinds of treatment facilities (WtE, biogas, composting, recycling etc.)
- (iii) The WMD is reinforced to strengthen the administrative function of the “**Megacity**.”
- (iv) **WBA** is disseminated to boost the “**Field-level activities**” for consolidating cross-field activities.
- (v) Waste reduction and 3R are promoted with a slogan of “**Zero-Waste**” for sustainable SWM.
- (vi) “**Participatory solid waste management**” is encouraged through public relation, public awareness, and public involvement.
- (vii) A sanitary collection system, such as “**Fixed-time and Fixed-place**” collection by compactors, is established in collaboration with the community.

The framework of the Master Plan is structured as shown in Figure-2 with illustrating a relationship between the abovementioned vision, goals, and policies.



Eco-Town: an intermediate treatment zone with various kinds of treatment facilities (WtE, biogas, composting, recycling etc.)

Figure-2 Framework of the Master Plan

E-4.4 Target

In principle, appropriate solid waste management is accomplished by (i) collecting more waste generated at households with increasing the collection capacity, (ii) reducing waste with introducing waste separation and recycling, and (iii) minimizing the volume of the remaining waste that goes to LFSs with intermediate treatment so that LFSs can be used longer. This Master Plan highlights four indicators i.e. waste collection, waste reduction, recycling, and landfill disposal to quantitatively monitor the DNCC’s achievement in consideration with the framework toward the proper waste management. The targets toward 2032 are set for each indicator, based on the population and waste generation projections of the DNCC as shown in Table-2.

Table-2 Target of the Master Plan

Indicator	Current situation (2017)	Intermediate target (2025)	Final target (2032)
Waste Collection	80%	83%	90%
Waste Reduction	0%	7%	12%
Recycling	10%	44%	44%
Landfill Disposal	73%	32%	33%

E-4.5 Key Components and Objectives

The Master Plan identifies the objectives in 10 key components of SWM in DNCC, as summarized in Table-3.

Table-3 Key Components and Objectives

Component	Objectives
Component 1 [C1]: Public relations, public awareness, and public involvement	C1-O1. Establish DNCC's capacity to promote public involvement in SWM
	C1-O2. Enhance public knowledge and understanding to work together with DNCC
	C1-O3. Stimulate public participation for waste management
Component 2 [C2]: WBA activities	C2-O1. Improve quality and efficiency of field-level SWM
	C2-O2. Enhance institutional capacity of the conservancy division
Component 3 [C3]: Waste reduction	C3-O1. Reduce waste amount generated
Component 4 [C4]: Waste collection and transport	C4-O1. Promotion of community participatory waste collection
	C4-O2. Expand the capacity of collection/transport
	C4-O3. Prepare for receiving the GAP vehicles
	C4-O4. Unify DNCC's waste collection management system
Component 5 [C5]: Vehicle maintenance system	C5-O1. Improve maintenance workshop operation and management and develop the capacity of workers and drivers
Component 6 [C6]: Intermediate treatment system (Eco-Town: WtE, composting, recycling etc.)	C6-O1. Develop Eco-Town (WtE, composting, recycling etc.) for sustainable waste management in Dhaka
	C6-O2. Establish the Intermediate Treatment (Eco-Town) management section in the WMD
Component 7 [C7]: Sanitary landfill	C7-O1. Improve Amin Bazar LFS
	C7-O2. Conduct safety closure at Amin Bazar LFS
	C7-O3. Establish a management section in the WMD for Amin Bazar LFS
	C7-O4. Develop a future LFS
Component 8 [C8]: Rules and regulations	C8-O1. Conduct daily SWM work in compliance with the administrative procedure book
	C8-O2. Enact SWM-related orders and WMD directives
Component 9 [C9]: Organizational capacity	C9-O1. Strengthen planning, coordination, monitoring, and evaluation capacity of DNCC
	C9-O2. Cover collection and transport work, collection vehicle operation, and landfill operation work exclusively in the WMD
Component 10 [C10]: Financial management	C10-O1. Reform SWM accounting system for budgeting and cost control
	C10-O2. Enhance financial capacity for Master Plan implementation

The relations between the policies and the components are described in Figure-3. The components, which can be categorized simply into “SWM system,” “institutional,” and “strategic and cross-field” aspects, are vital to structure the DNCC’s business sustainable and solid. Most of the policies correspond to one component, except Policy 3: *the WMD is reinforced to strengthen the administrative function of the “Megacity”*, which consists of four components. This Master Plan highlights development of a strong and consolidated institutional foundation correlating various functions of the WMD for sustainability.

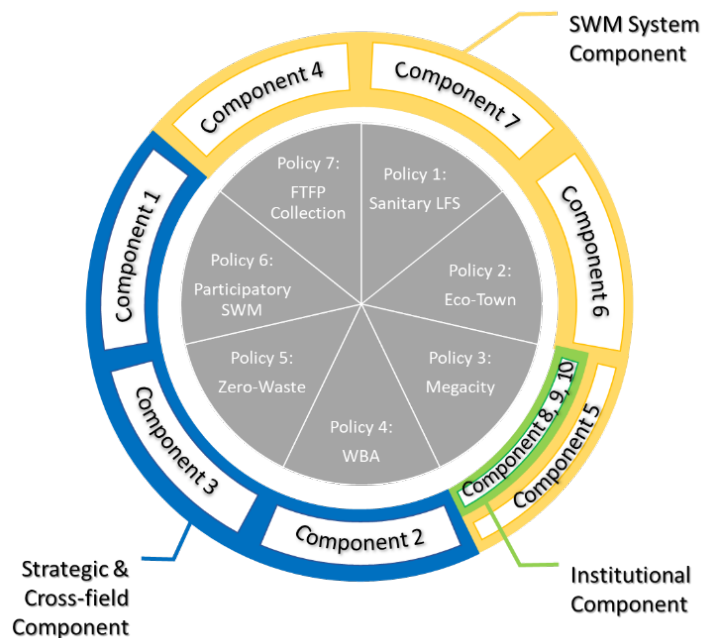


Figure-3 Relations between the Policies and Key Components of the Master Plan

E-5 PLANNING BASIS

E-5.1 Population Projection

The population of DNCC is estimated for 15 years based on the 2011 population census, and its growth rate is applied in accordance with the “Population Projection of Bangladesh 2011–2061” calculated by the Bangladesh Bureau of Statistics (BBS). In 2032, which is the target year of the Master Plan, the total population is estimated to increase to about 6.8 million, including the expansion area.

E-5.2 Study on Solid Waste

The waste generation is estimated to increase from 3,663 tons/day to 4,763 tons/day for 15 years, which is calculated based on the unit generation of household waste; business waste including that from markets, restaurant and hotels, and offices; and street waste. Business waste and street waste were calculated based on the population projection and economic growth rate.

The target waste collection rate was set as 90% of waste generation compared with 80% for the current waste collection rate in FY2017–2018.

Based on the recycling survey, the recycling amount was estimated as 10% of household and business waste, or 303 tons/day in FY2017–2018. By the year 2023 when centralized waste recycling will begin at Eco-town of DNCC, a separate collection systems for the market, hotels and restaurants recyclable waste will be started. The waste recycling will increase from hundreds to thousands numbers. The recycling amount will increase to 1,982 tons/day in FY2025–2026 and 2,113 tons/day in FY2032–2033.

E-6 PUBLIC RELATIONS, PUBLIC AWARENESS, AND PUBLIC INVOLVEMENT (COMPONENT 1)

This Master Plan has addressed the establishment of Public Awareness Planning Section (PAPS) for strategically building close partnerships and strong connections among DNCC, the community, NGOs, news media, and other governmental entities for socially acceptable SWM. PAPS will work closely with the Public Relation Department (PRD) who is in charge of DNCC’s overall public relations.

Introduction of a Public Consultative Group (PCG) for the SWM facility has been addressed to provide multiple channels of communication among the project proponent, operator, DNCC, and community for socially acceptable and sustainable facility operation. PCG meeting results such as discussion minutes should be publicly available for accountability and transparency. This Master Plan has also illustrated activity frameworks and comprehensive methodology for the WMD to develop a communication plan as public relations and public awareness strategy.

The LGD organizes a national SWM conference annually to share information and support among 12 CCs and nearby local governments. PAPS closely supports the LGD as a liaison for the meeting preparation, and the WMD takes a leading role in the meetings as a high-level waste management practitioner. The meeting framework is summarized in Table-4. Initially as a startup, regional cooperation meetings may be held in Dhaka and surrounding areas including Gazipur, DSCC, and Narayanganj.

Table-4 Information Exchange Meeting for 12 CCs

Host Organization and Secretariat	Host organization: LGD Secretariat: DNCC and DSCC
Members	LGD and 12 CCs (BCC, CCC, COCC, DNCC, DSCC, GCC, NCC, KCC, MCC, RCC, RACC, SCC)
Schedule	Annually (The 1 st meeting was held in December 2018)
Venue	LGD meeting room
Topics (example)	<ul style="list-style-type: none"> - Lessons learned from Clean Dhaka Project - WMD establishment - WBA activities - Waste management technology implementation

Note: BCC: Barisal City Corporation; CCC: Chittagong City Corporation; COCC: Cumilla City Corporation; DNCC: Dhaka North City Corporation; DSCC: Dhaka South City Corporation; GCC: Gazipur City Corporation; NCC: Narayanganj City Corporation; KCC: Khulna City Corporation; MCC: Mymensingh City Corporation; RCC: Rajshahi City Corporation; RACC: Rangpur City Corporation; SCC: Sylhet City Corporation

E-7 WARD-BASED APPROACH AND ACTIVITIES (COMPONENT 2)

The WBA is an innovative solution for enlightened thinking to strengthen the field activities of SWM. This approach enables field officers to think and act independently and to simultaneously function in a well-organized and systematic matter. In megacities such as DNCC, decentralization of organization is

inevitable; otherwise, public cleaning services and administrative works for SWM would fail to function. The philosophy of WBA is summarized below in four points.

Philosophy of WBA:

- (i) *“Field-oriented” Solid Waste Management*
- (ii) *“Bottom-up” and “Decentralized” Management Style*
- (iii) *“Cross-organizational” Structure*
- (iv) *“Participatory” Solid Waste Management with Multiple Stakeholders*

The WBA was first introduced to Dhaka City as part of the previous Master Plan and was launched in 2007 with a pilot project in two wards. This approach was then expanded actively to other wards throughout the project period. The WBA aims to build synergy of related activities in the wards and the City Corporation by synchronized intensive resource input, which includes the four main components described in Table-5. All components of the WBA are interlinked; the relationship between WBA activities and the target location of waste is shown in Figure-4.

All stakeholders for the WBA including DNCC officers, Conservancy Inspectors (CIs), Conservancy Officers (COs), and cleaners as well as ward councilors need to jointly work together for successful WBA activities.

Table-5 Definition of WBA

Activity	Ripple Effects
WBA 1: Construction and management of ward SWM office	- Community-based SWM in wards to cultivate mutual cooperation
WBA 2: Safety education for cleaners and establishment of safety and sanitation committee	- Establishment and implementation of an administrative command system between the headquarters and ward offices
WBA 3: Public awareness raising	- Word-of-mouth awareness raising in communities
WBA 4: Improvement of waste collection service in each ward	- Training for staff, officers, and residents - More democratic local autonomy in wards

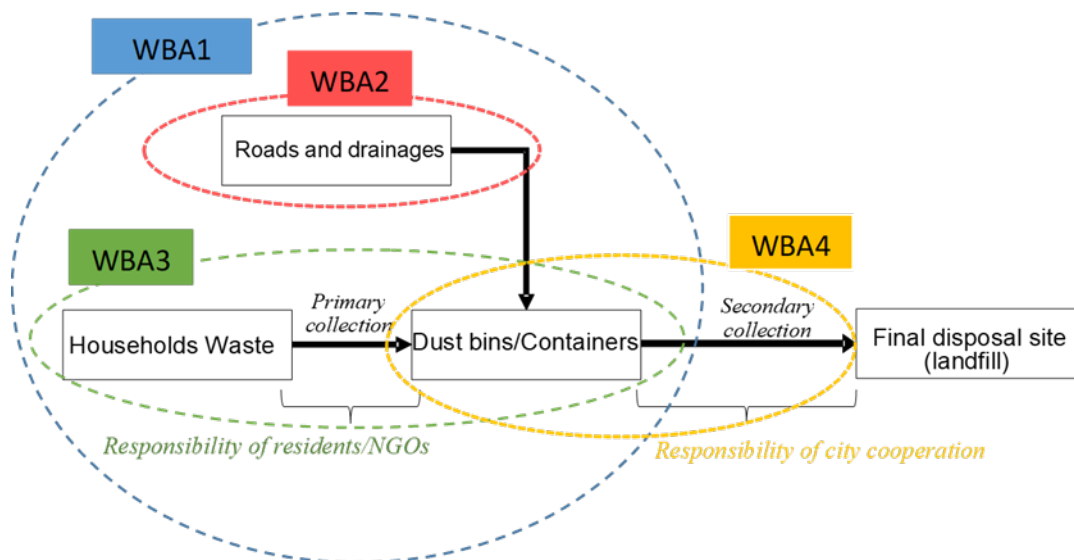


Figure-4 Structure and Activity Contents of WBA

E-8 WASTE REDUCTION (COMPONENT 3)

Waste reduction, often described as 3R (Reduce, Reuse and Recycle), is a key tactic used to minimize the disposal waste to LFSs. For promoting 3R, the cooperation of citizens is indispensable. Therefore, DNCC will implement such activities efficiently and effectively, taking advantage of the WBA function. The waste reduction activity plan in the WBA would be:

WBA 1: Ward Office Management

- WMD Directives are revised to emphasize the importance of waste reduction
- Measures for waste reduction are clarified by each ward in the WBA Annual Activity Plan (AAP) based on the WMD Directives
- Additional Chief Waste Management Officer (ACWMO) monitors the progress of WBA activities and promotes waste reduction regularly

WBA 2: Safety and Sanitation Education for Cleaners

- Cleaners are trained to persuade citizens to contribute to waste reduction

WBA 3: Community Participation

- Community Unit Working Group (CUWG) of each ward takes responsibility for promotion of waste reduction in a target area
- Main activities are reduction and source separation at household. Details of these activities are discussed by CUWG and are determined on the basis of social and cultural backgrounds of each area.

WBA 4: Waste Collection Improvement

- Collection of recyclables separated at source is introduced for improvement of the conventional waste collection system
- FTFP collection system encourages participation of the community, which helps the WMD to interact with the community for waste reduction

Considerable waste pickers work in DNCC. Prior to introducing waste reduction activities, DNCC will study the state of this work and will consider hiring additional waste pickers as, for example, Eco-Town staff, if their livelihood is adversely affected by waste reduction activities depending on the study results.

E-9 WASTE COLLECTION AND TRANSPORT (COMPONENT 4)

Although aimed toward implementation of efficient and sanitary waste collection and transport, current waste collection methods such as container collection has disturbed the landscape of the city and causes traffic congestion. To resolve these issues, expansion of FTFP collection by using plastic bins and compactors needs to be considered to replace the existing collection method. FTFP collection requires cooperation of communities. WBA3 encourages communication between the DNCC and residents and promotion of FTFP collection is carried out through WBA4. Target areas of FTFP collection will be extended and to be covered in all residential area.

WMD plans to procure waste collection vehicles and equipment and in principle, aged arm roll trucks and container careers will be replaced with compactor trucks, while dump trucks will be allocated for street and drainage cleaning. 70% of the current DNCC's waste collection vehicles are targeted to replace into compactor truck. Table-6 shows the precondition for calculating the number of necessary vehicles.

Table-6 Assumption for Calculating Necessary Number of Vehicles

Item	Assumption
Vehicle lifetime	20 years (50% of the procured vehicles are scrapped after 15 years, 50% after 20 years)
Replacement condition	Arm roll and container carriers will be replaced with compactor trucks
Vehicle type for household waste	Compactor : Dump truck = 7 : 3 (Dump truck is allocated for street and drainage cleaning)
Number of trips/day	Container Career: 4; Compactor truck: 3; Dump/Open truck: 2; Arm Roll: 4

Dump trucks are assumed to be used for continuous street and drainage cleaning. A container carrier can generally have four trips on average, and eight trips at a maximum. However, the number of the trips are limited owing to shortage of the containers in the DNCC area. This situation is a bottleneck to increase the waste collection rate. Therefore, the WMD will locate more containers in the DNCC area for efficient use of the container carriers.

DNCC owns 128 trucks and 56 trucks were procured by the grant aid project at present. The necessary number of waste collection vehicles in FY 2032–2033 is estimated 275 trucks⁷ and it is more than double compared with the existing vehicles.

Considering the fact that the collection vehicles are managed not only by WMD but also in close coordination with other departments, including the Transport Department (TD), Engineering Department (ED), and Store and Purchase Department (SPD), discussion and coordination have to be strongly encouraged among related departments in DNCC for the efficient management.

In addition, collection and transport operation methods for the expansion area should be examined carefully and immediately. There is only little practice of SWM in the expansion area. Recruitment and capacity development of new collection workers and drivers for the expansion area is necessary. In the extension area, FTFP collection by compactor will be introduced proactively. PCSP is effective under certain circumstances, especially in the initial stage of SWM. On the contrary, open dustbins and containers easily make the surroundings dirty with scattered waste. Odor emitted and flies bred from dustbins and containers result in the unsanitary environment.

The SWM framework in the extension area is shown in Table-7. In the framework, the DNCC will make contracts with private companies for waste collection and vehicle maintenance.

Table-7 SWM Framework in the Extension Area

Item	Responsible Organization	Remarks
Waste collection system	Private	FTFP collection system by compactor without PCSP
Maintenance of collection vehicles	Private	—
Treatment of waste	Private by zone	Waste to Energy (WtE), recycling
WBA activity	Ward office	—
Awareness raising	Ward office	—
Finance	DNCC Headquarters	—

For capacity development of the cleaners and drivers, the WMD encourages each cleaners and cleaner's group to support each other by, for example, helping other group's work after finishing own work. The drivers are also to be advised to help cleaners to load waste into compactors. Such an on-job training

⁷ Procurement plan of waste collection vehicles and equipment in the extension area will be reviewed and revised once the urban planning in that area is determined.

contributes to changing mind setting of the cleaners and drivers for mutual assistance and respect, and to better organizational governance.

E-10 VEHICLE MAINTENANCE SYSTEM (COMPONENT 5)

WMD should formulate “workshop management rules” to standardize operation of the workshop. The workshop management rules should contain, but not limited to, the following:

- (i) Job Description of each level
- (ii) Rules on General Affairs
- (iii) Work Rules
- (iv) Rules on Working Time and Holidays
- (v) Guidelines for Reporting System and Forms
- (vi) Safety and Sanitation Standards
- (vii) Guidelines for Safety and Sanitation Improvement
 - General Rules
 - Chief Manager of Safety and Sanitation
 - Safety and Sanitation Committee
 - Safety Gear
 - Medical Examination and Other Health Management Methods
 - Education and Training for Safety and Sanitation
- (viii) Rules on Staff Training

To unify operation and maintenance of the collection vehicle, WMD should take the sole lead of the works. The workshop for collection vehicles should belong to the WMD together with the vehicle ownerships, and the collection vehicle operation with drivers should be transferred gradually to the WMD.

The preventative maintenance method, conducting maintenance by controlling the expiration date of each vehicle part, needs to be introduced in DNCC for avoiding the serious failure by replacing parts at the workshop in advance. Periodic daily or monthly inspection and maintenance is very important for preventing serious accidents or breakdowns as well. When a serious failure occurs, the vehicle is sent to an outsourced private workshop for repair. This method leads to improve the Mean Time Between Failures (MTBF).

E-11 INTERMEDIATE TREATMENT SYSTEM (ECO-TOWN: WTE, COMPOSTING, RECYCLING ETC.) (COMPONENT 6)

DNCC has to change its waste treatment process to reduce waste going to the LFS. For that purpose, it is vital to develop an intermediate treatment system such as an Eco-Town, an intermediate treatment zone with several provisions of treatment facilities (WtE, biogas, composting, recycling etc.). The Eco-Town will be designed to satisfy the target recycling rate and landfill rate by promotion of material recycling and the remaining waste after the material recycling will be treated at a Waste to Energy (WtE) facility as thermal recycling.

DNCC is planning to construct two Eco-Towns located at Amin Bazar LFS extension area as Amin Bazar Eco-Town and Nasirabad new LFS area as Nasirabad Eco-Town. Outline of intermediate treatment facilities of Eco-Towns are summarized in Table-8, and the conceptual waste flow after introducing the Eco-Town system in 2032 is shown in Figure-5. The components of the Eco-Towns and capacities in the

Master Plan is a prototype, and it can be changed depending on development planning, urgency and budget constraints. Proposed schedule is given in Table-9.

Table-8 Outline of Intermediate Treatment Facilities in Eco-Town (Year 2025)

Facility Name	Target Waste	Capacity of Facility*
Recycling Plant	Household waste, Commercial and Business waste	1,000 tons/day (500 tons/day per Eco-Town)
Composting Plant	Organic waste	320 tons/day (160 tons/day per Eco-Town)
Biogas Plant	Organic waste	200 tons/day (100 tons/day per Eco-Town)
Construction Waste Recycling Plant	Street waste and Construction waste	720 tons/day (360 tons/day × 2 units)
Incineration Plant	Household waste, Commercial and Business waste	1,000 tons/day (500 tons/day × 2 units)

*The capacities here are only examples, and it should be determined depending on actual development planning and project characteristics

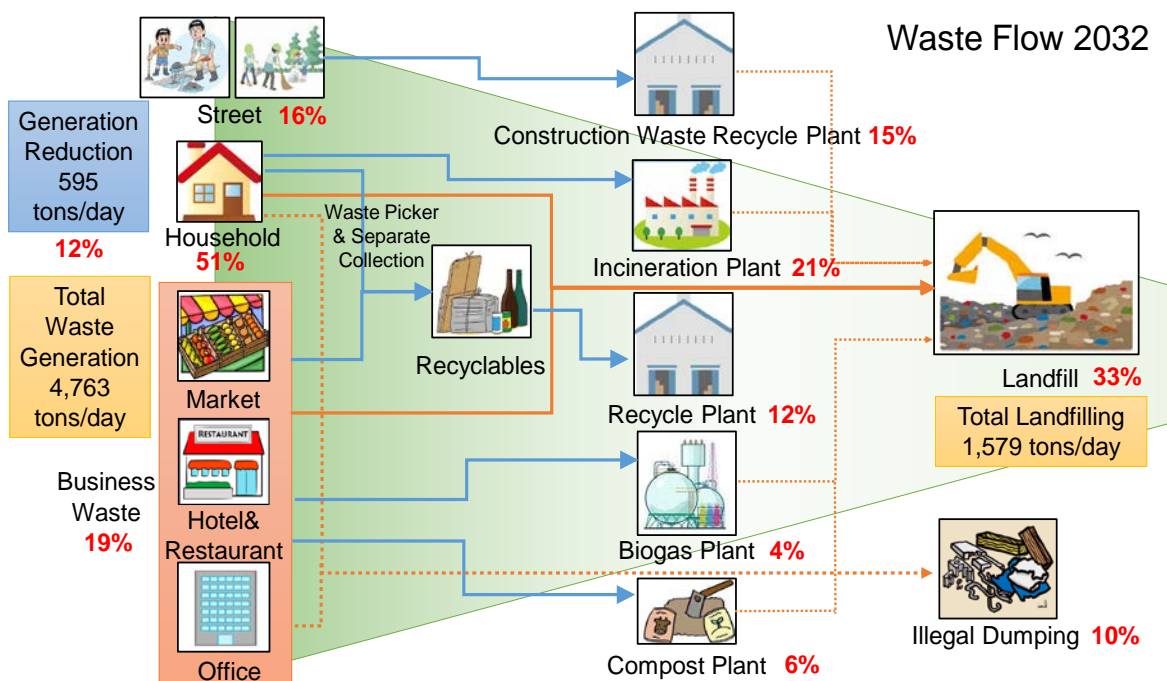


Figure-5 Conceptual Waste Flow after introducing the Eco-Town System (2032 year)

Table-9 Proposed Schedule of Construction and Operation of Eco-Town

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Feasibility Study	●													
Consultant Service		●	●	●	●	●								
Construction				●	●	●								
Operation & Maintenance						●	●	●	●	●	●	●	●	●

E-12 SANITARY LANDFILL (COMPONENT 7)

In order to fulfill the DNCC’s urgent needs for waste disposal, the landfill development are planned in three phases with consideration of the Eco-Town development and commencement as shown in Figure-6. In Phase-1 Amin Bazar existing LFS will be operated with improvement measures and close safely in 2021. In Phase-2 the Amin Bazar new extension area will be constructed and start operation from 2022. In Phase-3 Nasirabad new LFS will be constructed and start operation from 2023.

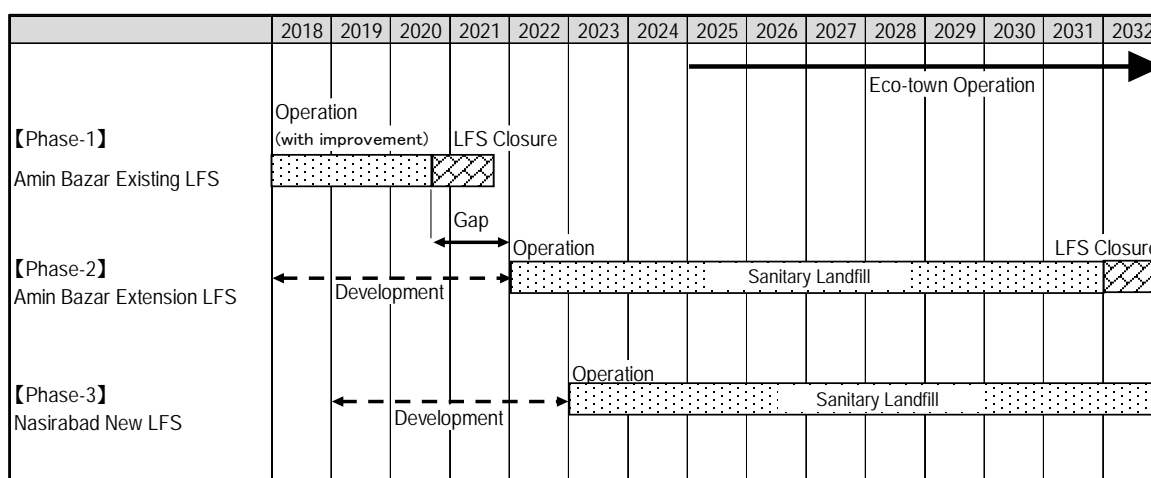


Figure-6 Proposed Landfill Development Schedule

DNCC should examine the operation methods in accordance with the landfill operation manual prepared by the WMD. A management section of LFS, named as Landfill Management Unit (LMU), is recommended to be established in WMD to improve the operation and maintenance at LFS continuously.

The outline of Amin Bazar extension LFS and Nasirabad new LFS, where the intermediate treatment facilities will be installed as well (referred to E-12), are summarized in Table-10.

Table-10 Outline of Amin Bazar Extension LFS and Nasirabad New LFS

Item	Description
Current situation	DPPs have been submitted to Government of Bangladesh and now under review (as of July 2019)
Type of receiving waste	Amin Bazar Extension LFS: Municipal waste Nasirabad New LFS: All types of waste (mostly domestic waste and business waste, except tannery waste and medical waste)
Target receiving area	Entire DNCC area including new 36 wards
Operating hours	From 10:00 p.m. to 6:00 a.m. in local time
Area (ha)	Amin Bazar Extension LFS: 26 ha (New landfill area: 13 ha, intermediate treatment (Eco-town) area: 13 ha) Nasirabad New LFS: 39 ha (New landfill area: 20 ha, Eco-town area (Intermediate Treatment) :19 ha)
Landfill system	Semi-aerobic method
Main facilities	Embankment, liner, leachate collection pipe, gas vent pipes, access road, operation road, dumping platform

E-13 RULES AND REGULATIONS (COMPONENT 8)

The existing WMD Directives, approved in 2012, states the framework of WMD's activities for the following five years. The updated version of the directives should be in place for maintaining the consistency of the current activities, based on this Master Plan. It is essential that the draft of new WMD Directives will be discussed thoroughly and endorsed by the Solid Waste Management Committee (SWMC), and then officially approved by the mayor. SWMC, which was originally planned in 2011, basically aims to monitor the overall WMD activities and to offer advice for waste management improvement. The SWMC is responsible for discussing not only WMD Directives but also other WMD's rules and regulations, and the institutional system. The committee consists of representatives from DNCC management officials, ward councilors, experts from academia, NGOs, and other related organizations, and communities, and holds meetings regularly. The PAPS takes a liaison role for committee activities and prepares the meeting minutes for public disclosure.

Ward offices should be operated in compliance with rules, regulations, and orders in a systematic manner. The SWM administrative procedure book (Admin Book), which includes all administrative processes necessary for SWM operation in DNCC, was drafted in 2012 and the first edition of the Admin Book was prepared in Bengali in 2018. To disseminate and accustom the Admin Book among DNCC, training sessions and workshops for DNCC staffs and related stakeholders are required. The Admin Book should be revised regularly in accordance with the revision of laws and orders, and with practical experiences.

E-14 ORGANIZATIONAL CAPACITY (COMPONENT 9)

Establishment of the new management division in the WMD, along with the existing engineering division and the waste collection division (restructuring of the conservancy division), is newly proposed in this Master Plan to enhance the planning, coordination, monitoring, and evaluation capacity of the department.

In addition, privatization of a certain field is considered in this Master Plan as an effective way although it is essential that proper management of the contract and supervision of the daily operation of the private waste management company by the WMD. For example, medical waste management is basically a responsibility of the City Corporation, but NGO (PRISM) is partially covering this area at present under the contract with DNCC. The current privatized system may be sustained under the proper supervision of the DNCC because it is autonomously operated up to today. The DNCC should implement an audit system for medical waste treatment operated by private companies or NGOs, with regular inspection to make sure their operation.

E-15 FINANCIAL MANAGEMENT (COMPONENT 10)

This Master Plan has proposed the reform of SWM accounting system for budgeting and cost control by the following measures;

- (i) Accounting system modification and annual budget reporting;
- (ii) Financial assessment for securing the accountability to citizens as well as enhancing the accuracy of the WMD's budget request;
- (iii) Enhance financial capacity for the Master Plan implementation through reassessment of conservancy tax and financial allocation for the Master Plan implementation

DNCC collects holding tax from citizens. Holding tax consists of four different types of taxes: i) building and land tax, ii) water tax, iii) lighting tax, and iv) conservancy tax. Holding tax is calculated by multiplying the holding tax rate per square foot, which is officially set in each ward by house or flat size. The housing or flat value is assessed annually by the Revenue Department (RD) and is based on the valuation, to determine the amount of tax payment.

The waste treatment cost is allocated from the conservancy tax. However, the four abovementioned taxes are not managed separately, and it is unclear how much in fact is collected as conservancy tax. Currently, conservancy tax is collected only for 2% of the housing or flat value, although it can be increased up to 7% in line with the tax regulations⁸. In case of large-scale investment by the GoB in SWM infrastructure such as a WtE facility, the operation cost of such infrastructure should be borne essentially by citizens, and the “polluter pay” principle should apply to the conservancy tax. Increases of the conservancy tax rate are carefully considered in the long term.

E-16 MEDICAL WASTE TREATMENT

Medical waste is generally considered as infectious and hazardous as it poses serious threats to environmental health and requires specific treatment and management. The problem is intensifying with an ever-increasing number of government and private hospitals, clinics, diagnostic center, autonomous hospital and laboratories in proportion of increasing population

DNCC generates about 6.1 tons of medical waste (hazardous fraction) daily. It is estimated that about 32 ton/day of medical waste will be generated in DNCC in the year of 2032, of which the amount of infectious, sharps, and recyclables are around 23,934 kg/day, 4,371 kg/day and 3,611 kg/day respectively, leading to a high requirement for facility expansion and reinforcements with incineration, autoclaving, deep burial, disinfection with chlorine solution (bleaching chamber).

Current waste collection covers 450 Health Care Establishments (HCEs) in DNCC. The HCEs wastes are now transported to Matuail LFS (Landfill site of DSCC) for treatment. DNCC has proposed an intermediate medical waste treatment facility in Nasirabad Eco-Town.

E-17 PRIORITY PROJECTS AND PROGRAMS

Some projects and programs in ten components of the Master Plan are prioritized and extracted, as shown in Table-11, considering the urgency of implementation.

⁸ "City Corporation Ideal Tax Schedule, 2015" defines that the conservancy tax rate is up to 7%.

Table-11 Priority Projects and Programs

No.	Priority Projects and Programs	Executing/Concerned Body	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Component 1: Public relations, public awareness, and public involvement																		
(1)	Establishment of a unit for increasing public awareness in the WMD	WMD, PRD	█															
(2)	Development of information disclosure system																	
(3)	Active involvement in information exchange meetings among all CCs	LGD, All CCs	█															
(4)	Establishment of a PCG for SWM facilities	WMD, PRD, ED, TD	█															
Component 2: WBA activities																		
(1)	Improvement and expansion of WBA implementation in wards with encouraging CO/CIs	WMD	█															
(2)	Proper community budget allocation with WBAAAP		█															
(3)	Daily work practice in accordance with the administration procedures manual		█															
Component 3: Waste reduction																		
(1)	Preparation of waste reduction plan	WMD, DOE	█															
(2)	Introduce 3R activities through WBA activities		█															
Component 4: Waste collection and transport																		
(1)	Examination of collection and transport operation methods for expansion area	WMD, ED, TD	█															
(2)	Introduction of new waste collection system including harmonization of primary and secondary collection		█															
(3)	Unification of waste collection management		█															
(4)	Improvement of management for maintenance workshops		█															
(5)	Capacity development of workers and drivers		█															
Component 5: Vehicle maintenance system																		
(1)	Formulation of workshop management rules	WMD, LGD, ED, TD	█															
(2)	Reform of workshop and maintenance system	WMD, ED,TD	█															
(3)	Introduction of preventive maintenance method		█															
Component 6: Intermediate treatment system (Eco-Town: WtE, composting, recycling etc.)																		
(1)	Propose Eco-Town and obtain approval from related organization	WMD, LGD, ERD, DOE	█															
(2)	Implementation of feasible study for Eco-Town		█															
(3)	Preparation of construction and operation cost	WMD, LGD, ERD			█													
(4)	Establishment of Intermediate Treatment (Eco-Town) section in the WMD	WMD, LGD, ED			█													
(5)	Capacity development of Intermediate Treatment (Eco-Town) section	WMD, ED			█													

No.	Priority Projects and Programs	Executing/Concerned Body	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Component 7: Sanitary landfill																		
(1)	Improvement of Amin Bazar LFS	WMD, ED																
(2)	Secure future LFSs	WMD, LGD, RD, UPD, DOE, RAJUK																
(3)	Closure of Amin Bazar LFS																	
(4)	Establishment of landfill management section in the WMD	WMD, ED	■	■														
(5)	Capacity development of the landfill management section		■	■	■	■												
Component 8: Rules and regulations																		
(1)	Preparation and release of the administration procedures manual	WMD, SWMC	■	■														
(2)	Development of WMD directives through SWMC		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(3)	Training for rules and regulations provided to staff and related stakeholders		■	■	■	■												
Component 9: Organizational capacity																		
(1)	Reform of WMD organizational structure	WMD, ED, TD, RD, AD		■	■	■	■											
(2)	Preparation of an annual activity plan in accordance with the new Master Plan		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(3)	Capacity development of implementing organizations in the WMD for the new Master Plan through training and workshops		■	■	■	■												
Component 10: Financial management																		
(1)	Modification of accounting system to explicitly exhibit the actual SWM cost	WMD, AD, RD	■	■	■	■												
(2)	Secure operation and maintenance cost for Intermediate Treatment (Eco-Town) development	WMD, LGD, AD, RD	■	■	■	■												
(3)	Financial allocation for the Master Plan implementation	WMD, AD, RD	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
(4)	Development of financial assessment system		■	■	■	■												

Source: JICA Project Team

E-19 CONCLUSIONS AND RECOMMENDATIONS

The Master Plan has suggested the following various directions for approaching a sustainable administration for SWM.

- Establishment of an intermediate treatment system (Eco-Town) to extend the lifespan of LFS
- Administrative efforts made for enhancing the governance capabilities
- Strengthening of the WMD organization, expansion of the WBA, and revision of the WMD directives that detail the policy on SWM
- Necessity of staff participation in human resources development activities through the social learning method
- Introduction of the SMW administrative procedure book that utilizes existing laws and office orders
- Implementation of participatory waste management through public relations, public awareness, and WBA activities.

The conclusion of the Master Plan has also implied the direction after 2032. Essentially, the trend of main issues on solid waste, such as the lack of landfill space, will not dramatically change. Therefore, the policy of waste reduction and strengthening of institutional capacity as an administrative authority could be better prioritized and accelerated. In addition, the following points are raised as potential issues that may occur in the near future can be expected in the following Master Plan for the next term.

Promotion of Waste Reduction:

Waste reduction at source would be promoted by the CI through WBA 3 in collaboration with the community, business enterprises, and other stakeholders, which is explained repeatedly in the Master Plan. Responsibility among stakeholders including DNCC is expected to be clarified under the supervision of DNCC. Evidently, community awareness is important and should be carried out continuously. In addition, public awareness for large-scale buildings should be a focus for the next step. A reporting system of large-scale buildings, where the waste discharge amount depends on the designated waste type or discharge method, should be established for better communication of administrative guidance.

Moreover, extended producer responsibility, a policy approach under which producers are given significant responsibility for the treatment or disposal of post-consumer products, should be considered in the planning stage.

Appropriate Technology of Solid Waste Treatment:

Incineration, which reduces the volume of the solid mass of the original waste to about one-twentieth of its former size, is one of the most effective way to extend the lifespans of LFSs and to preserve landfill space. Full recovery of materials from E-waste requires a complicated treatment process using an expensive facility. At this time, DNCC should focus on the recycling of plastics to reduce the incoming landfill volume, following the clarification of the targeted E-waste, such as TVs, refrigerators, air conditioners, washing machines, PCs and other products.

Sustainability of Solid Waste Management:

SWM in a megacity such as DNCC requires a strong foundation of governance to make important decisions, and strong organization to enforce regulations and disseminate them at the field level. As mentioned

repeatedly, establishment and strengthening of the WMD, and promotion of the WBA are the core competence of DNCC, which makes SWM of DNCC sustainable and independent. Decentralization is the key concept for promotion of WBA. The CI must be an office manager for each ward, which has to be endorsed by legislation to justify the authority of planning, financial, and human resources management. Continuous capacity development of the CI is also needed. Exchange of human resources between the conservancy division and the engineering division is an innovative and effective option for capacity development to overcome the rigid structure of organization.

GoB has already drafted “Waste Management Rules, 2018” which shall be gazetted soon. This rules will be enacted as per the power given in Section 20 of Bangladesh Environment Conservation Act, 1995, and executed by the DoE. To strengthen the SWM of CCs more systematically, an SWM rule exclusively for DNCC is desirable in addition to the DoE’s SWM Rules to interpret the DoE’s rules into the practical field. The LGD should prepare separate SWM rules having more stringent and adjuvant for the CCs as per the powers given in Section 40 under the Local Government (City Corporation) Act, 2009, for the sustainable and efficient SWM.

In Section 7 of the draft SWM rules, three types of standards i.e., operation standards, emission standards, and radioactivity standards, have been included. These standards may be applied to the WtE projects, including incineration; however, there is no specific ordinance or guidance exclusively for WtE projects or incineration in Bangladesh. Therefore, such a regulatory framework for incinerators and WtE facilities must be developed to advance the installation of WtE projects.

Spatial Coverage of DNCC’s Waste Management:

DNCC has just started to work on planning of SWM in the extension area, but still needs some time to develop it because of data and information deficiency; however, the DNCC has the following long-term idea for the extension area at this moment.

- (i) Set up a zonal SWM office at each zone
- (ii) Outsource waste collection to private companies
- (iii) Construct a WtE plant in each zone for intermediate treatment, and dispose ash in the Nasirabad LFS

DNCC will detail the SWM plan in the extension area, including a framework for the potential DNCC area in the time of this Master Plan revision scheduled in 2020. In the meanwhile, to the extent possible, information sharing and technical support to not only the other CCs including Gazipur and Narayanganji, but also the outer townships of Dhaka is encouraged to disseminate better solid waste management practice.