No.

Dhaka City Corporation
The People's Republic of Bangladesh

Japan International Cooperation Agency

THE STUDY ON THE SOLID WASTE MANAGEMENT IN DHAKA CITY

Final Report

Volume 1

Summary

CLEAN DHAKA MASTER PLAN

March 2005

Pacific Consultants International
Yachiyo Engineering Co., Ltd.

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The following foreign exchange rate is applied in the study:

US$ 1 = Tk. 58 (Bangladeshi Taka) as of end of September, 2004

PREFACE

In response to a request from the Government of Bangladesh, the Government of Japan decided to conduct “The Study on Solid Waste Management in Dhaka City ” and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched the study team headed by Dr. Katsuhide NAGAYAMA of Pacific Consultants International Co., Ltd. and consisted of experts from YACHIYO ENGINEERING Co. to Bangladesh, from November 2003 to March 2005. In addition, JICA set up the advisory committee headed by Mitsuo YOSHIDA, Senior Advisor of JICA.

The team had a series of discussions with the officials from Dhaka City Corporation in Bangladesh, and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the practice of effective solid waste management in Dhaka City and to the enhancement of friendly relationship between Malaysia and JAPAN.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Bangladesh for their close cooperation extended to the team.

March 2005

Etsuo KITAHARA
Vice-President
Japan International Cooperation Agency

March 2005

Mr. Etsuo KITAHARA
Vice-President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

Dear Sir,

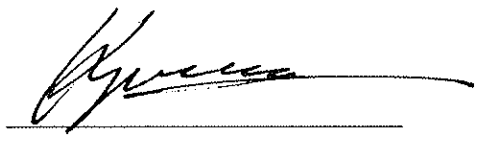
We are pleased to formally submit herewith the Final Report of "The Study on the Solid Waste Management in Dhaka City in the Republic of Bangladesh."

This report compiles the result of the Study, which was undertaken in the Republic of Bangladesh from November 2003 through March 2005 by the Study Team, represented by Pacific Consultants International.

We had been assisted by many people for the accomplishment of the Study, and we would like to express our sincere gratitude and appreciation to all those who extended their kind assistance and cooperation to the Study Team, in particular, Dhaka City Corporation, as the counterpart agency headed by Honorable Mayor who kindly deployed all the relevant sections to implement the study.

Also we acknowledge the effective assistance by all the officials of your Agency and the Embassy of Japan in the Republic of Bangladesh.

We hope that the report will be able to contribute greatly to improvement of solid waste management in Dhaka City.



Katsuhide NAGAYAMA
Team Leader
The Study on the Solid Waste Management in Dhaka City in the Republic of Bangladesh

List of Abbreviation and Acronyms

ABD	Apparent Bulk Density
ACCO	Assistant Chief Conservancy Officer
ADB	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BIEDF	Bangladesh Integrated Environmental Development Forum
BRAC	Bangladesh Rural Advancement Committee *(former name)*
BSCIC	Bangladesh Small and Cottage Industry Corporation
BSIC	Bangladesh Standard Industrial Classification
BUET	Bangladesh University of Engineering and Technology
BWDB	Bangladesh Water Development Board
CBM	Community Based Management
CBO	Community Based Organization
CC	Container Carrier
CCO	Chief Conservancy Officer
CEGIS	Center for Environment and Geographic Information Services
CEO	Chief Executive Officer
CI	Conservancy Inspector
CIDA	Canadian International Development Agency
CLAC	Central Land Allocation Committee
CMI	Census of Manufacturing Industries
CNG	Compacted Natural Gas
CO	Conservancy Officer
CPU	Counterpart Personnel Unit
CSI	Conservancy Supervising Inspector
DCC	Dhaka City Cooperation
DCCO	Deputy Chief Conservancy Officer
DG	Director General
Dhaka WASA	Dhaka Water Supply and Sewerage Authority
DMCH	Dhaka Medical College Hospital
DMDP	Dhaka Metropolitan Development Planning
DOE	Department of Environment, Ministry of Environment and Forests
DS	Deputy Secretary
DTCB	Dhaka Transport Coordination Board
DUTP	Dhaka Urban Transport Project
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERD	Economic Relations Division, Ministry of Finance
ETP	Effluent Treatment Plan
GDP	Gross Domestic Product
GIS	Geographic Information System
GNP	Gross National Product

GOB	Government of Bangladesh
GPS	Global Positioning System
HH	Household
ICDDR	International Centre for Diarrhea Diseases Research
IDA	International Development Association
IEB	Institution of Engineers Bangladesh
IEC	Information, Education and Communication
IEE	Initial Environmental Examination
IGES	Institute for Global Environmental Strategies
IT	Information Technology
JICA	Japan International Cooperation Agency
LGD	Local Government Division, Ministry of Local Government, Rural Development and Co-operatives
LGRD&C	Ministry of Local Government, Rural Development and Co-operatives
MCHTI	Maternity and Child Health Training Institute
MIS	Management Information System
MOEF	Ministry of Environment and Forests
NGO	Non-Governmental Organization
NOC	Non-Objection Certificate
OT	Open Truck
PCP	Project Concept Paper
PO	Personal Officer
PVC	Polyvinyl Chloride
RAJUK	Rajdhani Unnayan Katripakkha: Capital City Development Authority
RCV	Refuse Collection Vehicle
RHD	Roads and Highways Department
SE	Superintending Engineer
SEMP	Sustainable Environment Management Program
SOB	Survey of Bangladesh
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
SPM	Suspended Particulate Matter
SWM	Solid Waste Management
SWMC	Solid Waste Management Cell
TOR	Terms of Reference
TT	Trailer Truck
TWG	Technical Working Group
UNDP	United Nations Development Program
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Children's Fund
UPD	Urban Planning Department, Dhaka City Cooperation
WB	The World Bank
WHO	World Health Organization
WMC	Waste Management Committee
WMD	Waste Management Division
ZCO	Zonal Conservancy Officer
ZEO	Zonal Executive Officer

Executive Summary

1. Study Framework

1.1 Objectives

The objectives of this Study are:

(1) To formulate master plan concerning solid waste management in Dhaka City with the target year of 2015

(2) To develop capabilities and management skills of the DCC personnel through the technology transfer during the course of the Study.

1.2 Study Area

The Study area covers the jurisdiction of the Dhaka City Cooperation (DCC), which totals about 131 km^2. Sites of the new landfill facility will also be included in the study even if they are located in new urban area outside the jurisdiction of DCC.

1.3 Target Waste

The Study covers three types of solid wastes generated in the jurisdiction of the Dhaka City Cooperation: namely, Domestic waste, Industrial waste, and Medical waste. Liquid and gaseous wastes are not included in the scope of this study.

The master plan shall be prepared for only Domestic waste in this study. With regard to Industrial waste and Medical wastes, surveys will be conducted to identify the problems, and possible solutions will be proposed separately from Domestic waste.

1.4 Target Year

The master plan has one decade time-horizon with the target year 2015.

2. Present Situation of Solid Waste Management in Dhaka City

2.1 Waste Generation

Waste generation and disposal in Dhaka City is summarized below.

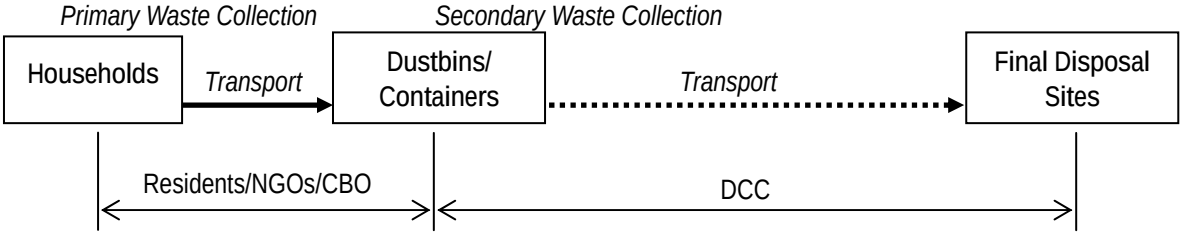
item	parameter
estimated generation	domestic waste: 1,950 t/d business waste: 1,050 t/d street waste: 200 t/d
generation rate	domestic waste: 0.34 kg/d/person (domestic+business+street) waste: 0.56 kg/d/person
calorific value	all waste average: 550 to 850 kcal/kg *requirement of self combustion: 1,200 kcal/kg
share of disposal volume by dump site	Matuail: 65 % Berri Band: 30 % Uttara: 5 %
total disposal volume at 3 dump sites	wet season average: 1,400 t/d

source: waste amount and quality survey by the study team

2.2 Primary Waste Collection

(1) Legal Basis of Waste Collection

Dhaka City Corporation Ordinance[1] is the basic law regarding street/drain cleaning, waste collection and transportation. According to Section 78 of the Ordinance, DCC is responsible for secondary waste collection to remove waste from its dustbins/containers, and transport the waste to final disposal sites. Residents are responsible for bringing their waste to DCC's waste collection points where dustbins/containers are located as shown below.



(2) DCC Initiative in Primary Waste Collection

In 2002, DCC introduced an approval system of NGOs/CBOs/private organization for providing door-to-door waste collection services in all wards. DCC has given approvals to 47 NGOs/CBOs, however, not all of them have started their activities yet.

2.3 Secondary Waste Collection and Road/Drain Cleaning

(1) Allocation of Resources

DCC deploys the following facilities and manpower for secondary waste collection. DCC seems to have sufficient capacity of vehicle, but the number of drivers is apparently insufficient.

[1] Dhaka City Corporation Ordinance was promulgated by the Chief Martial Law Administrator on 24 August 1983.

Owner	Receptacle		Trucks		Truck Driver
DCC	dust bin:	647 units	OT+TT:	216 units	
	6m^3 container:	260 units	CC 3 t:	93 units	
	12 m^3 container:	123 units	CC 5 t:	34 units	
subtotal:		1,030 units		343 units	266 persons
Private	dust bin:	41 units	OT 5 t:	19 to 27 units	27 persons

source: DCC

For cleaning of roads/drains and public spaces, DCC deploys about 7,000 cleaners in eight zones while private firms deploy about 600 cleaners in two zones. A remarkable feature of DCC cleaners is the working hours; they work on average 4 hours with minimum 2 hours while private cleaners work on average 6 hours with minimum 4 hours

(2) Comparison of Efficiency between Open Truck & Container Carrier

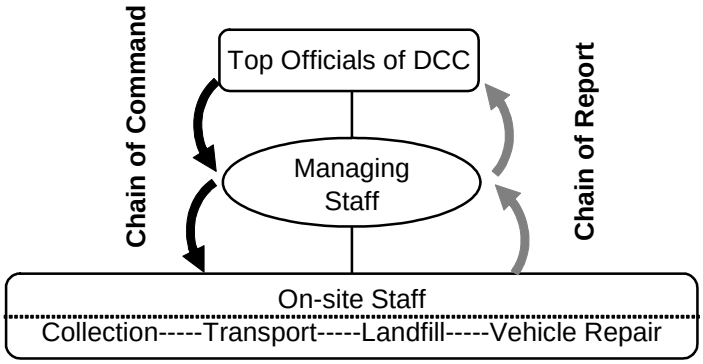
As for overall collection/transport efficiency (ton/hour), container carriers achieved on average 2 t/h, that is four times as much as open trucks, which carried only 0.5 t/h on average. As for the cost-performance, a container carrier spends 20% less cost than an open truck with the same capacity.

(3) Slow Motion in Vehicle Repair

Repair usually takes a long time. Half of vehicles that finished repair in 2004 had taken two years since the request for repair. Major repair is contracted with private workshops outside DCC. The tender document needs final decision by the Mayor and the process takes long time to complete. Because of the limited frequency of Mayor's approval, there is inevitable waiting for the next time of application to the Mayor. A fundamental improvement in this process is urgently needed.

(4) Lack of Management

The chain of management consists of two actions in opposite directions: namely, the chain of command and the chain of report as shown below. With the complete pair of chains, the Solid Waste Management (SWM) is executed effectively and efficiently.



DCC has a well connected chain of command; however, it does not have the opposite direction, the chain of report. To cope with this defect, a pilot project B for Management Information Acquisition (MIA) was initiated under the financial assistance of JICA.

2.4 Final Disposal

(1) Remaining Capacity of Landfill Site

DCC uses three landfill sites: namely, Matuail, Berri Band and Uttara; Matuail is the only official site owned by DCC. The rest (Berri Band and Uttara dumpsites) are private land. It is explained that owners of the land have requested DCC to fill the low lying land with solid waste. In response to their request, DCC started disposing of solid waste there. The remaining capacity of Matuail site is estimated at 1.1 million ton as of the end of 2004.

(2) Legitimacy of Landfill Site

As for Berri Band and Uttara sites, the final disposal of solid waste was started after the enforcement of the Environmental Conservation Act of 1995 and the Environmental Conservation Rules of 1997. These regulations require the Environmental Clearance Certificate (ECC) for earth filling by industrial, domestic and commercial waste, but this has not yet been acquired. Furthermore, neither of the sites got approvals from RAJUK, which is required for structural change of open space and/or reservoirs according to the Preservation Act of 2000.

(3) Operation and Management of Landfill Site

Conservancy Department dispatches 4 staff to Matuail landfill site; however, there is no job description for them or work record at all. Mechanical Division 2 also provides heavy equipment and operators to three landfill sites; however, there is no task description or work record or operation plan of landfill site either.

Operation method of solid waste at three landfill sites are open dumping (crude dumping) without control of incoming waste and no covering soil. The solid waste is dumped without surrounding bank at either Berri Band or Uttara.

(4) Heavy Equipment for Landfill

Three types of heavy equipment are used for final disposal; however, the provision is unstable because more than half of the equipment stock is broken.

2.5 Recycling

Recycling industry raises a total of 436 t/d of material recovery as shown in the table below. The amount recovered is the reduction of waste to be managed by DCC. Composting contributes very little to the waste reduction although the compostable waste has the largest portion among generated wastes.

Estimated Volume of Recycled Wastes in Dhaka City

Material	a) Estimated generation of recyclable waste (t/d)	b) Estimated recycled waste (t/d)	c) Recycle rate	d) Contribution to waste reduction (b / 3,200)
Plastic	124	103	83 %	3.2 %
Paper	260	168	65 %	5.3 %
Glass	46	24	52 %	0.8 %
Metal	27	41	*	1.3 %
Compostable	2,211	6	0 %	0.2 %
Others	99	94	95 %	2.9 %
Total	2,767	436		13.6 %

Source: Survey on recycle market by the Study Team

2.6 Legal Aspect

In connection with the existing landfill site, DCC should comply with Environment Conservation Act and Rules and Preservation Act.

2.7 Organization

(1) Job Allocation

Job descriptions of the departments, divisions and posts are not yet defined for those engaged in SWM.

(2) Missing Function

DCC does not have the function for planning, public involvement and management of final disposal at present.

2.8 Financial management

(1) Revenue and Expenditure of DCC

DCC budgeted Tk 2,670 million of their own account for financial year 02/03. The problem of finance is that revenues collected were only 70% of budgeted amounts, on average, from 2000-01 to 2002-03. This income gap compels DCC to squeeze its expenditures except for salary/wages. The major source of revenue is holding tax that accounts for 63% of revenue. The latest balance sheet of SWM indicates a growing deficit trend as shown below.

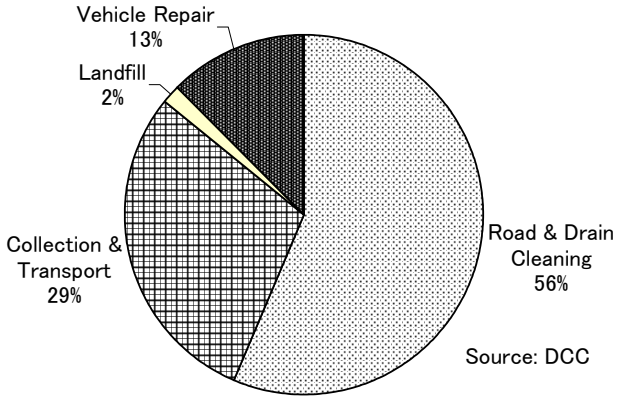
Financial Balance of SWM (million Taka)

Items	1999-00	2000-01	2001-02	2002-03	Ratio in own DCC Account
1. Overall SWM Income	126	141	150	176	6%
2. Overall SWM Expenditure	367	383	402	476	18%
3. Balance	-241	-242	-252	-300	-

Note: 1) Estimated by the Study Team based on various information and data of DCC.
2) Recurrent DCC own expenditures were used for estimates. Depreciation was not considered.
3) There were no capital expenditures during the period.

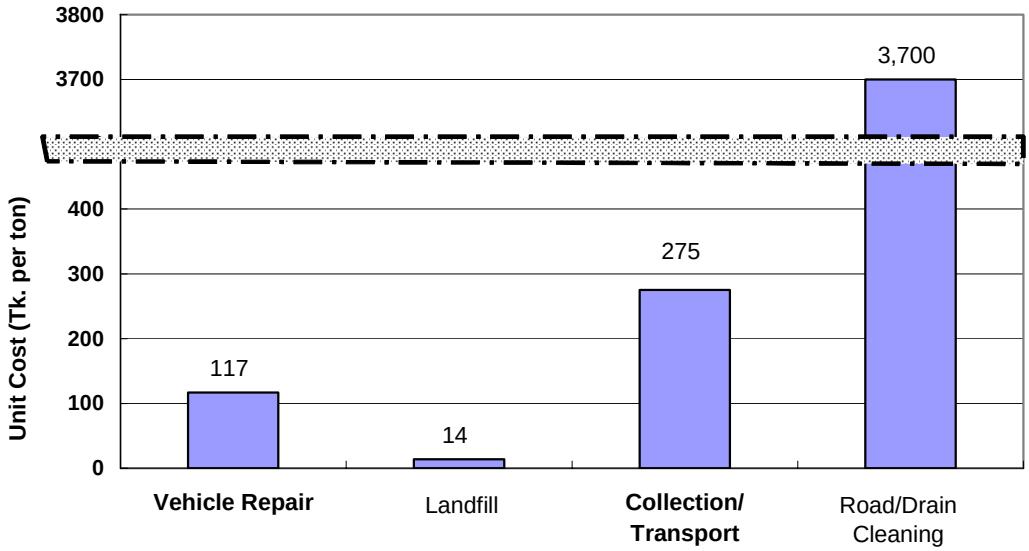
(2) SWM Expenditure by Type of Operation

DCC spends only 1.5% of budget for landfill while more than half is for road/drain cleaning.



(3) SWM Cost by Type of Operation

Total SWM cost of DCC in the financial year of 2002-03 is estimated at Tk. 930/ton (= US$ 16 /ton) as a whole. Operation-wise unit cost for road/drain cleaning is by far bigger than the other operation as summarized in the chart below.



2.9 Privatization

(1) Initiation of the Privatization Project

SWM privatization project for 8 wards of Dhaka City has been going on since May 15, 2003 as "Ward-Wise Waste Management Project of DCC (Private Initiative)". Through competitive bids, four organizations were selected and awarded contracts. The contractors shall undertake the same tasks as is done by DCC in the other wards.

(2) Prospect of the Privatization Project

As a result of grading for the first year, 3 contractors were given another contract for the second year with the same amount as the first year. On the other hand, the contractor of Ward 37 failed in the renewal of contract, so that competitive bidding was made with the revised contract term of 3 years.

3. Framework of Master Plan

3.1 Numerical Framework of Master Plan

(1) Population

The future population is projected at 7.7 million for 2015 and 6.7 million for 2010 respectively. The area of DCC is assumed fixed at 131 km^2.

(2) Solid Waste Generation Amount

Quantity of solid waste to be generated is estimated based on the population growth and waste generation rate. The future waste generation is projected at 3,909 t/d and 4,624 t/d for the years 2010 and 2015, respectively

3.2 Scenario for Improvement

(1) Alternative Scenarios

Three scenarios for the improvement are conceived, based on different collection service levels:

Scenario 1: with the same amount as 2004
Scenario 2: at the same collection rate as 2004
Scenario 3: at an expanded collection rate (with best effort)

(2) Adopted Scenarios

The target level of waste disposal is set up on the Scenario-3 as shown below. As a result, 3,054 t/d should be collected in 2015 with. Cumulative disposal volume is estimated at about 9 million tons by the end of 2015.

Targets of Waste Disposal

	Present 2004 (t/d)	Target for 2015 (t/d)	Year 2015/2004
Collection/ transport	1,400	3,054*	218%(almost twice)
Final disposal	1.385	3,032*	219%(almost twice)
Recycling	435	672	154%
Unidentified disposal	1,380	920	one-third reduction

Note: * indicates the assumption without counting effect of source reduction by waste generator

4. Master Plan for Improvement of SWM in Dhaka City

4.1 Schedule for Implementation of Priority Projects and Programs

Some of the priority projects and programs need immediate commencement in accordance with the desirable time schedule as shown in the chart below.

Priority Projects/Programs and Implementation Schedule

	Priority Projects and Programs	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Primary Collection/Public Involvement												
1	Institutionalization of Ward Solid Waste Management System											
2	Establishing a System of Approval and Monitoring of Primary Collection Service Providers											
3	Supporting Primary Collection Service Providers											
4	Initial Implementation of Ward Solid Waste Management System (20 Wards)											
5	Organization of Bangladesh Solid Waste Management Conference											
Secondary Collection/Transport and Road/Drain Cleaning												
1	Inctrease of New Containers and Trucks											
2	Increase of driver and truck cleaner											
3	Formation of Chain of Management in SWM											
4	Setting up Operation and Management Plan											
5	Capacity Development of Workers											
Final Disposal												
1	Improvement of Existing Matuail Dump Site											
2	Securing Future Landfill Site											
3	Closure of Berri Band Dump Site											
4	Establishment of Management Organization for Final Disposal											
5	Capacity Development of Disposal Section											
Legal Aspects												
1	Compliance with Environmental Conservation Act/ Rules and Preservation Act											
2	Legal Training to DCC Staff											
3	Enforcement of Section 150 against Illegal Garbage Throwing and Dumping											
Organization Aspects												
1	Preparation of Annual Operation Plan according to Master Plan											
2	Improvement of Operational Organization											
3	Reforming Organization for SWM											
4	Training of DCC Staff for SWM											
Financial Aspect												
1	Modification of Accounting system to Exhibit Actual SWM Cost explicitly											
2	Financing for Master Plan Implementation											
Privatization												
1	Continuation of Pilot Project on Privatization with In-depth Evaluation											

4.2 Financial Requirement

(1) Development & Procurement Cost

The sum of Development and Procurement Cost until 2015/16 is estimated at Tk. 3,595 million. The table below shows the estimate of sources of funds for Development and Procurement Cost. Some of the funds are already budgeted and the rest is a proposal of the study team.

Proposed Sources of Funds for Development and Procurement Cost

Project	Source of Funds (Taka in million)		
	SWM Own Income	Grant from Central or Foreign Government	Total
① New Landfill Development	-	670	1,575
	136	769	
② Existing Landfill Improvement	-	471	471
③ Closure of Berri band	11	-	11
④ Container Carrier and Truck Procurement	435	882	1,317
⑤ Heavy Equipment Procurement	55	107	162
⑥ Community Activities	-	59	59
Total	637	2,958	3,595

Source: Estimates by the JICA Study Team

(2) O&M Cost

On the other hand, the sum of O&M Cost until 2015/16 is estimated at Tk. 6,058 million. The unit cost is assumed to decrease continuously in spite of growing amount of waste collection as summarized in the table below.

SWM O&M Cost per Ton

Items	Unit	Actual	Master Plan			
		04/05	05/06	10/11	15/16	Average
SWM O&M Cost	Taka. In million	487	509	532	594	-
Collected Solid Waste Amount	1000Ton/Year	511	548	749	1,030	-
Taka/Ton		953	929	710	577	703

Source: Estimates by JICA Study Team

(3) Financial Balance

The financial balance of SWM finally reaches surplus from 2014/15 by putting the three income enhancement measures into effect (reassessment of estates, increase of tax rate and collection rate).

Final Report

Volume 1: Summary

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Appendix

COMPOSITION OF THE REPORTS

This Report consists of 4 volumes as follows:

volume 1: Summary
volume 2: Main Report
volume 3: Supporting Report
volume 4: Data Book

CHAPTER 1 INTRODUCTION

1.1 Background of the Study

The metropolitan city of Dhaka has an area of 131 km^2 and population of 5.7 million. Because of the scarcity of flood free land, the population density exceeds 40,000 per km^2 on one hand, and the rest of flood prone area is commonly used as voluntary dump site. The conspicuous intensity of building causes difficulty in waste collection from the city particularly from the old Dhaka area. The collection rate is estimated in this study at 44 % of generated volume. This means more than half of waste is not properly collected and disposed at official dump sites. Uncollected waste has been recognized as the root of inferior environment such as scattered garbage, offensive odor, drain clogging, water pollution and mosquitoes.

Dhaka City Corporation is mandated the task of solid waste disposal and carries out the task by mobilizing 7,000 workers and 300 plus trucks. The achievement of cleaning has not yet been appreciated by either of citizens or the government. The prime minister also expressed her concern about "Clean Dhaka" as an important mission of administration. Various studies have been conducted with the assistance of Asian Development Bank and United Nations Development Program in Dhaka City; however, an entire solution is yet to be found. The waste volume is still increasing as the city grows although Dhaka City Corporation does not have a confident view to solve the problems of uncollected waste.

Japan International Cooperation Agency (JICA) dispatched short-term specialist for the technology transfer of the waste disposal from March to August 2000. Further in response to the request of Bangladesh, JICA sent a preliminary study team and concluded the Scope of Work for the study for formulation of a Master Plan on the waste management in Dhaka City. Accordingly, JICA dispatched a study team to commence the study in November 2003 and study has continued for 1 5 months since then.

1.2 Objectives of the Study

1.2.1 Objectives

The objectives of the Study are:

(1) To formulate master plan concerning solid waste management in Dhaka City

(2) To improve and strengthen the capabilities and management skills of DCC personnel in terms of solid waste management through the technology transfer during the Study.

1.2.2 Study Area

The Study area covers the jurisdiction of the Dhaka City Cooperation (DCC), which totals about 131 km^2. Sites of the new landfill facility will also be included in the study even if they are located in new urban area outside the jurisdiction of DCC.

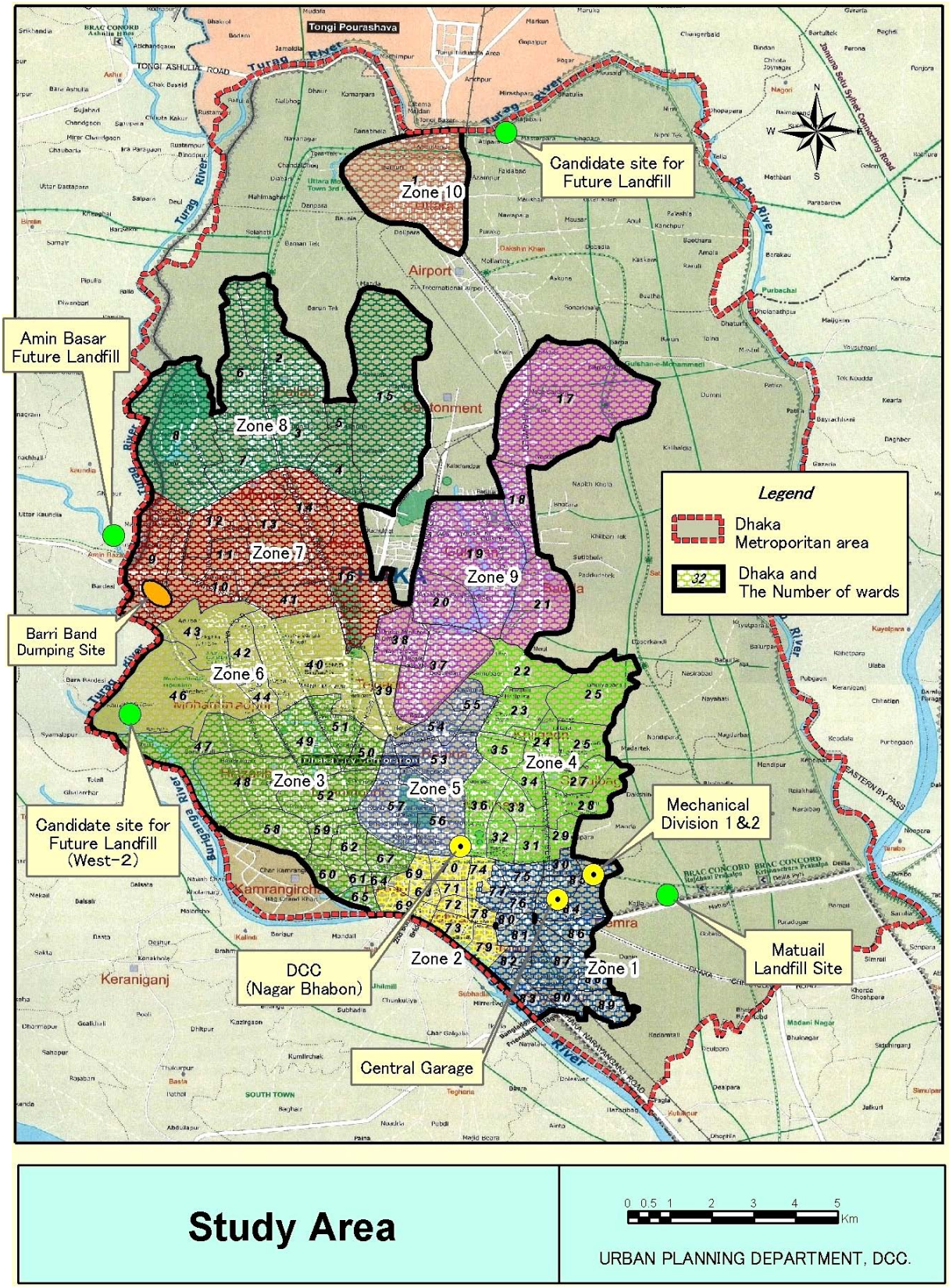


Figure 1.1 Study Area

1.2.3 Target Waste

The Study covers three types of solid wastes generated in the jurisdiction of the Dhaka City Cooperation: namely, Domestic waste, Industrial waste, and Medical waste. Liquid and gaseous wastes are not included in the scope of this study.

The master plan shall be prepared for only Domestic waste in this study. With regard to Industrial waste and Medical wastes, surveys will be conducted to identify the problems and possible solutions will be proposed separately from Domestic waste.

1.2.4 Target Year

The master plan views one decade with the target year 2015.

1.3 Organization for Study Implementation

Figure 1.2 shows the overall Study organization and the relationship between the Study Team and the Counterpart organizations.

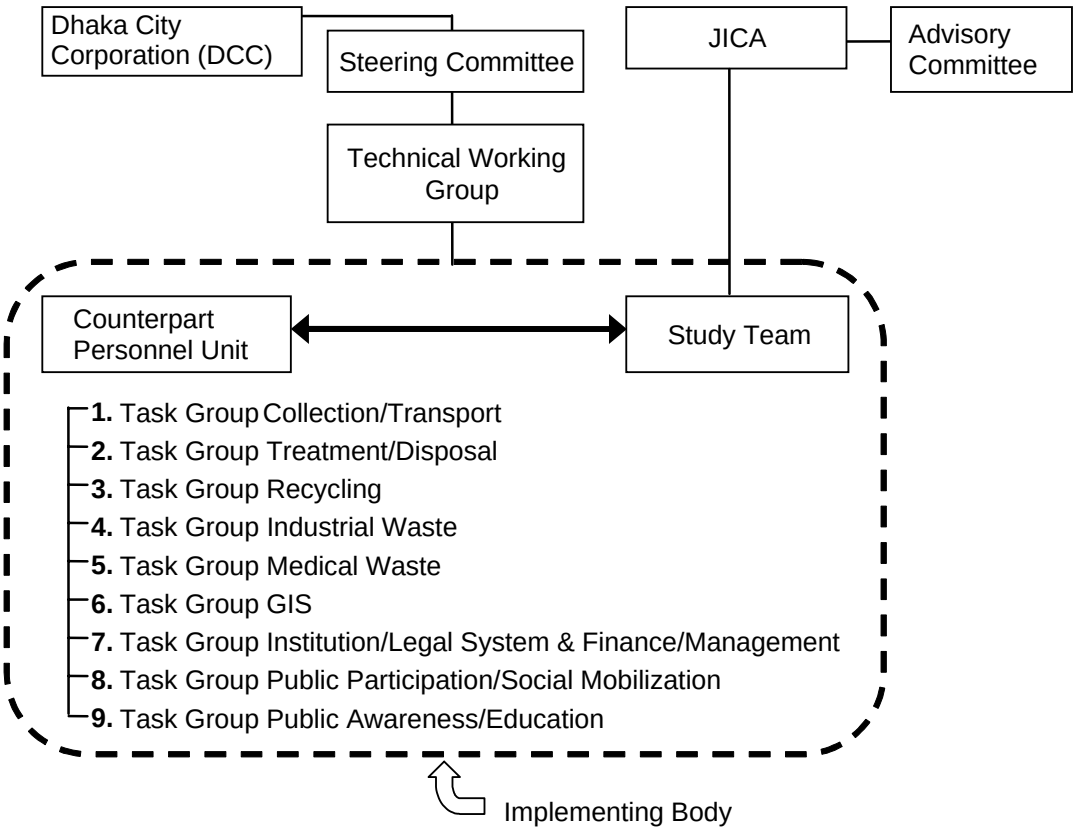


Figure 1.2 Overall Study Organization

CHAPTER 2 PRESENT SITUATION OF SOLID WASTE MANAGEMENT IN DHAKA CITY

2.1 Waste Generation

(1) Waste Generation Volume and Quality

Waste generation in Dhaka City is summarized below.

Table 2.1 Summary of Waste Generation Volume and Quality

item	parameter
estimated generation	domestic waste: 1,950 t/d business waste: 1,050 t/d street waste: 200 t/d
generation rate	domestic waste: 0.34 kg/d/person (domestic + business + street) waste:0.56 kg/d/person
bulk density	all waste average: 0.24 t/m^3
food waste contents	domestic waste: 67 % market waste: 60 %
calorific value	all waste average: 550 to 850 kcal/kg *requirement of self combustion: 1,200 kcal/kg

Source: waste amount and quality survey by the study team

(2) Waste Collection and Disposal

Waste collection and disposal are summarized below.

Table 2.2 Summary of Waste collection and disposal

item	parameter
share of disposal volume by dump site	Matuail: 65 % Berri Band: 30 % Uttara: 5 %
total disposal volume at 3 dump sites	wet season average: 1,400 t/d
collection rate by Zone	max. Zone 5: 71 % of generation min. Zone 8: 19 % 10 zones average: 44 %

Source: waste amount and quality survey by the study team

2.2 Primary Collection

(1) Task Allocation in Waste Collection

Dhaka City Corporation Ordinance[1] is the basic law regarding street/drain cleaning, waste collection and transportation. According to Section 78 of the Ordinance, DCC is allowed to provide dustbins or other receptacles at suitable places, and to require residents to bring their waste to the dustbins or receptacles. DCC is responsible for secondary waste collection to

[1] Dhaka City Corporation Ordinance was promulgated by the Chief Martial Law Administrator on 24 August 1983.

remove waste from its dustbins/containers, and transport the waste to final disposal sites. Residents are responsible for bringing their waste to DCC's waste collection points where dustbins/containers are located as shown in Figure 2.1. The regulation is clear as far as dustbins/containers are located. On the contrary it becomes unclear where no dustbins/containers are located is provided.

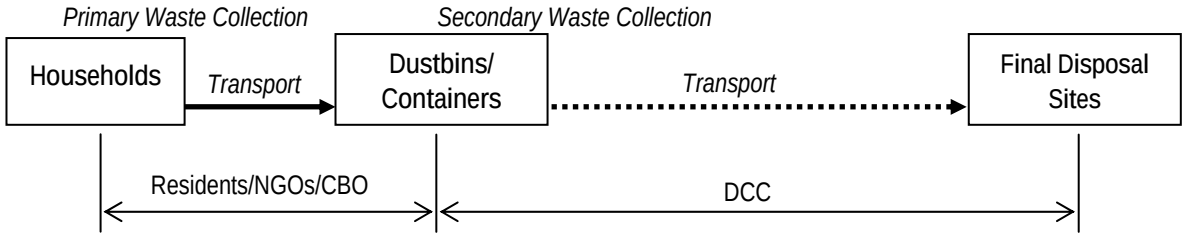


Figure 2.1 Waste Collection System in Dhaka City

(2) Private Initiative in Primary Waste Collection

It is commonly observed that NGO/CBO or private firm are engaged in primary collection in Dhaka City. Various local civil societies or CBOs duplicated the system of door-to-door collection introduced in Kalabagan in 1987 that uses rickshaw van as basic collection tool as seen in Photo 2.1. It is said that more than 130 organizations were providing the door-to-door waste collection services in 1999[2] and the number is still increasing.

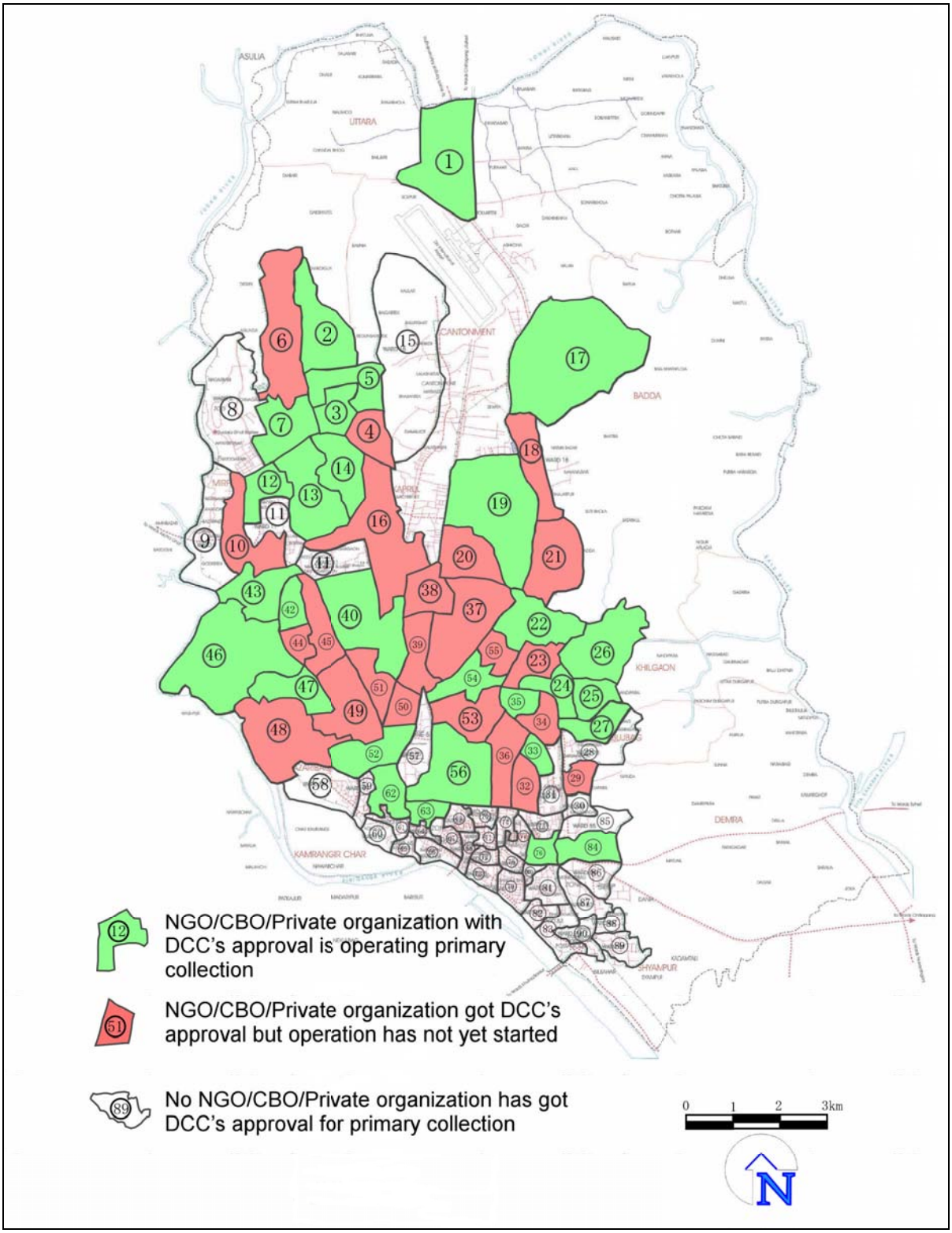
Photo 2.1 Various Designs of Rickshaw Vans Used for Primary Collection

(3) DCC Initiative in Primary Waste Collection

In 2002, DCC introduced an approval system of NGOs/CBOs/private organization for providing door-to-door waste collection services ward-wide. DCC has given approvals to 47

[2] Decentralized Composting, Waste Concern

NGOs/CBOs to work in 57 areas, however, not all NGOs who got approvals have started their activities as shown in Figure 2.2.



Source: DCC Conservancy Department and BIEDF

Figure 2.2 Distribution of NGOs/CBOs with DCC Approval for Primary Collection

(4) Service Charge for Door-to-Door Collection by NGO/CBO

The service charges collected by NGOs/CBOs vary, depending upon the areas and revenue groups as shown in Table 2.3.

Table 2.3 Service Charge for Door-to-Door Collection Service

Revenue	Area	Service Charge (per month) (Tk)	
High	Gulshan	Hotel	500-1,000
	Banani (Ward 19)	Resident -High	100-300
Middle & Low	Khilgaon (Ward 23)	Resident - Middle	10
		Resident - Low	10 or free
Middle & Low	Mirpur (Ward 6)	Resident - Middle	20
		Resident - Low	10 or free
		Industry	100-500

Source: Interview Survey by JICA Study Team

2.3 Secondary Collection/Transport and Road/Drain Cleaning

(1) Organization and Activity for Secondary Collection and Transport

a) Conservancy Department

Conservancy Dept. is the core organization for solid waste management; it undertakes street and drain cleaning, carrying street and drain waste to dustbins/containers, and loading and unloading of waste at places of dustbins/containers and disposal sites. Conservancy Dept. consists mostly of field workers and very few officers at headquarters.

b) Transport Department

Transport Dept. has two parts: central pool and conservancy pool. The conservancy pool is in charge of transportation of waste from dustbins/containers to disposal sites. The number of drivers in the Conservancy Pool is less than the number of open trucks and container carrier. Some drivers are working in 2-shifts to cover the shortfall.

c) Engineering Department

Engineering Dept. is involved in solid waste management for operating heavy equipment at disposal sites and repair of vehicles and heavy equipment used at two workshops: Mechanical Division 1 for repair of transport vehicles, and Mechanical Division 2 for heavy equipment. Mechanical Division 1 also is in charge of manufacturing steel containers at demands of the Conservancy Dept. Civil Engineering Circle is also involved in the field of facility construction and site development for waste disposal.

d) Store and Purchase Department

Store and Purchase Dept. procures conservancy appliances, such as brooms and baskets, at the request of the Conservancy Dept. Store and Purchase Department also purchases spare parts for vehicles and equipment.

e) Urban Planning Department

This department undertakes the pilot project for privatization in 8 wards in cooperation with the Conservancy Dept.

(2) Deployment of Manpower and Vehicles for Collection/Transport

a) Regulatory Basis of Deployment of Resources

There are no regulations, by-laws/guidelines or public notices for installation of dustbins and container. Ward Commissioners makes a request to the Mayor for the installation of such receptacles. When the Mayor approves the request, the order is given to the Conservancy Dept. to install them. The Conservancy Dept. then asks Engineering Dept. to construct the dustbins or to install containers. Currently, DCC has a policy not to construct new dustbins, but to replace them with containers. After the installation of the receptacles, respective Ward Commissioners give "public notice" verbally to the residents. Deployment of additional vehicles/drivers as well as additional cleaners also starts with requests by Ward Commissioners. Currently, there are about 1,000 receptacles are deployed in the city.

- dust bin 688 units
- $6m^3$ container 260 units
- 12 m^3 container 123 units
- total 1,071 units

b) Manpower Allocation to Collection and Transport Sector

Manpower allocation is summarized by assignment in Table 2.4. The significant point of cleaners work is variation of working hours. The working hours vary from 2 to 8 hours with average about 4 hours for DCC cleaners, while private cleaners work from 4 to 8 hours with average 6 hours.

Table 2.4 Assignment and Number of Cleaners and Drivers

Workers category	Assignment	Number	Total
DCC worker			
Road Cleaner	Ward	5,003	6,992 (6.880 cleaners are deployed to Zones and Wards)
Deep Drain Cleaner	Zone	284	
Storm Sewage Cleaner	Zone	119	
VIP Road Cleaner	Zone	178	
Market Cleaner	Zone	425	
Other Cleaner	Zone	19	
Truck Cleaner	Ward	663	
Special Truck Cleaner	Zone	189	
Container Cleaner	Central	112	
Truck Driver	Ward	266	266
Container Driver	Central		
Private worker	Zone 9 & 10		578
Road Cleaner		359	
Deep Drain Cleaner		86	
Truck Cleaner		106	
Truck Driver		27	

Source: Questionnaire Survey with ZCO and CI by JICA Study Team

c) Stock of Collection and Transport Vehicle

There are 343 units of registered conservancy vehicles. Out of the stock, 60 units are under repair and the balance of 283 units are in operation as of October 2004. The actual capacity of collection by DCC is estimated at 2,061 t/d as shown in Table 2.5.

Table 2.5 Estimated Collection and Transport Capacity of DCC Vehicles

Type and Capacity of Vehicle	Trucks in Stock		Trucks in Use	
	Nos. of Vehicle in stock (unit)	Estimated Capacity (t/d)	Nos. of Vehicle in use (unit)	Estimated Capacity (t/d)
Registered Vehicles				
1.5 ton Open/Cover Truck	83	249	67	48
3 ton Open Truck	104	499	83	101
5 ton Open Truck	26	208	24	16
3 ton Container Carrier	93	893	76	163
5 ton Container Carrier	34	544	30	64
20 ton Trailer Truck	3	60	3	60
Total	343	2,453	283	2,061

Source: DCC

Note: It is assumed the average number of trips to dump sites a day is 2 for open trucks and 4 for container carriers.

d) Sufficiency of Trucks and Drivers

Transport Department is making a request to increase the number of vehicles by 150 together with 200 more drivers to the Mayor. The number of driver is apparently insufficient: 266 drivers were assigned to operate 283 trucks. The number of trucks is considered still sufficient to transport 1.5 times as much waste as achieved in 2004.

Provided that 307 drivers achieve 1,400 t/d of transport, 452 drivers are proportionally required to run the trucks currently in use at their full capacity as shown in Figure 2.3. The current solution is to use trucks with more frequent trips to dump site by more drivers and longer operating hours.

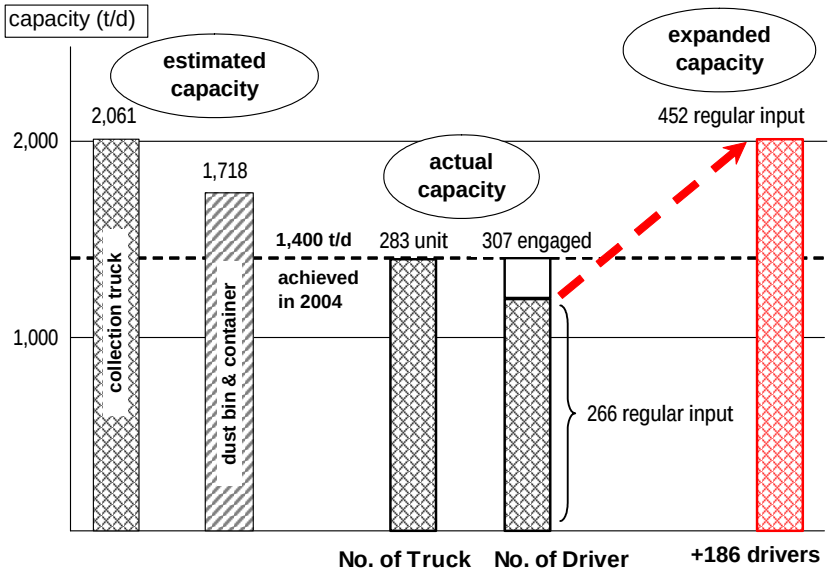


Figure 2.3 Expansion of Transport Capacity by Increase of Driver

e) Composition of Trucks

DCC regularly uses three types of trucks as follows.

- Open Truck (OT): 3 ton, 5 ton for dustbins on wider road, 1.5 ton for narrow road
- Container Carrier (CC): 3 ton, 5 ton for containers on wider road
- Trailer Truck (TT): 20 ton for big market

Loaded amount of each type of trucks was observed at the entrance of Matuail dump site for three months as part of Pilot Project B. As the result of observation in September, OT 1.5 ton and trailer exhibit larger load than rated capacity. CC 3 ton were almost fully loaded to their rated capacity, whereas OT 3 ton and CC 5 ton were just loaded about 70 % of rated capacity.

Regarding the frequency of trips for dumping in a day, OT made 1 to 2 trips a day while CC made 2 to 10 trips a day and about 3 trips on average. The combination of three types works well in spite of the minor problem of partial inefficiency.

Owing to short distance to dump site, the trucks keep chassis, tires and engine better than the age of vehicle. On the other hand the body for loading is comparably worse because of corrosion. The same deterioration is found in containers which are mostly eroded inside by leachate generated from raw waste.

f) Comparison of Efficiency between Open Truck & Container Carrier

Figure 2.4 shows the efficiency of trucks in secondary collection and transport by type of vehicle based on the result of time & motion survey. For overall collection/transport efficiency (ton/hour), container carriers achieved on average 2 t/h, that is four times as much as open trucks which carried only 0.5 t/h on average. As for the cost-performance, it is found container carriers cost 20 % less than open truck of 3-ton class.

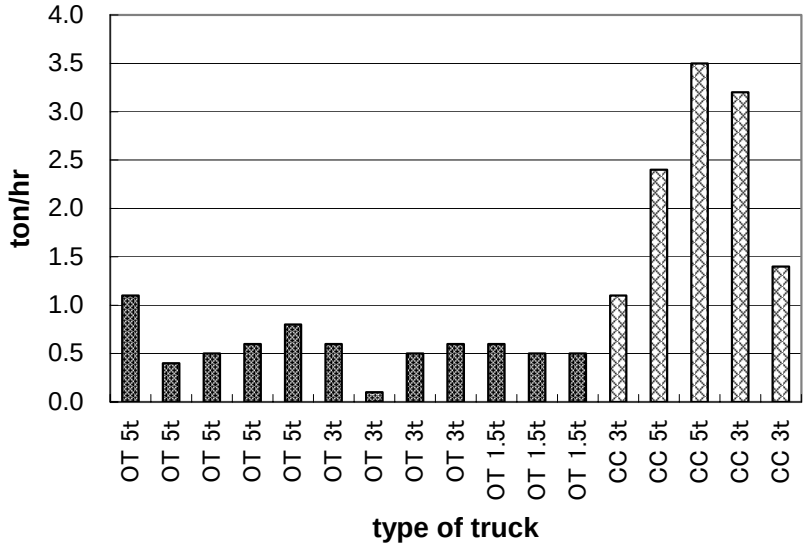


Figure 2.4 Efficiency of Waste Transport by Type of Truck

(March 2004, time & motion survey)

g) Slow Vehicle Repair

The repair usually takes a long time. Half of the vehicles that finished repair in 2004 took two years since the request of repair. Major repair is contracted with private workshops outside DCC. The tender document needs final decision by the Mayor and the process takes a long time to complete. Because of the limited frequency of Mayor's sanction, there is an inevitable waiting for application to the Mayor. A fundamental improvement in this inefficiency is urgently needed.

h) Lack of Management

In the Pilot Project B (Management Information Acquisition), waste transport operation was recorded by two different sources: namely, at garages based on logbook and at Matuail based on interviews with drivers. The two records from different sources should be in accord with each other; however, they showed an apparent difference particularly in number of trips. The number of trips recorded in logbook counted almost twice as many as those recorded at the entrance of Matuail dump site. The number of trips is regarded as a basis of estimation of fuel consumption in the current routine. The discrepancy of trip number in two sources implies the expense for fuel is questionable.

In addition, most conservancy trucks are not equipped with distance meter in the cabin, which gives an essential data for rational valuation of fuel consumption. The absence of this equipment is overlooked by the top management of DCC.

(3) SWM Expenditure

DCC prepares only 'total actual expenditures' after closing of the financial year. Neither 'department-wise expenditures' nor 'operation-wise expenditures' are available. In order to analyze the expenditure for SWM, the Study Team estimated the operation-wise expenditures of SWM for the last 4 years as shown in Figure 2.5. The largest amount (58%) was spent for cleaning of roads and drains, while very little amount (1.4%) was spent for landfill.

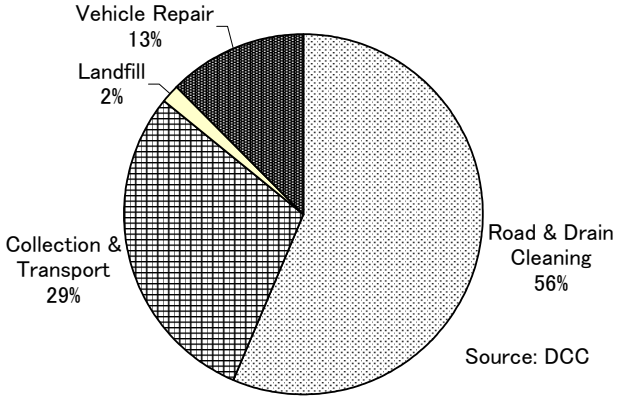


Figure 2.5 Budget Allocation to Waste Management by Process

Total SWM expenditures have increased each year up to approximately Tk 480 million in the financial year 2002-03, which accounted for 18% of DCC's total expenditures, and 42% of its

own revenues of the year. The unit SWM cost of DCC in the financial year of 2002-03 is estimated at Tk. 930/ton (= US$ 16 /ton) as shown in Figure 2.6.

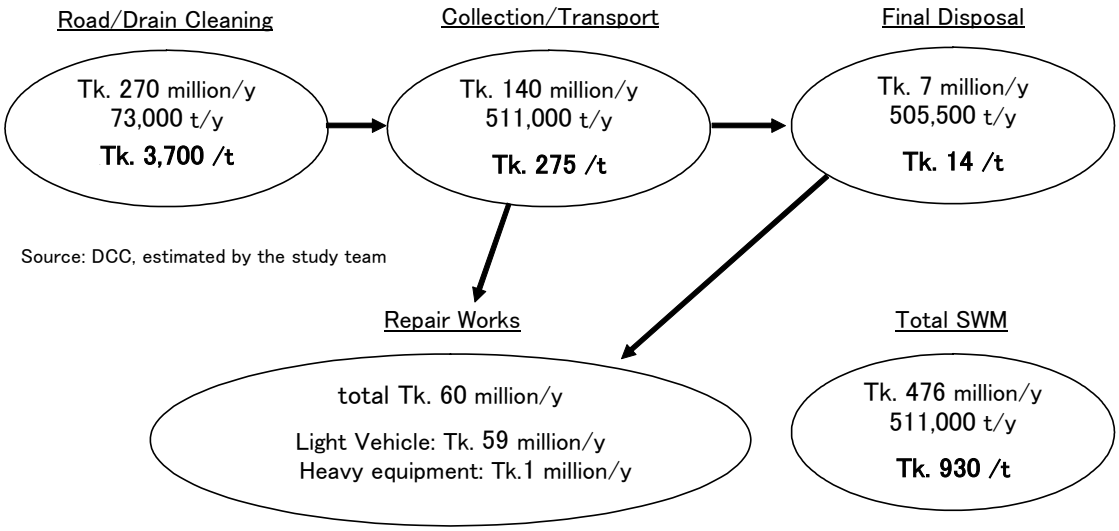


Figure 2.6 Solid Waste Management Cost Flow

2.4 Final Disposal

(1) Existing Landfill Sites in Operation

a) Remaining Capacity of Existing Landfill Sites in Operation

DCC uses three landfill sites: namely, Matuail, Berri Band and Uttara; Matuail is the only official landfill site owned by DCC and is estimated at 1.1 million tons with the remaining capacity. The rest, Berri Band and Uttara dumpsites are on privately owned land. It is explained that owners of the land have requested DCC to fill the low lying land with solid waste. In response to their request, DCC started disposing of solid waste there.

b) Legitimacy of Existing Landfill Sites in Operation

As for Berri Band and Uttara sites, the final disposal of solid waste was started after the enforcement of the Environmental Conservation Act of 1995 and the Environmental Conservation Rules of 1997. These regulations require the Environmental Clearance Certificate (ECC) for earth filling by industrial, domestic and commercial waste. However, neither of the sites has got the ECC yet. Moreover both have not yet got approvals from RAJUK, which is required for structural change of open space and/or reservoirs according to the Preservation Act of 2000.

Table 2.6 Existing Landfill Sites in Dhaka

Name of the site	Area	Start operation	Incoming trucks*
Matuail	20 ha	1993	282
Berri Band	4 ha	Not clear	138
Uttara	1 ha	2003	18

Source: JICA Study Team *: average of observation in two seasons

(2) Operation and Management of Landfill Site

a) Management of Landfill Site

Conservancy Department dispatches 4 staff to Matuail landfill site; however, there is no task description for them or work record at all. Mechanical Division 2 also provides heavy equipment and operators to three landfill sites; however, there is also no task description or work record or operation plan either. Construction works in Matuail landfill site are executed under the supervision of Civil Engineer of Zone 1; however, it is not clear who is responsible for making a plan for such construction.

b) Operation of Landfill Sites

Operation method of landfill at all three sites is open dumping, which has neither control of incoming waste nor covering soil. Surrounding embankment, access road and dumping platform are provided at Matuail landfill site, but no leachate collection and gas removal facilities are installed. The solid waste is dumped without surrounding bank at either Berri Band or Uttara.

c) Heavy Equipment for Landfill

Three types of heavy equipment are used for final disposal; however, the provision is unstable because more than half of equipment is broken as shown in Table 2.7. The repair work is done by Mechanical Division 2, but its repair capacity is poor.

Table 2.7 Heavy Equipment for Landfill

equipment	stock	broken	operating
bulldozer	15	11	4
excavator	6	4	2
tyre dozer	8	4	4
total	29	19	10

Source: DCC Mechanical Division

2.5 Recycling/Compost

(1) Outline of Recycling Activities in Dhaka City

a) Status of Recycling Industry in Dhaka City

According to “Bangladesh Statistical Yearbook 2001”and “Profile of Dhaka City”, the labor force excluding unemployed persons is estimated at approximately 1.2 million. On the other hand, approximately 74,000 people are engaged in recovering material out of solid waste, according to the interview survey by the Study Team. This means that approximately 6% of the total labor force in Dhaka City is in the recycling sector.

b) Stakeholders of Recycling Activities

Recycling stakeholders of municipal solid waste are composed of three principal groups: namely, collectors, buyers and factory/shops for recycled products. Recycling factories

are usually small-sized and located in old Dhaka area; they process material collected from inside and outside of the city.

There are special groups that function as collector and buyer. They are called *feriwalla* and they collect waste from waste generator (households) by paying cash in exchange for recyclable wastes. *Feriwalla* also buys recyclable wastes from other collectors.

c) Compostable Wastes

At present, there are five small-scale compost plants in Dhaka City. The total capacity of 5 plants totals 19 t/d; however, they are at present producing approximately 1.5 ton per day only in Dhaka City as a whole due to weak demand, according to Waste Concern. The products of kitchen waste is valued one digit lower than that of other recycle materials, according to the interview survey results with manufacturers and dealers.

(2) Estimated Volume of Recovered Waste

Recycling activity raises a total of 436 t/d of material recovery as shown in Table 2.8. According to the estimate, paper and plastic contribute to a considerable reduction of the waste disposal, while composting contributes very little in spite of the largest content of generated wastes.

Table 2.8 Estimated Volume of Recycled Wastes in Dhaka City

Material	a) Estimated generation of recyclables (t/d)	b) Estimated recycled waste (t/d)	c) Recycle rate	d) Contribution to waste reduction (b / 3,200)
Plastic	124	103	83 %	3.2 %
Paper	260	168	65 %	5.3 %
Glass	46	24	52 %	0.8 %
Metal	27	41	*	1.3 %
Compostable	2,211	6	0 %	0.2 %
Others	99	94	95 %	2.9 %
total	2,767	436		13.6 %

d) Assumed total municipal solid waste generation : 3,200 (t/d)

* Generation amount of metal is estimated by averaging 60 samples of waste composition survey, which did not contain metal factory at all. While recycled volume of metal contains imported metal from other cities in the country that did not appear in the composition survey. With this mechanism it is understood the recycled volume exceeds the estimated generation amount.

Source: Survey on recycle market by the Study Team

2.6 Industrial Waste

(1) Industrial waste flow

In the case of industrial wastes, reuse and recycling are aggressively done by industries themselves or by industry-related businesses. As a result, the amounts of recovered wastes by waste pickers and scavengers seem to be relatively small compared to those removed at sources.

(2) Amounts of Industrial Waste

The survey on industrial waste management has never been conducted except for tannery waste. The amount of tannery waste, which is mostly generated in Hazaribag area, is estimated at 150 t/day.

(3) Hazardous Industrial Waste Management

Cases of the environmental pollution resulted from improper industrial waste management are reported as soil contamination by heavy metals at some industrial zones[3]. The objective industrial zones are Tejgaon, Hazaribag, Tongi and Narayanganji where found the pollutants of Cr., Cu, Zn, Ni, Cd, and Pb from such industries as tannery, food, chemical, textile, battery, power, metal and steel.

Hazaribag is a famous tannery industrial area situated inside Dhaka, where soil is highly contaminated by toxic chemicals and heavy metals like Cr and Cu. The total pollutant emission from tannery industry shares 57 % of national total of toxic chemical and 32 % of toxic metals.[4] In 2004, the government decided to relocate the tannery industry from Hazaribag area to Savar area within a few years to restore the environmental condition in Hazaribag area. The Ministry of Industry ordered Bangladesh Small and Cottage Industry Corporation (BSCIC) to construct a tannery industrial zone in Savar together with infrastructure development.

(4) Related Laws and Regulations of Industrial Waste Management

At present, there is no legal requirement to manage industrial waste including hazardous waste. However, some laws and rules influence industrial waste management more or less. These are:

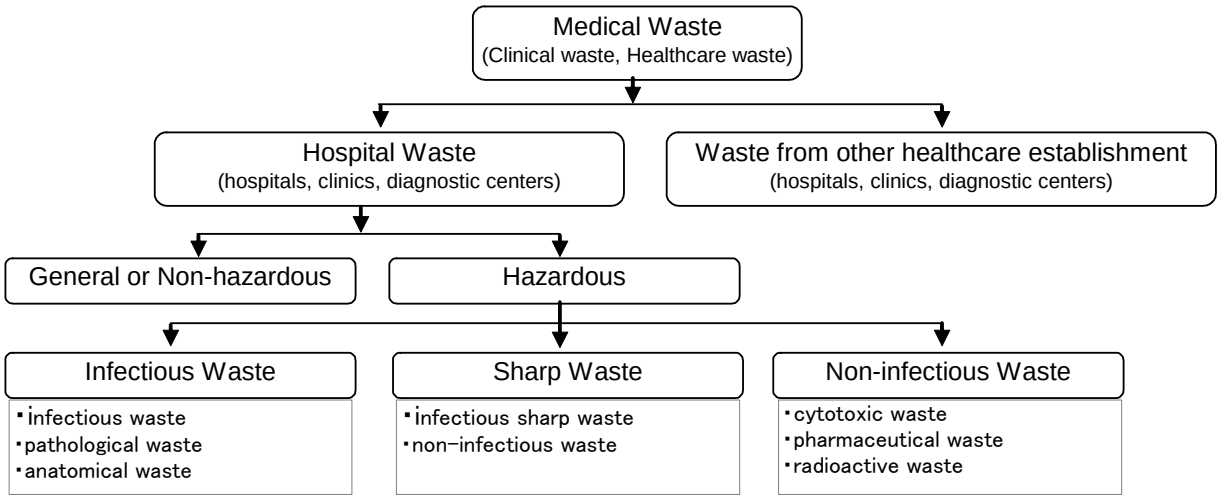
- Environmental Conservation Rules of 1997,
- Environmental Management Plan,
- Pollution Effect Abatement Plan,
- Emergency Plan for Adverse Environmental Impact, and
- Environmental Impact Assessment Plan.

2.7 Medical Waste

(1) Definition and Sources of Medical Waste

Medical wastes from hospitals, clinics and diagnostic centers are taken as the targeted waste in this study. Figure 2.7 shows the classification of hospital wastes sourced from the Manual for Hospital Waste Management.[5]

[3] S. M. Ullah, Heavy Metals and Industrial Pollution In Bangladesh, in 1st national Conference on Environmental Health, 19-20 February 2002.
[4] http//www.sdnpbd.org/wb/industry.php .
[5] Manual for Hospital Waste Management, Ed. by A.K.M. Saiedur Rahman, General of Hospital Services, Ministry of Health and Family Welfare, 2001.



Source: Slightly modified from Manual for Hospital Waste Management, Ed. by A.K.M. Saiedur Rahman, Director General of Hospital Services, Ministry of Health and Family Welfare, 2001

Figure 2.7 Classification of Medical Waste in Bangladesh.

(2) Medical Waste Generator

The total number of beds in the health care establishments in the study area is estimated at minimum 12,000 excluding some private hospitals as shown below.

Table 2.9 Number of Hospitals/Clinics and Beds in the Study Area

Entity	Type	Ministry	No	Beds	Remarks
Gov.	Hospital	Health & Family Welfare			
		DG Health Service	13	2,400	
		DG Family Welfare	1	100	Azimpur Maternity Hospital
		Defence	2	?	Out of Study Area
		Home Affair	2	?	Police Hospital, Jail Hospital (175)
		Communication	1	?	Railway Hospital
		LGRD&C	2	100	DCC Hospital
	Medical College Hospital	Health & Family Welfare/Education	5	2,220	
Private bedded	Medical College Hospital		244	6,196	
	Clinics				
	Clinics with Diagnostic lab.				
Private	Diagnostic C.		>450	0	No beds.
Others	BSMMU		1	600	Bangabandhu Shekh Mujib Medical University
	ICDDR,B		1	250	International Centre for Diarrhea Diseases Research, Bangladesh
Total			>722	12,041	

Source: (1) Memo No. DGHS/Dir. Hosp/HWM/2004/572 by Director (Hospital and Clinics) & Line Director, Hospital Services, DGHS, May 11, 2004. (2) Health and Population Statistical Report 1999-2000, DGHS, Dec. 2001. (3) Bangladesh Health Bulletin 1996, DGHS, Nov. 1998.

Besides hospitals/clinics there are about 450 diagnostic centers in Dhaka that also produce syringes, needles, blood soaked materials, toxic chemicals; their quantities are, however, considered difficult to determine.

(3) Medical Waste Generation Rate

Hospital waste generation rate increases as the size of the hospital (i.e. as the number of beds) becomes larger.[6] In the survey conducted during March and May 1998, it was found that waste generation rate at hospitals in Dhaka was 1.2 kg/bed/d on average;[7] 15% of it was hazardous waste that included infectious waste (10.5%), pathological waste (1.5%), sharp waste (3.5%), and a very small amount of pharmaceutical and chemical wastes.

(4) Amount of Medical Waste Generation in the Study Area

Based on generation rate of hospital wastes mentioned in the previous section, total amounts of hospital waste and hazardous hospital waste in the study area are projected at 7.2~22.8 t/d and 0.6~2.4 t/d, respectively, by multiplying total bed number with waste generation rates.

(5) Discharge, Collection and Transport of Medical Waste

Hospital wastes that are segregated at sources, more or less, are normally discharged to a public dustbin in which wastes are mixed with general municipal waste. The mixed wastes are collected by DCC for final disposal.

(6) Treatment Technology of Medical Waste

Quite a few hospitals have on-site treatment facilities for their hospital wastes. There are three incinerators installed in the city, but only one of three units of Dhaka Medical College Hospital (DMCH) was in operation at the time of survey. Holy Family Hospital with 375 beds has a crusher for infectious waste and hazardous waste to be buried in a pit at the hospital compound.

(7) Reuse and Recycling of Medical Waste

Some sort of hospital wastes such as syringe, plastic tube, and plastic packaging materials are recycled. Recovered materials are sold to specific traders, who wash and clean the syringes and needles for reuse. The syringes and needles thus return to the hospitals or clinics again.

(8) Disposal of Medical Waste

Majority of hospital wastes discharged at public dustbin, either hazardous or non-hazardous, are hauled and dumped at Matuail dumpsite together with ordinary municipal waste.

(9) Related Laws and Regulations of Medical Waste Management

At present, there is no law that specifically regulates medical waste generation and its management. Government has only a manual compiled by the Directorate General of Health

[6] Non-Incineration Medical Waste Treatment Technologies, Health Care Without Harm, August 2001.
[7] M.Habibur Rahman, S.N. Ahmed and M. Shehab Ullah, A Study on Hospital Waste Management in Dhaka City, 25th WEDC Conference, Addis Ababa, Ethiopia, 1999.

Services, Ministry of Health and Family Welfare in 2001. Some laws that may influence hospital waste management system, more or less, are:[8]

- Environmental Conservation Rules of 1997;
  This law partly regulates waste management and disposal facilities. It classifies polluting industries into four categories, such as Green, Orange A, Orange B, and Red. Orange B includes pathological clinics and Red indicates hospitals,
- Import and Export Control Act of 1950 controlled by Shipping Ordinance of 1979,
- Custom Act of 1965,
- Environmental Management Plan,
- Pollution Effect Abatement Plan,
- Emergency Plan for Adverse Environmental Impact, and
- Environmental Impact Assessment Plans (EIA).

According to Environmental Conservation Rules, Effluent Treatment Plan (ETP) and Pollution Effect Abatement Plan along with Emergency Plan for Adverse Environmental Impact must be submitted to establish a clinic or hospital. However, there is no definite description of hospital solid waste. The City Corporation Ordinance does not cover hospital waste treatment and disposal.

2.8 Public Involvement

(1) Findings from Household Survey

Household Awareness Survey was conducted by the Study Team in February 2004. The survey was composed of Household Questionnaire Survey (340 samples) and Focus Group Discussion (Ward 19: Gulshan, Ward 23: Khilgaon, Ward 61: Lalbag, Ward 84: Saidabad/ Jatrabari). The following are the findings from the household questionnaire survey of upper to lower income group households.

a) Waste Discharge and Primary Collection

- Who discharges the waste?

  Servants/maids are in charge of waste discharge among 96 % of upper group and 79 % of middle group, while members of the households, mostly wives and daughters, are in charge among 95 % of lower group,.

- Receive door-to-door collection service ?

  88 % of upper group households and 75 % of middle group receive door-to-door collection service, while only 30 % of lower group receive such service.

- Throw waste in vacant place?

  51 % of lower group households dump their waste in vacant lands/river/marsh, while only 5% of upper group and 4% of middle group do that.

[8] A.K.M. Saiedur Rahman (Chief editor), Situation Assessment and Analysis of Hospital Waste Management (A Pilot Study), Line Director, Hospital Services, Directorate General of Health Services, Ministry of Health and Family Welfare, June 2000.

- Who provides door-to-door collection service?

80 % in new urban areas receive the service from CBO and 14 % from private companies. In old urban areas, 64 % of households receive the service from CBO and 19 % from DCC cleaners. In Old Dhaka, 78 % replied DCC cleaners are providing the service.

- 85% are satisfied with the door-to-door collection service.

b) Waste Collection Charge

- 88% are paying door-to-door waste collection charges.
- How much paying?

Upper group pay from Tk. 11 to more than Tk. 100 per month. 77 % of middle group pay Tk. 11 to Tk. 20 per month. 82 % of lower group pay Tk. 1 to Tk. 10 per month.

c) DCC Services and Secondary Collection

- 21 % of the respondents (household heads), do not know the locations of nearest dustbins/containers.
- How far are the dustbins/containers?

58 % in new urban areas and 52 % in older urban areas replied that dustbins/containers lie farther than 300 ft from house. On the other hand, 32 % in Old Dhaka replied that dustbins/containers are located nearer than 70 ft and 28 % nearer than 150 ft.

- Satisfied with DCC?

72 % of middle group and 75 % of lower group households are not satisfied with the services, while more than half of upper group households are satisfied with the services.

- What is the point of dissatisfaction?

Of those who are not satisfied with the waste collection service, 69 % replied that wastes are scattered around bins/containers and 34 % replied that bins/containers are too far or there are no bins in their areas; 21 % replied that time schedule of collection is not suitable.

- Satisfied with street sweeping?

60 % are not satisfied with the street sweeping provided by DCC (or private companies in privatized zones); 34 % of respondents in new urban areas replied that street sweeping is not provided in their areas.

d) Waste Segregation, Recycling and Composting

- Joining recycle?

91 % of upper group and 88 % of middle group give or sell recyclable waste, while only 29 % of lower group do that.

- Willing to segregate?

70% of upper group, 68 % of middle group and 75 % of lower group are not willing to participate in waste segregation activities.

- Willing to join recycle?

88 % of upper group, 95 % of middle group and 100 % of lower group are not willing to participate in recycling activities.

- Willing to join composting?

85% of upper group, 96 % of middle group and 98% of lower group are not willing to participate in composting activities.

e) Participation in Community Activities

- Joining now?

80% of upper group, 83 % of middle group and 96 % of lower group are not participating in any community activities.

- Willing to join community activities?

77 % of all respondents replied that they are willing to participate in activities on solid waste management in their communities.

(2) Unique Sense of "Community" and "Participation"

a) General Feature of "Community" in Dhaka

In Dhaka City, there is almost no area-based community to which member has strong sense of belonging. Boundaries of "community" are vague and usually difficult to identify. One of the reasons might be that more than half of the households in Dhaka City do not own lands and they pay rent to landowners. Most of them are immigrants from rural areas and still holding strong links with their home villages and relatives. They still identify the village/township of origin to be their real home[9].

b) Informal Community

Some kinds of informal communities called "Shomity" and "Ponchayt" exist in Dhaka City. Shomity is an association of neighborhoods. Their main activities include community security, waste collection, road widening, sports and culture. Ponchayt was a system originally introduced by the Chaukidari Act of 1880. It was established by one village or a group of villages, mainly for the maintenance of police. Now local associations of ponchayt are seen only in Old Dhaka. Their activities and functions are similar to Shomity at present. The past several decades saw the decline of these kinds of small-scale informal communities except for some working in particular fields as waste collection.

c) Formal Community

On the other hand, there are various civil organizations working in local areas for specific purposes (CBOs). CBOs have emerged in response to the various needs of the concerned locality. There are now approximately 1,830 CBOs in Dhaka City[10]. The

[9] Overcoming the Governance Crisis in Dhaka City, Kamal Siddiqui, Jamshed Ahmed, Abdul Awa, Mustaque Ahmed.

[10] The Role of Civil Society Organizations in Urban Development in Dhaka City, Nazrul Islam, Zeenat Mahjabeen, Oriental Geographer Vol.47: No.2: July 2003.

organizations are mainly funded by individual members/sympathizers/patrons, who pay yearly or monthly contributions/subscriptions/donations. They are registered with the GOB Directorate of Social Services, under the Voluntary Social Welfare Agencies (Registration and Control) Ordinance 1961.3. CBOs' activities include social welfare, micro-credit, health, education, securities, and waste collection.

d) Sense of "Participation"

In Dhaka City, "Participation" does not always mean that local people are involved in. In solid waste management sector, many organizations/government institutions use the word "participation" as the meaning that people understand and support their activities. For example, "participation" could mean that people stop throwing their waste in vacant lands or roads and give the waste properly to CBOs who provide door-to-door collection services, and pay the charge.

(3) Formal Environmental Education

a) Education System of Bangladesh

The education system in Bangladesh is divided into three major stages: primary education, secondary education, and higher education as shown below.

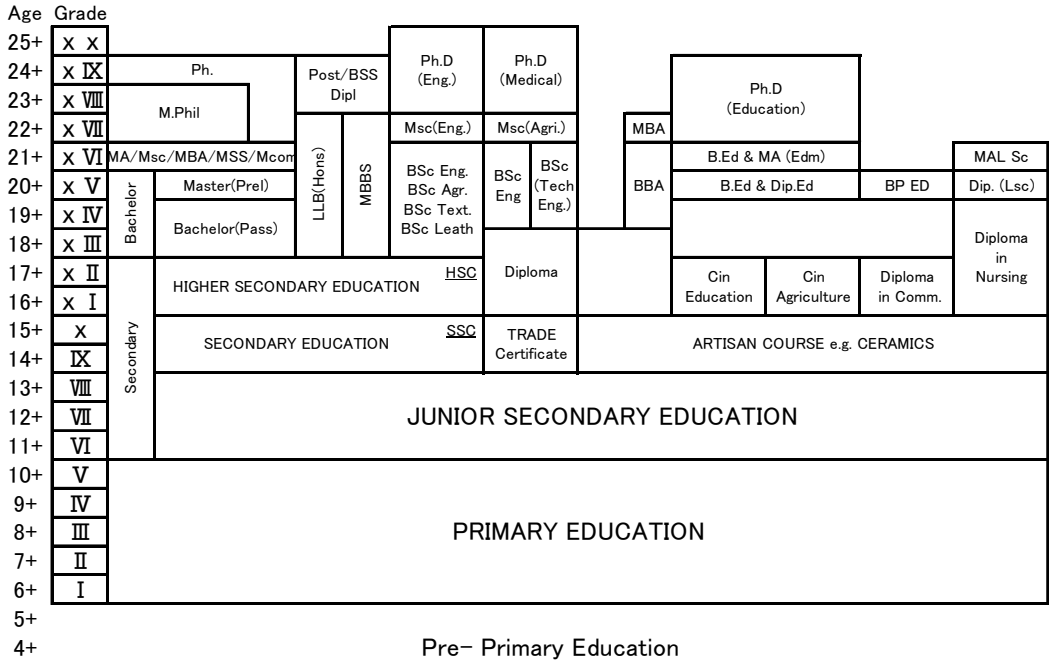


Figure 2.8 Education Structure in Bangladesh

b) Educational Statistics of Primary and Secondary Education (Grades 1-10)

The educational institutes are categorized into governmental, registered non-governmental, non-registered non-governmental, madrasa and NGO's school in primary and secondary education of Bangladesh. Enrollment rate is 83 % for Primary Education

(Grades 1-5), and 55.7 % for Grades 6-8 and 40.6 % for Grades 9-10 for Secondary Education.

c) Policy of Environment Education

Environment education is not mentioned either in the National Education Policy "NEP2000" of Bangladesh or in the action plan. It seems that Environment Education in Bangladesh depends mostly on donors' support because of the financial constraints.

d) Education on Solid Waste

The textbooks of Science and Social Science describe solid waste for the above third grade. The connection among environmental pollution, infectious diseases and unmanaged solid waste is taught to pupils.

2.9 Legal Aspect

(1) DCC Ordinance of 1983

a) Relevant Section of the Ordinance

Basic law regarding solid waste management in Dhaka City is Dhaka City Corporation Ordinance promulgated by the Chief Martial Law Administrator on 24 August 1983. Section 78 of the Ordinance stipulates as follows:

Section 78. Removal, collection and disposal of refuse.

(1) The Corporation shall make adequate arrangements for the *removal of refuse*[11] *from all public streets,*[12] *public latrines, urinals, drains and all buildings and land vested in the Corporation, and for the collection and proper disposal of such refuse.*

(2) The **occupiers of all other buildings and lands** within the Corporation shall be responsible for the removal of refuse from such buildings and lands *subject to the general control and supervision of the Corporation.*

(3) The Corporation *may cause public dustbins or other suitable receptacles to be provided at suitable places* and where such dustbins or receptacles are provided, the Corporation *may, by public notice, require that all refuse accumulating* in any premises or land shall be deposited by **the owner or occupier of such premises or land** in such dustbins or receptacles.

(4) All refuse removed and collected by the staff of the Corporation or under their control and supervision and all refuse deposited in the dustbins and other receptacles provided by the Corporation shall be property of the Corporation.

[11] "Refuse" includes rubbish, offal night soil, carcass of animals, deposits of sewerage, waste and any other offensive matter, according to the definition of the Ordinance.

[12] "Public street" is defined as a street maintained by the Government.

b) Responsibility of DCC

According to the above, DCC is responsible for removal of waste from all public streets, drains and buildings and land of the Corporation and for proper disposal of waste.

c) Responsibility of Occupiers

In turn, the occupiers of all other buildings and lands within jurisdiction of DCC are responsible for the removal of refuse from their buildings and lands. To discharge their responsibility, they have to carry and dispose of their waste in the receptacle (containers or dustbins), which DCC may install, by themselves or to contract an NGO, CBO or private company to carry their refuse to the public dustbins or containers.

d) Offense and Penalty

When the occupiers do not follow the Ordinance, i.e., "throwing or placing any refuse on any public street or in any place not provided or appointed for the purpose by the Corporation (item 19 of the Third Schedule of the Ordinance)", it shall constitute an offense and punishment shall be meted out after conviction according to Sections 150 – 153 of the Ordinance.

e) Interpretation of Boundary between DCC and Occupiers

Although the ordinance does not explicitly define, the responsibility of disposal of refuse deposited in dustbins or containers is widely regarded as that of DCC; then DCC transports and disposes of the refuse at dumpsites.

(2) Environment Conservation Act and Rules

a) Requirement related to SWM

Environmental Conservation Act of 1995 and Environmental Conservation Rules of 1997 require the person, who proposes or undertakes every industrial unit or project, to acquire Environmental Clearance Certificate (ECC, Section 12 of the Act). Landfilling by industrial, household and commercial wastes is classified as "Red Category", which includes most harmful or dangerous industrial units and projects (Rule 7. and Schedule 1 of the Rules).

b) Little Sense of Compliance in DCC with the Act and Rules

Most of the staff appear not to be aware of these provisions. Uncontrolled or unidentified dumping or disposal prevails. In some cases, this kind of dumping is done by DCC upon request of the landowners.

(3) Preservation Act

a) Requirement related to SWM

Preservation Act of 2000, requires prior consent of the Government for changing the structure of specific lands such as open place, playing field or natural reservoir of water by *filling land*, building construction and any other construction that alter the original Master Plan of RAJUK.

b) Compliance with the Act by DCC

DCC currently does not comply with the above Act. Almost all of its staff seem not to know these provisions.

2.10 Organization

(1) Job Allocation within DCC

Currently, some of departments have internal job descriptions for high ranked posts while others do not have them yet. About ten years ago, Administration and Establishment Dept. had started defining job descriptions of departments and divisions; however, it has not yet been completed.

(2) Capacity of Operating Departments/Divisions

Based on the observation of performance, the important missing jobs were found in planning, public involvement and management of final disposal as shown below.

Table 2.10 Capacity of Operation Component for SWM

job	number	function	remarks
road cleaning	excessive	enough	too short working hour
drain cleaning	lacking	not enough	tools be improved
secondary collection			
vehicle	enough	enough	
driver	lacking	enough	too long working hour
truck cleaner	lacking	enough	unhealthy & exhausting work
repair vehicle	lacking	inferior	years of time for repair for approval process
final disposal	nil	nil	no job description
heavy equipment	lacking	not enough	old and frequent breakdown
operator	enough	not enough	no instruction on effective & sanitary landfill
conservancy staff	enough	inferior	no work reported
public involvement	nil	nil	nobody assigned
planning	nil	nil	nobody assigned

(3) Capability of Planning and Coordination among the Departments Concerned

a) Establishment of New Organization

Waste Management Committee (WMC) and Waste Management Division (WMD) were established with the objective of enhancing coordination mechanism among the departments of DCC. Proposed organizations were regarded as evolving from Solid Waste Management Cell, which was established for better coordination and management among the concerned departments and divisions.

b) Function of WMC

WMC is composed with chairmanship of Chief Executive Officer (CEO) and membership of relevant department heads of DCC and representatives from the relevant Government Ministries. Functions of the WMC are to finalize the recommendations to the Mayor on the following:

- Implementation Plans /Action Plans including Formulation of Implementation Unit
- Annual Operation Plan and Budget Plan
- Formulation/Review of Master Plan (every five years)

c) Function and Composition of WMD

WMD is to carry out i) secretarial works to WMC and ii) day-to-day liaison with external organizations. WMD was placed in Conservancy Dept. Due to a mismatch of qualification and available manpower of DCC, the nomination of staff was left incomplete. To escape from the stagnated situation, the Study Team proposed a revised composition of WMD to CEO in December 2004.

2.11 Financial Management

(1) Budget and Actual Revenue/Expenditure

a) Ordinance and Rules related to Budget

"The Dhaka City Corporation Ordinance, 1983" and "The Dhaka Municipal Corporation (Preparation and Sanction of Budget) Rules, 1974" determine the process of the budget preparation and sanction of DCC. In compliance with the Ordinance and Rules, the budget shall be submitted to the Government by the first day of June each year. The Revised Budget is also prepared and sanctioned in the third quarter of the Financial Year[13] that starts in July and ends in June in Bangladesh. Usually, revised revenues are lower than the original ones.

b) Actual Revenue and Expenditure

A summary of actual revenue and expenditure of DCC own account is shown below. The problem is that revenues collected were only 70% of budgeted amounts, on average, from 2000-01 to 2002-03. This revenue gap compels DCC to squeeze its expenditures aside from salary/wages.

[13] The term "Financial Year" is commonly used in official documents, such as budget statements of the Government of Bangladesh and DCC, instead of the words "fiscal year" used in other countries. For better understanding of the counterparts and other officials of DCC and the Government, "financial year" is used in this report.

Table 2.11 Actual Revenue and Expenditure of DCC Own Account*1 (Taka million)

Items			Financial year	99-00	00-01	01-02	02-03	% (02-03)
Opening Balance				39	42	41	286	10
Revenues	Revenue			1,615	1,717	1,625	1,828	64
	Development	Government Grant		550	550	500	463	
		Special Govt. Grant		0	0	0	285	
		Total		550	550	550	748	26
	Total			2,165	2,267	2,125	2,575	
Opening Balance + Revenues				2,204	2,309	2,166	2,861	100
Expendi-tures	Revenue*2	Salary/wages		464	504	607	634	24
		Others		476	487	364	504	19
		Total		940	991	971	1,138	
	Development*3	Own source/Govt. Grant		1,158	1,134	711	1,241	46
	Others	Loan repayment, etc		64	143	199	291	11
	Total			2,162	2,268	1,881	2,670	100
Closing Balance				42	41	286	216	

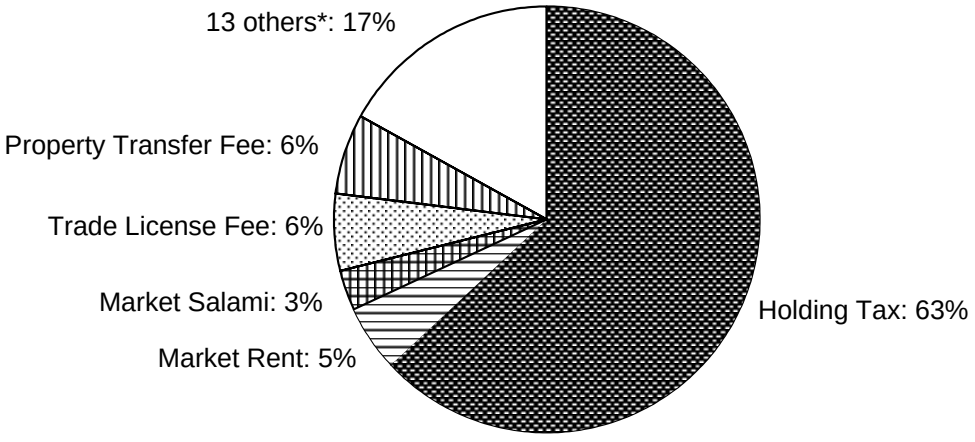
Source: Information from Accounts Department
Note 1: DCC own account does not include revenue and expenditures of Government/Foreign-Aided projects.
Note 2: So-called general or recurrent budget is denominated as "Revenue Budget" in Bangladesh.
Note 3: The capital or investment budget is denominated as "Development Budget".

(2) Breakdown of DCC Revenues

DCC revenue consists of tax and development revenue.

a) Tax Revenues

DCC has as many as 19 regular revenue items of its own. Among these items, Holding Tax accounts for more than 60 % of total revenue as shown below. The substantial amount of arrears has remained in the account of holding tax, which chronically constrains the financial operation of DCC.



Source: DCC Budget Report and Information
Note*: Road Cutting Fee is not included.

Figure 2.9 Composition of Revenue

b) Development Revenue

(i) Government Grant

This is the basic intra-governmental grant to DCC. DCC retains considerable discretion over the use of funds if they are spent on development program. Annual amount of the Government Grant is informed to DCC in July, payable in 4 installments—September, December March and June.

(ii) Government/Foreign-Aided Project Funds

DCC also receives substantial financial support from the Government and foreign agencies and donors to implement specific projects approved by the Government.

(3) Balance Sheet

The balance sheet (B/S) is only available for the year up to 2000, and those for last three years are still being processed. Receivable account of holding tax soared to Tk 1.47 billion in 2003. Total assets increased Tk. 5.2 billion during 4 years over the period of 1996/2000, mostly caused by increase of building/structures (Tk. 4.0 billion). Actual financial balance of the past four years is estimated below. The financial balance was red every year and the amount is growing.

Table 2.12 Financial Balance of SWM (Taka in million)

Items	99-00	00-01	01-02	02-03	Ratio in own DCC Account
1. Overall SWM Revenue	126	141	150	176	6%
2. Overall SWM Expenditure	367	383	402	476	18%
3. Balance	-241	-242	-252	-300	-

Note: 1) Estimated by the Study Team based on various information and data of DCC.
2) Recurrent DCC own expenditures were used for estimates. Depreciation was not considered.
3) There were no capital expenditures during the period.

(4) Department-wise and Operation-wise SWM Cost

Conservancy Department is the largest portion (64 %) of department-wise SWM cost, and "cleaning of roads & drains" is the largest (57 %) in operation-wise SWM cost. Approximately 90 % of the cost for "cleaning of roads & drains" is spent for staff salaries & allowances.

Table 2.13 Department-wise and Operation-wise Actual SWM Cost (Taka in million)

Items	99-00	00-01	01-02	02-03	Ratio
1. Department-wise Actual SWM Cost					
1) Conservancy Department	212	243	279	305	64%
2) Transport Department	66	73	84	106	22%
3) Engineering Department	89	67	39	65	14%
Total	367	383	402	476	100%
2. Operation-wise Actual SWM Cost					
1) Cleaning of roads & drains	201	227	249	273	57%
2) Collection & transport	87	98	116	139	29%
3) Final disposal	5	5	6	7	1.4%
4) Repair works	74	53	31	57	12%
Total	367	383	402	476	100%

Source: Estimated by the Study Team based on various information and data of DCC

2.12 Privatization

(1) Initiation of the Privatization Project

SWM privatization project for 8 wards of Dhaka City is going on since May 15, 2003 as "Ward-Wise Waste Management Project of DCC (Private Initiative)". Through competitive bid, four organizations were selected and awarded the contract.

(2) TOR for Contractor

The Objectives of the contract stated in the TOR is to provide superior quality of service to the residents in the following working area.

- All roads, market, park, footpaths, etc
- All open and closed drains
- The surrounding area of dustbin and container
- Dumping the waste at landfill site (Matuail)
- Road signs and traffic signs

The four organizations awarded shall be graded from rank A to rank D by DCC. If graded rank A, the organization will be given the right to continue the project in the following year. On the other hand, if ranked D, no right will be given for the next year.

(3) Progress of Project in the First Term

The contractors employed generally slum dwellers especially as cleaners. Total number of field staff they employed was smaller than the number before privatization. At the beginning, conservancy inspectors of Zone 9 and Zone 10 gave practical training to the new employees of the contractors.

Containers were removed due to unavailability of container carriers with the contractors. The contractors also reduced the number of locations of dustbins/containers in response to the demand of residents after consultation with DCC and local communities. In fact, the number of locations in the area of 3 contractors interviewed was cut from 111 before privatization to 73 at present.

Table 2.14 Summary of Program Management by the Awarded Organizations

Zone	9							10
Ward	18	19	20	21	38	17	37	1
Organization Name	BIEDF					Messer's Rhythm	LN Corporation	MIRUD
Legal Status	NGO					Private Company	Proprietorship	NGO
Contract Amount	37,000,000 in Total							
No. of field staffs	46	154	55	51	52	55	46	130
-Manager	1	1	1	1	1	1	1	1
-Supervisor	2	2	2	2	1	6	2	6
-Cleaner	26	110	30	30	37	36	25	65
-Drain cleaner	7	16	12	8	3	6	10	24
-Truck loaders	10	25	10	10	10	6	8	27
-Others	-	-	-	-	-	-	(7-10)	7
Trucks (Rental)	14 (22 in rainy season)					2	2	3
No. of dustbins	3	10	4	2	5	4	8	41
Dump site	Uttara B. Band	Uttara Matuail	Matuail B. Band	Uttara B. Band	Uttara B. Band	Tongi	B. Band	Uttara (Ashulia)
Trips a day/truck	2					2	2	3
Financial results	Probably around the break-even point					In loss	Break-even	Not clear
References								
-Population (.000)	36	72	81	73	82	85	117	66
- Area (km^2)	8.85	4.62	1.60	2.07	1.13	6.77	2.99	3.92

Source: JICA Study Team, Interviews with Contractors
Note: 1) Population – preliminary data of 2001 from Bangladesh Bureau of Statistics
2) Area – Information from Urban Planning Department of DCC

(4) Opinions on the Privatization Project

At the beginning stage, the contractors often received a variety of demands and complaints from community, either directly or through DCC. Nowadays this kind of problem has been minimized due to the action taken against the demands and complaints. The contractors think the followings are the obstacles for better performance:

- contract period is too short to make capital investment
- income tax and value added tax that is in total 7.5% of the contract amount are withheld monthly from bill.

(5) Prospect of the Project over the Next Term

As a result of grading for the first year, 3 contractors were given another contract for the second year with the same amount as the first year. However, the contractor of Ward 37 failed in renewal of the contract, so that the competitive bid was made with the revised contract term of 3 years.

CHAPTER 3 FRAMEWORK OF MASTER PLAN

3.1 Numerical Frame of Master Plan

(1) Population Growth

Figure 3.1 shows the forecasts of population together with the past record. In 2015, the target year of the Master Plan, the total population will increase to 7.7 million, and the area of DCC is assumed fixed at 131 km^2.

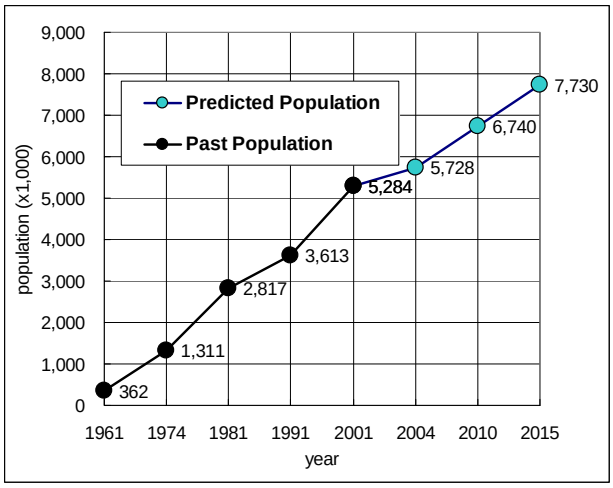


Figure 3.1 Population Prediction for 90 Wards in DCC (2002-2015)

(2) Solid Waste Generation Amount

Quantity of solid waste generated in the DCC administration area was estimated based on the waste generation rate and other economic conditions as shown in Table 3.1. The total solid waste generation was forecast at 3,909 t/d and 4,624 t/d for the years 2010 and 2015, respectively (See Figure 3.2).

Table 3.1 Assumptions for Forecasting Solid Waste Generation Amount in Future

Per Capita GDP	US$ 240:1995 *1	US$ 389:2002 *2	Increase Rate: 6.90% per year
Per Capita Municipal Solid Waste Generation Rate (kg/c/day)	0.49 : 1995	0.56 : 2004	Increase Rate : 0.71% per year
Increase Ratio of per Capita Waste Generation Rate to GDP (Elasticity Coefficient) in 1995-2004			10.3% per 1% GDP
Assumption of GDP during 2004-2015			6% per year
Assumed Elasticity Coefficient during 2004-2015			0.62% to 6% GDP
Estimated per Capita Domestic Waste Generation Rate in Future (kg/c/day)	0.340 : 2004	0.352 : 2010	0.364 : 2015
Assumption of Ratio (Domestic Waste : Business Wastes)			65% : 35%

* 1: "What a Waste", Solid Waste Management in Asia, Urban development Sector Unit, East Asia and Pacific Region, October 1998

*2: Country Report, Website of Ministry of Foreign Affairs of Japan

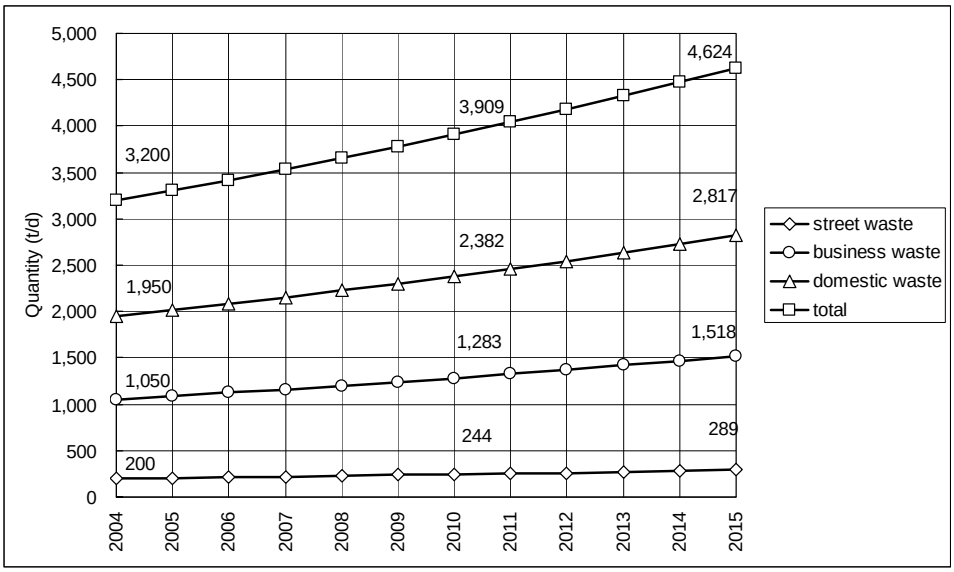


Figure 3.2 Forecast of Solid Waste Generation Amount

(3) Estimate of Waste Reduction and Recycling

The target level is determined in terms of the ratio of waste generation amount as shown below.

Table 3.2 Proposed Target Level of Waste Reduction and Recycling

Item Year	2004	2010	2015
Waste Generation	3,200 t/d	3.909 t/d	4,624 t/d
Waste Reduction at Source*	-	98 t/d	231 t/d
	-	2.5 %	5.0 %
Material Recovery at Source and Collection	420 t/d	531 t/d	650 t/d
Process**	13.1 %	13.5 %	14.0 %
Recovery of Resources at Disposal Sites	15 t/d	18 t/d	22 t/d
	0.5 %	0.5 %	0.5 %

Note: * effects expected by changing consumable goods into less waste and changing lifestyle into generating less waste

** effects expected by promoting recycling at source or discharging manner favorable to recycle business

3.2 Scenario for Improvement

(1) Alternative Scenarios

Three scenarios for the improvement are set based on different collection service levels as follows:

Scenario 1: with the same amount as 2004

Scenario 2: at the same collection rate as 2004

Scenario 3: at an expanded collection rate (with best effort)

[Scenario 1]: amount of collection at 1,400 t/d

The waste collection amount and disposal volume, which are at present 1,400 t/d and 1,385 t/d respectively, remain the same throughout the planning period from 2004 to 2015.

[Scenario 2]: collection rate at 44%

Waste collection rate will be kept at 44 % of waste generation, which is the rate of 2004. However, waste generation in 2015 will be 1.44 times as much as 2004, so that collection volume will be 2,023 t/d in 2015.

[Scenario 3-A]: collection rate at 61 % or 2,823 t/d in 2015

Collection rate will increases to 61 % of waste generation in 2015 on condition the waste reduction at sources is achieved at 5 %, collection volume also increases to 2,823 t/d.

[Scenario 3-B]: collection rate at 66 % or 3,054 t/d in 2015

Collection rate will increase to 66 % of waste generation in 2015 on condition the waste reduction at sources is not achieved, collection volume also increases to 3,054 t/d.

(2) Adopted Scenario

Since Scenario 3 can provide a lower volume of unidentified disposal waste than the others, it should be adopted in the Master Plan. Based on the Scenario-3, the target level of waste disposal is summarized in Table 3.3. With this scenario, the performance of waste disposal system is illustrated in Figure 3.3. Figure 3.4 shows the schematic waste stream for the milestone years of the master plan.

Table 3.3 Targets of Waste Disposal

	Present 2004 (t/d)	Target for 2015 (t/d)	Year 2015/2004
Collection/ transport	1,400	3,054*	218%(almost twice)
Final disposal	1.385	3,032*	219%(almost twice)
Recycling	435	672	154%
Unidentified disposal	1,380	920	one-third reduction

Note: * indicates the assumption without counting effect of source reduction by waste generator

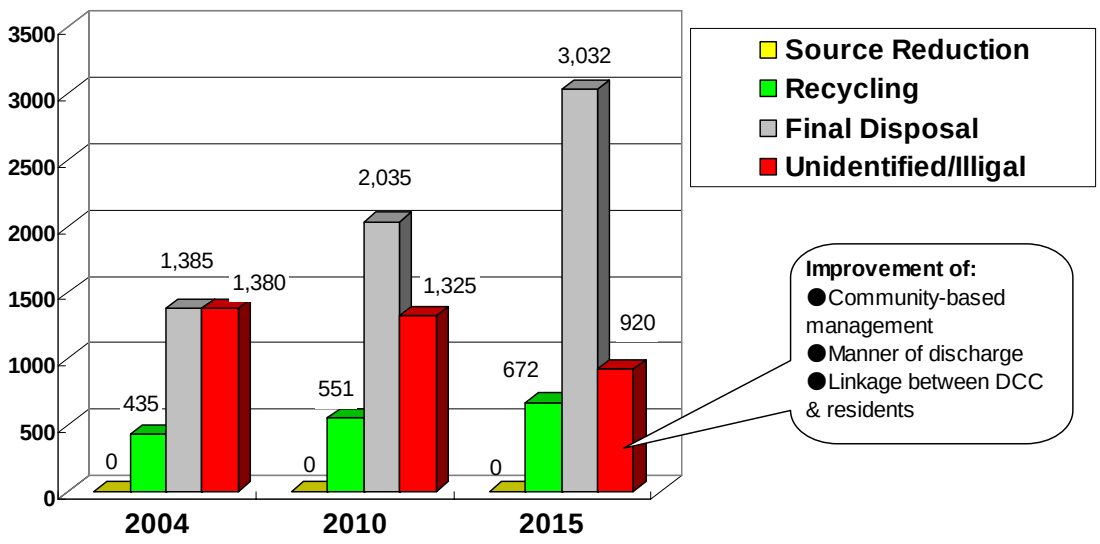


Figure 3.3 Targets of Waste Disposal System (maximum case of disposal volume)

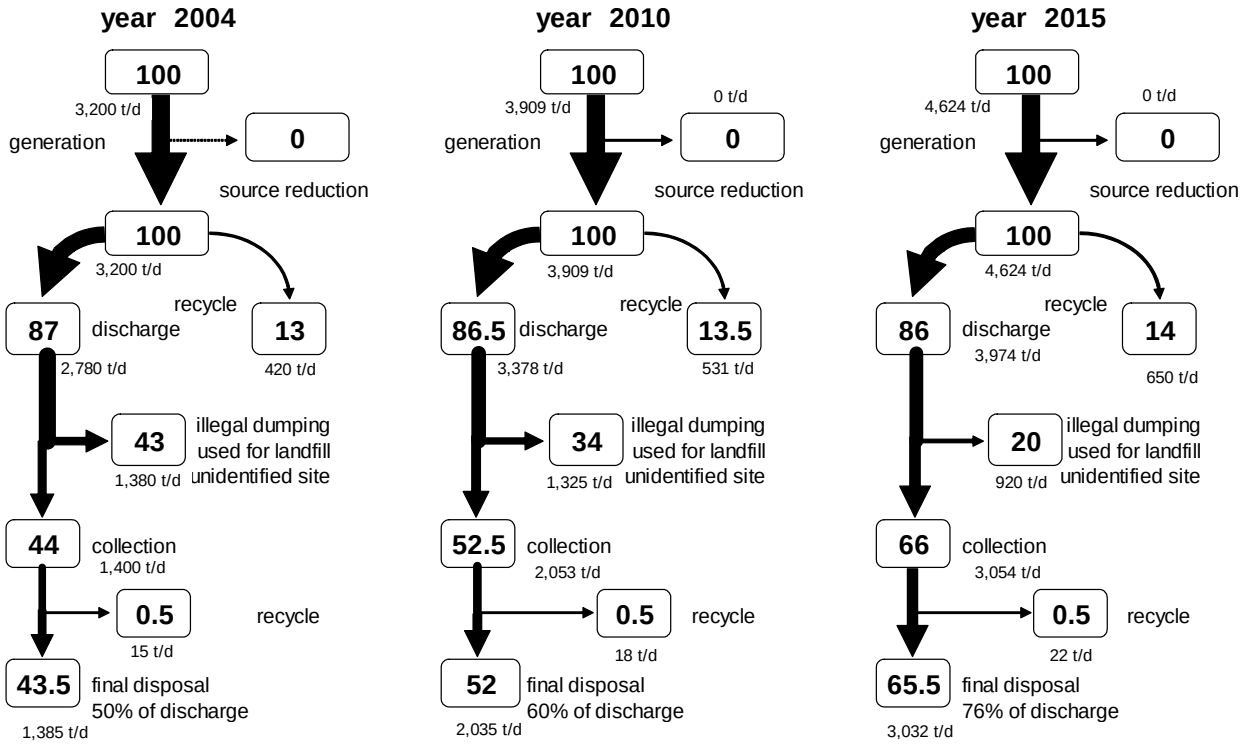


Figure 3.4 Transition of Waste Stream by Target Year (without source reduction)

(4) Reduction of Unidentified/Illegal Dumping

Unidentified or illegal dumping is still common phenomenon driven by many people in Dhaka City regardless they are conscious or not that they are doing an illegal thing. Because of the huge number of potential actors in this kind of activity, wide spread control measures

are needed to solve the situation. Table 3.4 gives a guide to what sort of actions are assumed in the master plan to reduce unidentified or illegal dumping.

Table 3.4 Control Measure over Unidentified/Illegal Dumping

Concerning Party	Control Measure	Assumed Action
• residents • business entities	• awareness promotion • expansion of service area of primary collection • increase of licensed service provider for primary collection	• ward level SWM • school education • IEC program
• primary collectors	• proper distribution of DCC containers • expansion of DCC capacity for secondary collection	• increase number of truck, driver and container • setting up operation and management plan of waste collection
• road/drain cleaners	• removal of voluntary waste collection points	• standardization of collection and transport work
• DCC drivers	• reduction of waste dumping on request of landowners • reduction of voluntary waste dumping	• capacity development of DCC workers

(5) Target Amount of Final Disposal

The disposal amount is estimated based on Scenario 3 with the following assumptions:

- The present disposal amount: 1,385 t/d (43.5 % of generated waste).
- Disposal amount by DCC will increase to 2,035 t/d (52% of generated waste) in 2010 and 3,032 t/d (65.5% of generated waste) in 2015 without waste reduction by generators at source.
- DCC shall stop the operation at Berri Band by the end of 2006.
- The distribution ratio of waste disposals is assumed as follows:

  - Matuail: Berri = 70%: 30% until the end of 2006

  - Matuail (new): Amin Bazar = 70%: 30% from the beginning of 2007
- 30% of the waste generated in the surrounding areas will be received in 2015, amounting 110 t/d from the surrounding area of Matuail and 30 t/d from the surrounding area of Amin Bazar.

The accumulated disposal amount up to 2015 will reach 9.3 million tons, of which 6.5 million tons will be disposed of at the Matuail landfill site and 2.3 million tons at the Amin Bazar landfill site. The balance of 0.5 million tons will be accepted at Berri Band until 2006, as shown in Tables 3.5 and 3.6.

Table 3.5 Projection of Daily Disposal Amount

(t/d)

Disposal Sites	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Disposal Amount from												
DCC	1,385	1,477	1,575	1,679	1,790	1,909	2,035	2,204	2,387	2,585	2,800	3,032
Matuail neighboring area				22	30	40	53	61	70	81	93	107
A. Bazar neighboring area				8	10	13	17	19	21	23	25	28
Total	1,385	1,477	1,575	1,709	1,830	1,962	2,105	2,284	2,478	2,689	2,918	3,167
Disposal Sites												
Matuail	970	1,034	1,102	1,196	1,281	1,373	1,474	1,599	1,735	1,882	2,042	2,217
Berri Band	416	443	472	0	0	0	0	0	0	0	0	0
Amin Bazar	0	0	0	513	549	588	632	685	743	807	875	950
Total	1,385	1,477	1,575	1,709	1,830	1,962	2,105	2,284	2,478	2,689	2,918	3,167

Table 3.6 Projection of Annual Disposal Amount

(1,000 ton)

Disposal Sites	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Matuail												
Annual amount	354	377	402	437	468	501	538	584	633	687	745	809
Accumulation	354	731	1,133	1,570	2,038	2,539	3,077	3,660	4,293	4,980	5,726	6,535
Berri Band												
Annual amount	152	162	172									
Accumulation	152	313	486	486	486	486	486	486	486	486	486	486
Amin Bazar												
Annual amount	0	0	0	187	200	215	230	250	271	294	319	347
Accumulation	0	0	0	187	388	602	833	1,083	1,354	1,649	1,968	2,315
Total												
Annual amount	506	539	575	624	668	716	768	834	904	981	1,065	1,156
Accumulation	506	1,045	1,619	2,243	2,911	3,627	4,395	5,229	6,133	7,115	8,180	9,336

CHAPTER 4 OBJECTIVES AND STRATEGIES

The objectives and strategies for major technical, institutional and social components of the master plan are presented in Table 4.1 based on the numerical targets for solid waste management and the issues.

Table 4.1 Objectives and Strategies (1/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Generation/ Primary Collection	• Lack of coordination and collaboration among DCC, primary collection service providers and community people at the local level • Improper DCC's approval system of primary collection • Low capacity of primary collection service providers • Poor development of primary collection method • Uneven distribution and quality of primary collection services	1. To encourage community people to participate in primary collection for ensuring effective, socially acceptable and sustainable primary collection at the local level 2. To expand service coverage of primary collection especially at congested areas with narrow roads and slum areas 3. To improve quality and efficiency of primary collection to contribute more to the cleanliness of living environment	1. To promote partnership among DCC, primary collection service providers and community people at the Ward level through Ward Solid Waste Management System 2. To supervise and monitor primary collection activities by DCC 3. To encourage primary collection service providers 4. To develop suitable and efficient methods of primary collection 5. To promote equitable primary collection services in Dhaka City	a) WMD b) CD, SDD

WMD (Waste Management Division/Department in future); CD (Conservancy Department); SDD (Slum Development Department); Each of them belongs to DCC.

Table 4.1 Objectives and Strategies (2/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Secondary Collection/ Transport & Road/Drain Cleaning	• Improper structure, inappropriate location, and shortage of bins/containers • Inefficient use of collection vehicle • lengthy procedure for repair works • Shortage of drivers • Watered records on collection/ transport • Poor management and monitoring system • Lack of sanitary care in cleaning works • Uneven geographical distribution of cleaners • Poor development of work standard • Lack of training for cleaners and inspectors • Lack of communication between DCC, primary collection service providers and community people	1. To expand the capacity of collection/transport 2. To develop the capacity of road/drain cleaning 3. To improve work environment and health condition in collection/transport and cleaning 4. To develop capacity of cleaning workers	<u>Expansion of Capacity of Collection/Transport</u> 1. To expand collection/transport capacity by existing vehicles 2. To replace aged vehicles and procure new vehicles 3. To expand storage capacity of waste containers 4. To expand collection and transport capacity through service providers 5. To identify an alternative way of vehicle repair 6. To standardize collection/transport work <u>Development of Capacity of Road/Drain Cleaning</u> 1. To make effective use of cleaning workers by reviewing existing work method and area-wise deployment 2. To standardize road/drain cleaning work 3. To coordinate with recycle industry <u>Improvement of Work Environment</u> 1. To clear scattered waste around dustbins and waste containers 2. To protect cleaning workers from health risks <u>Capacity Development of Cleaning Workers</u> 1. To give street cleaners wider tasks for cleaning 2. To raise awareness of DCC and cleaning work staff for sanitation and environment	a) WMD, ED b) CD, TD, UPD

WMD (Waste Management Division/Department in future); CD (Conservancy Department); ED (Engineering Department); TD (Transport Department); UPD (Urban Planning Department) ; Each of them belongs to DCC.

Table 4.1 Objectives and Strategies (3/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Final Disposal	• Lack of responsible organization to manage and control landfill sites • Illegal dumping at Berri Band and Uttara • Lack of ECC of Matuail landfill site • Improper operation of landfill • Insufficient heavy equipment • Inefficient maintenance system • Low ratio of disposal at landfill sites out of of generated waste • Poor allocation of budget and manpower to final disposal • Lack of coordination in planning of existing/future landfill sites	1. To establish future landfill site 2. To improve operation and landfill site at Matuail 3. To challenge for managed final disposal	<u>Establishment of Future Land fill Site</u> 1. To cooperate with “Infrastructure and Environmental Improvement Project”. 2. To acquire land by facilitating the necessary legal procedures 3. To obtain Environmental Clearance Certificate (ECC) 4. To make efforts in timely land acquisition, ECC and construction to meet the schedule for starting operation of Matuail extension and new Amin Bazar site in 2007 5. To identify a few candidate locations for construction of new landfill sites, other than Matuail extension and Amin Bazar, on a longer term perspectives after 2015. <u>Improvement of Existing Landfill Site at Matuail</u> 1. To introduce covering soil 2. To compact waste layer and to shape the surface in gentle slope 3. To continue preparing dumping platform and working road 4. To prepare drainage 5. To introduce leachate collection and gas removal <u>Challenge for Managed Final Disposal</u> 1. To establish a task force to improveoperation in Matual landfill site 2. To extend the task force to manage and control all landfill sites	a) WMD b) CD, ED, TD

WMD (Waste Management Division/Department in future); CD (Conservancy Department); ED (Engineering Department); TD (Transport Department) ; Each of them belongs to DCC.

Table 4.1 Objectives and Strategies (4/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Public Involvement	• Lack of "community" sense • Weak interest of community people in participation in SWM • Weak environmental education • Lack of IEC activities of DCC for raising public awareness	1. To establish socially acceptable and sustainable community initiative in SWM 2. To raise awareness of stakeholders	<u>Establishment of Community Initiative in SWM</u> 1. To establish partnership among people, community, ward commissioners and DCC 2. To establish a SWM system at ward level <u>Raising Awareness of Stakeholders</u> 1. To develop suitable methods considering local situations 2. To educate young generation in order to change their behavior at childhood 3. To raise awareness of decision makers of DCC and staff members	a) WMD b) CD, MOPME
Legal Aspect	• Unclear boundary of responsibility between DCC and waste generators • Weak enforcement of laws and rules (i.e. Environmental Conservation Act and Rules, Prevention Act, and punishment against the offenses of DCC Ordinance.)	1. To allocate responsibility clearly and equitably between DCC and waste generators 2. To comply with existing laws/rules	<u>Clear and Equitable Responsibility Allocation between DCC and Waste Generators</u> 1. To define responsibility of DCC and primary collection service providers/residents by clarifying the conditions of container installation 2. To start discussion to define responsibly of business waste management <u>Compliance to the Existing Laws/Rules</u> 1. To provide training on legal matters to DCC staff 2. To prepare and implement Environmental Management Plan (EMP) 3. To prepare and enforce the procedure for punishment of offenses against the Ordinance	a) WMC, WMD, CD b) ED, TD, UPD, LGD, MOEF, Magistrates

WMC (Waste Management Committee); WMD (Waste Management Division/Department in future); CD (Conservancy Department); ED (Engineering Department); TD (Transport Department); UPD (Urban Planning Department); AD (Accounts Department); MOPME (Ministry of Primary and Mass Education); LGD (Local Government Division in the Ministry of Local Government, Rural Development and Co-operatives, MOEF (Ministry of Environment and Forests) ; Each of them belongs to DCC.

Table 4.1 Objectives and Strategies (5/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Organization	• Nobody is assigned to planning, coordination, monitoring and evaluation of SWM • Nobody is assigned to community-based SWM. • Nobody is assigned to manage final disposal. • Poor capability of vehicle repair	1 To strengthen planning/ coordinating/ monitoring/ evaluation capability 2. To restructure organizations for SWM 3. To strengthen capability for community-based SWM and promotion of public awareness	<u>Strengthening Planning/Coordinating/Monitoring/ Evaluation Capability</u> 1. To consolidate the function of planning/coordinating, monitoring/evaluation and to introduce a certain form and procedure for cooperation 2. To establish Waste Management Department <u>Improvement in Operational Organizations</u> 1. To enhance the function of Zone Offices for secondary collection and transport 2. To establish a task force for disposal 3. To study on procedure for repair of the conservancy vehicles and the heavy equipment <u>Strengthening Capability for Community Solid Waste Management and Public Awareness</u> 1. To establish Community SWM Section in WMD 2. To enhance the function of Zone Offices for community SWM and public awareness enhancement	a) WMC, WMD b) CD, TD, ED, UPD, AD, ESD

WMC (Waste Management Committee); WMD (Waste Management Division/Department in future) ; CD (Conservancy Department); ED (Engineering Department); TD (Transport Department); UPD (Urban Planning Department); AD (Accounts Department); ESD (Establishment Department) ; Each of them belongs to DCC.

Table 4.1 Objectives and Strategies (6/6)

Planning Components	Identified Issues	Objectives	Strategy	a) Responsible/ b) Concerning Body
Financing	• Inadequate budget preparation and cost management • Lack of operation-wise budget control and unclear actual SWM cost • Shortage of SWM finance caused by inconsistent tax collection system	1. To reform SWM accounting for budgeting/cost control 2. To enhance financial capacity for master plan implementation	<u>Reform of SWM Accounting for Budgeting/Cost Control</u> 1. To introduce a modified accounting system for actual SWM cost 2. To prepare annual report <u>Enhancement of Financial Capacity for Master Plan Implementation</u> 1. To increase revenue by reassessment of estate, raising conservancy rate of holding tax and improving tax collection rate 2. To prepare a financial plan enough to cover the cost for implementation of Master Plan	a) WMC, WMD b) AD
Privatization	• Still on the way of a pilot project for privatization	1. To continue an in-depth evaluation of the privatization projects	<u>To continue an in-depth evaluation by examining terms and conditions of the privatization projects</u> 1. To pursue possible work for outsourcing in addition to the pilot project in operation 2. To review the terms of contract for better work 3. To study appropriate system for evaluation	a) WMD b) CD, TD, UPD

WMC (Waste Management Committee); WMD (Waste Management Division/Department in future) ; CD (Conservancy Department); ED (Engineering Department); TD (Transport Department); UPD (Urban Planning Department); AD (Accounts Department) ; Each of them belongs to DCC.

CHAPTER 5 MASTER PLAN FOR SOLID WASTE MANAGEMENT IN DHAKA CITY

5.1 Primary Collection and Public Involvement

(1) Establishment of Ward Solid Waste Management System

a) Formation of Local Organization at War Level

From legal point of view, primary collection belongs to the responsibility of residents or business entities. It is essential to formulate the orderly manner of waste discharge for every individual resident and business entity in this connection. This is self-evident but, in general, people do not know their responsibility and do not want to take any responsibility. The plan proposes to form a special organization and encourage residents through the movement envisaged by the organization to change their behavior of waste discharge to well-managed primary collection. The stakeholders of primary collection are expected to form a partnership with the others as shown in Figure 5.1. The proposed conceptual structure of a ward solid waste management system is shown as Figure 5.2.

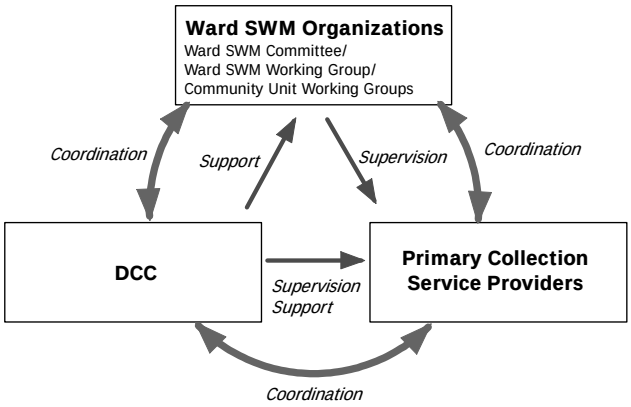


Figure 5.1 Partnership of Stakeholders in Primary Collection

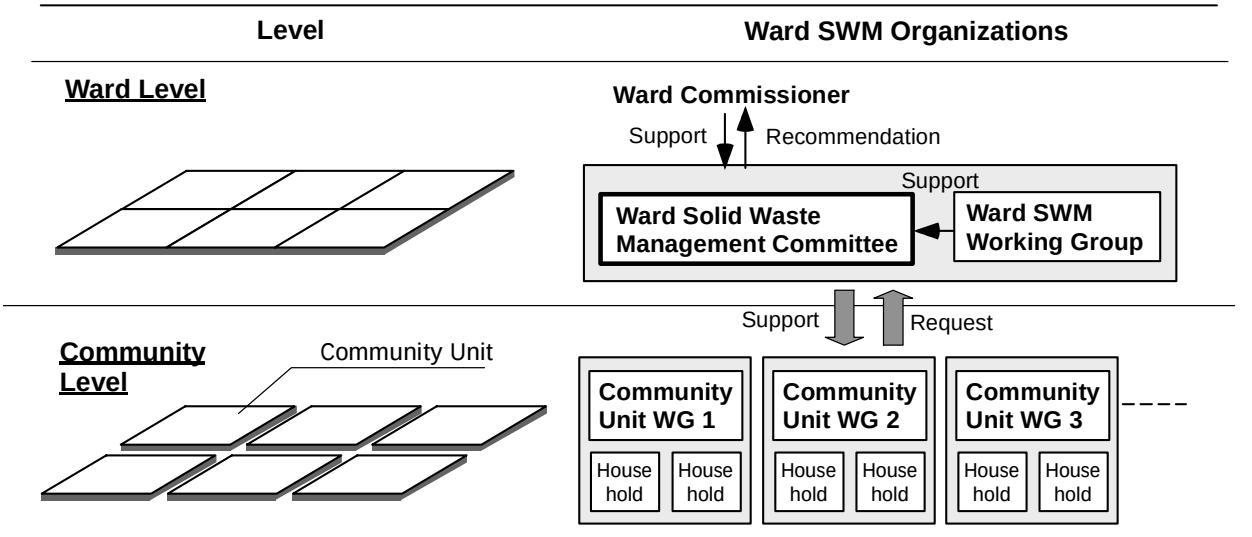


Figure 5.2 Structure of Ward Solid Waste Management Organizations

The structure of ward solid waste management was verified through the pilot project in Ward 6 and 65.

b) Ward Solid Waste Management Planning

A bottom-up approach will be taken in planning process; planning workshops will be held by the Committee to be supported by the Working Group. Ward Solid Waste Management Plan will be formulated based on result of workshops.

c) Development of Primary Collection through Community Based Approach

A suitable method of primary collection based on the town structure should be developed at the community level. DCC Conservancy Department should coordinate by responding to the plan in distribution of DCC containers and adjustment of waste collection time and frequency. The conceptual primary collection System is presented in Figure 5.3.

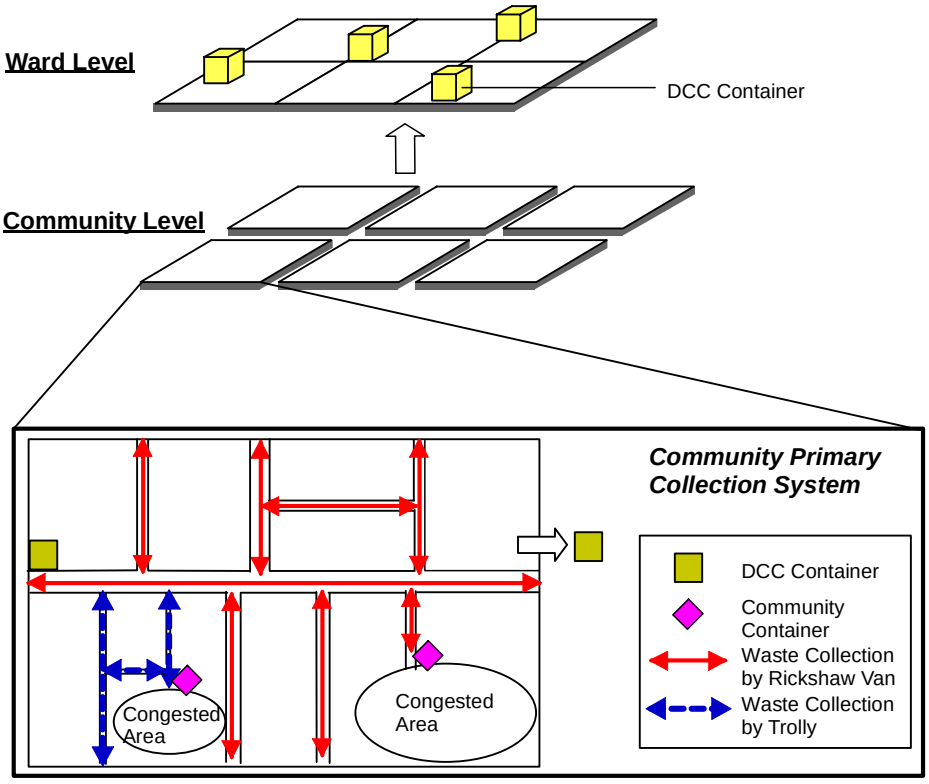


Figure 5.3 Community Level Primary Collection System

(2) Strengthening the Function of DCC in Primary Collection and Community Involvement

a) Short Term Action

A special section (Community Solid Waste Management Section) with full-time staff should be set up in the Waste Management Division in order to develop and expand the Ward Solid Waste Management System and support primary collection activities as shown in Figure 5.4. Proposed roles of Ward Solid Waste Management Committee and Working Group are summarized in Table 5.2.

Table 5.2 Proposed Roles of Ward Solid Waste Management Organizations

Related Groups	Proposed Members	Roles
Ward Solid Waste Management Committee		
	• Ward key persons • Representative of people's organization • Representative of private sector	➔ Coordinate ward administration ➔ Decide Ward Solid Waste Management Policy ➔ Establish ward Solid Waste Management plan
Ward Solid Waste Management Working Group		
	• Residents' representatives at ward level • Volunteers	➔ Support Ward SWM Committee technically ➔ Prepare Ward Solid Waste Management Plan ➔ Support Community Unit Working Group ➔ Encourage residents for SWM at ward level ➔ Arrange and implement SWM activities with residents
Community Unit Working Group		
	• Residents' representatives at community unit • Volunteers	➔ Prepare Community Unit Solid Waste Action Plan based on Ward Solid Waste Management Plan ➔ Implement and monitor Community Unit Solid Waste Action Plan

Source: JICA Study Team

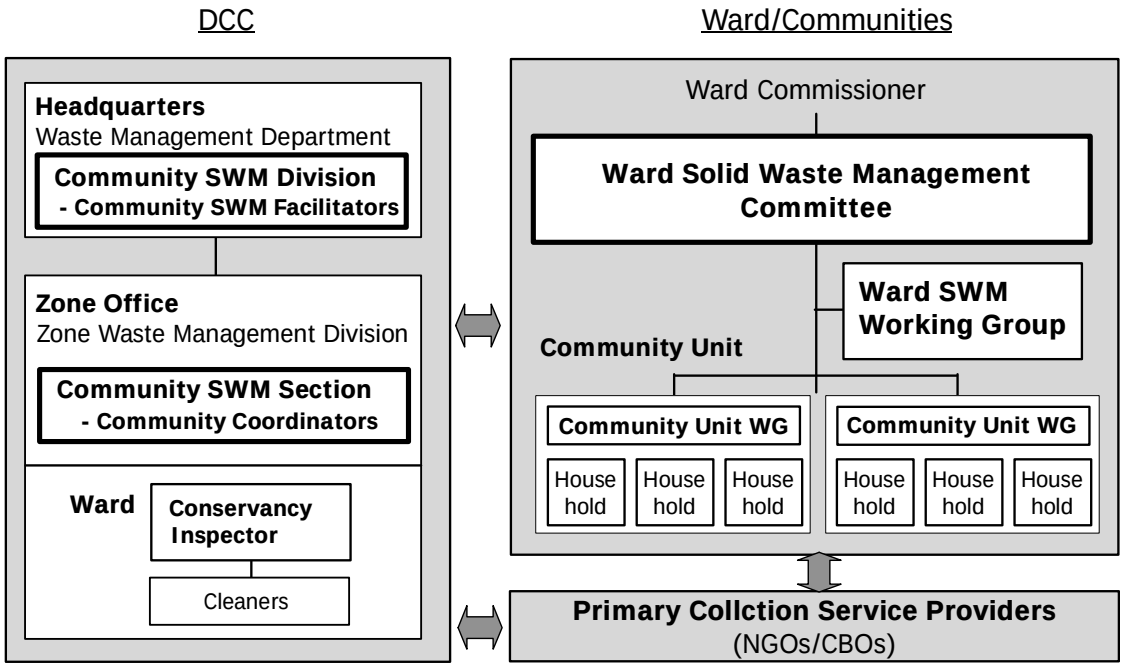


Figure 5.4 Structure of Ward Solid Waste Management System and Linkage with DCC

b) Medium Term Action

Functions of DCC in primary collection and community involvement should be further strengthened according to the phased organisational reform as shown in Figure 5.5.

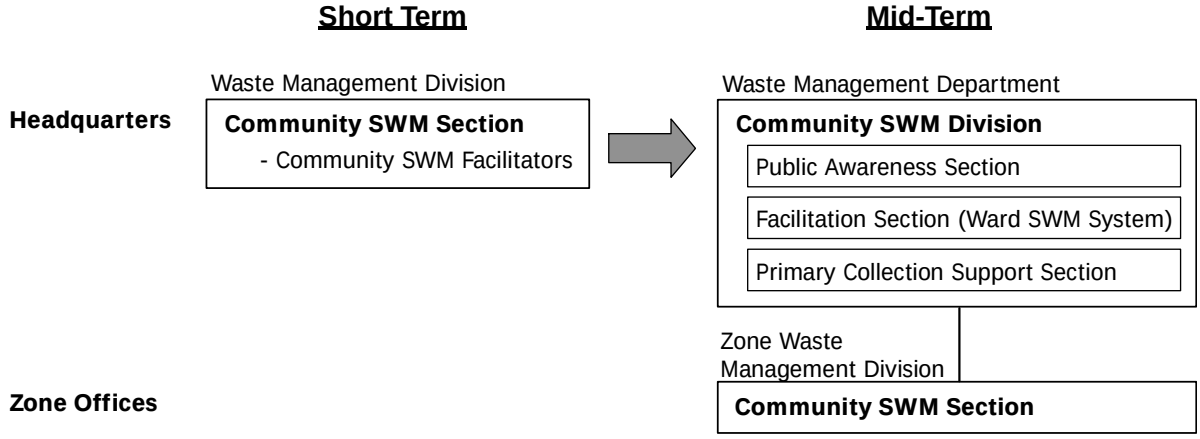


Figure 5.5 Proposed Evolution of Competent Section in Community Involvement

(3) Support of Primary Collection Service Providers

Most primary collection service providers are facing difficulties to invest for further expansion of the activities because of the lack of funds. On the other hand it is difficult for DCC to provide collection equipment/facility free of charge since the primary collection is a private activity. The two-step loan through DCC and/or establishment of loan scheme by Bangladeshi NGOs for investment in primary collection might be worth examination for possible solution. .

(4) Technical Development of Primary Collection

DCC should make continuous efforts to develop the primary collection methods in order to improve the efficiency and cleanliness. Pilot projects are proposed to test some alternative equipment/facilities for primary waste collection.

The highest priority is harmonization of design of rickshaw vans and DCC containers. At present, transfer of waste from rickshaw vans to containers takes too long and the waste is scattered around containers. Alternative design of rickshaw vans and containers is expected in cooperation with users including primary collection service providers and DCC. Another priority is to develop primary collection system in congested areas with narrow roads where even trolleys cannot enter.

(5) Raising Public Awareness

a) Establishment of a Section in Charge of IEC (Information Education and Communication) Activities

Community Solid Waste Management Section should be established under WMD immediately. The Community Solid Waste Management Section should implement IEC activities for promotion of people's understanding, awareness and behavior.

b) "Clean Dhaka Ward Contest"

"Clean Dhaka Ward Contest" will present an award to the best ward(s)—a ward that would have made brilliant success in cleaning and beautifying its hometown.

(6) Education of Young Generation

It is expected that young generation can raise awareness and adapt to modest behavior more firmly than adults. Therefore, education for young generation should be started immediately although it takes time to change the entire society. As the first step, education of schoolteachers is indispensable because most of schoolteachers are not familiar with solid waste management and have never visited s**o**lid waste management facilities. DCC can give them lessons on solid waste management and opportunity to visit the relevant facilities.

(7) Raising Awareness of Decision Makers and DCC Staff Members

a) Decision Makers

In Dhaka, decision makers such as mayor, DCC high ranking officers and ward commissioners have important roles in solid waste management. It is indispensable that decision makers are familiar with the issues of solid waste management as the priority policy. Waste Management Division should coordinate and implement the following events in order to keep them more closely to SWM:

- Sharing actual information
- Bangladesh Solid Waste Management Conference

b) Enlightenment of DCC Staff Members

DCC should undertake the following with suitable material:

- make people understand a cleaner's job
- boost cleaner confidence and pride in their work by letting them know that they are doing a precious job and are contributing to clean Dhaka

5.2 Secondary Collection & Road/Drain Cleaning

(1) Procurement of New Vehicles and Waste Containers

a) Recommendable Type of Vehicle

From viewpoints of efficiency and cost-performance, the following principle is recommended for the future composition of collection and transport trucks.

- CC 5 ton to keep the present quantity
- OT 5 ton not to renew
- OT 3 ton not to renew
- OT 1.5 ton to keep the present quantity
- TT 20 ton to keep the present quantity

- CC 3 ton to increase as many as necessary to meet the demand in any year in the planning period

b) Consideration of Aging of Trucks and Containers

Trucks are costly goods but have limited lifetime. In planning future line-up of collection and transport trucks, the following residual ratio should be adopted for estimation of service life of every type of trucks.

Table 5.3 Adopted Residual Ratio of Trucks by Age

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Rate (%)	100	100	100	100	100	94	86	79	71	64	56	48	41	33	26	0

Containers also undergo deterioration by age. The following residual ratio should be adopted. With this residual ratio, it is assumed that all the existing containers will be retired by year 2008.

Table 5.4 Residual Ratio of Waste Container by Age

Purchased by 2006	Residual Ratio	Purchased from 2007 on*	Residual Ratio
Initial 3 years	100 %	Initial 4 years	100 %
4th year	66.7 %	5th year	66.7 %
5th year	33.3 %	6th year	33.3 %
6th year and thereafter	0 %	7th year and thereafter	0 %

*Note: Car washing equipment will be installed in 2007 at dump sites so that the service life is expected longer than present by washing container every time unloaded

c) Assumption of Truck Operation

Trucks are assumed to operate with the following frequency of dumping and loading rate.

Table 5.5 Assumption of Truck Operation

Type of truck	frequency of dumping	loading rate
CC 5 ton	4 trips/d	80 %
CC 3 ton	4 trips/d	80 %
OT 5 ton	2 trips/d	80 %
OT 3 ton	2 trips/d	80 %
OT 1.5 ton	2 trips/d	100 %
TT 20 ton	1 trips/d	100 %

d) Procurement Plan of Trucks and Waste Containers

The required number of trucks and containers to be procured is estimated at 411 units and 2,161 pieces respectively during the planning period. The numbers to be procured is summarized in Table 5.6 by year and type.

Table 5.6 Procurement Plan of Trucks and Containers

year	OT 1.5 ton	CC 5ton	CC 3 ton	TT 20 ton	12 m3 container	6 m3 container
'05	0	0	0	0	80	166
'06	0	0	0	0	32	0
'07	30	10	17	0	36	203
'08	0	0	0	0	15	0
'09	20	10	54	0	70	255
'10	0	0	0	0	0	30
'11	20	10	88	3	60	216
'12	0	0	0	0	0	63
'13	25	10	117	0	50	613
'14	0	0	0	0	50	75
'15	0	0	0	0	0	147
total	95	40	276	3	393	1,768

Source: estimated by the JICA Study Team

e) Staffing Plan and Assumed Operation Manner

The required number of drivers and cleaners is estimated under the following conditions by type of trucks.

- CC 5 ton (1 crew consists of 1 driver + 2 cleaners) 2-shift a day
- CC 3 ton (1 crew consists of 1 driver + 2 cleaners) 2-shift a day
- OT 5 ton 1 crew consists of 1 driver + 5 cleaners (truck and special cleaners)
- OT 3 ton 1 crew consists of 1 driver + 4 cleaners (truck and special cleaners)
- OT 1.5 ton 1 crew consists of 1 driver + 3 cleaners (truck and special cleaners)
- TT 20 ton 1 driver for trailer

Two-shift aims at ensuring 4 trips a day to dump site because present achievement of container carrier is 3 trips at most and it needs a special measure to increase the frequency by one more trip. The number of truck cleaners is set minimum 2 persons in a crew and becomes larger number as the size of truck becomes bigger in order to save time for loading waste. The planned staff for each year is summarized in Table 5.7. Drivers need to be increased about 3 times as much as present while truck cleaners need milder increase.

Table 5.7 Summary of Planned Staffing for Collection and Transport

year	driver	cleaner: truck, special & container	Dispatcher (8 zones)
'04	266	964	16
'05	365	964	16
'06	365	964	16
'07	373	964	16
'08	373	964	16
'09	451	1,126	16
'10	451	1,126	16
'11	492	1,126	16
'12	492	1,126	16
'13	694	1,534	16
'14	694	1,534	16
'15	694	1,534	16

As the result of retirement of aged truck and new input, composition of car stock will undergo a significant change as shown below.

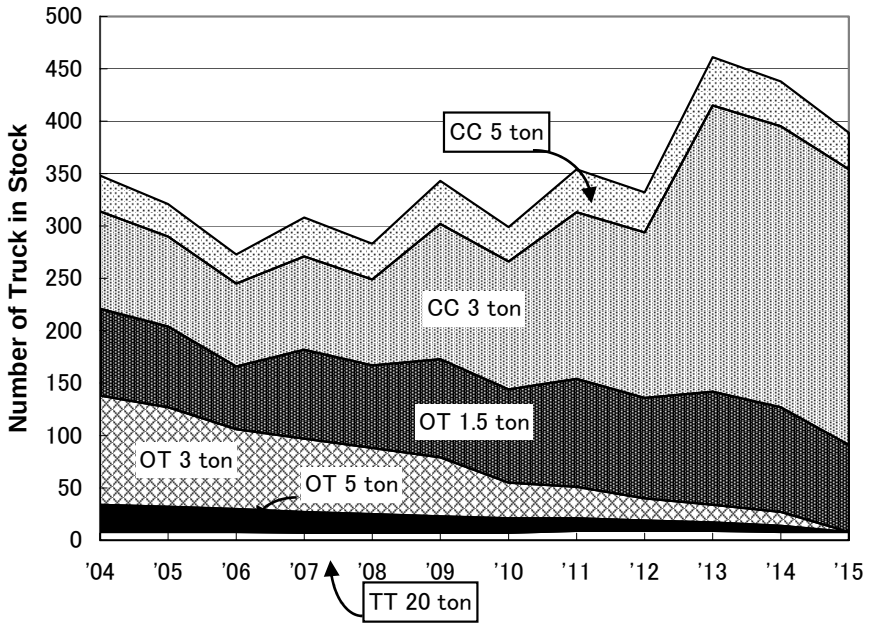


Figure 5.6 Change of Truck Type Composition

f) Expansion of Collection/Transport Capacity

Considering the plan of procurement and staffing, the collection and transport capacity will increase to meet the target waste collection amount as indicated below.

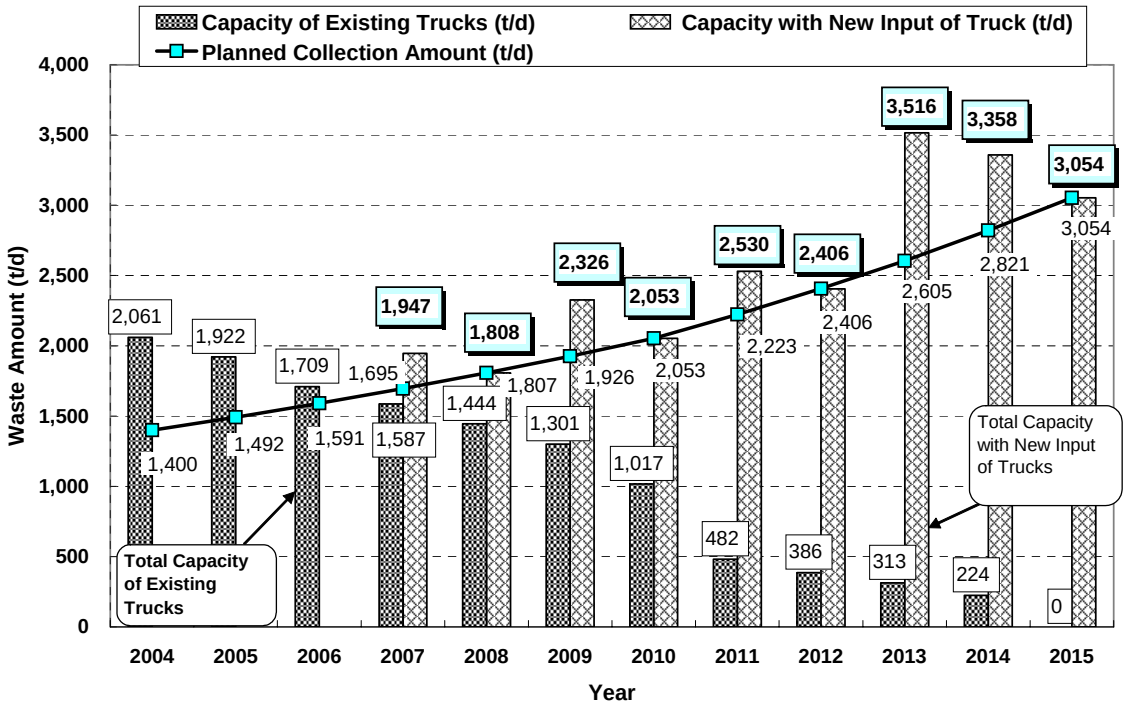


Figure 5.7 Total Capacity with New Trucks (estimated by the Study Team)

(2) Formation of Chain of Management in SWM

The chain of management consists of two actions in opposite directions: the chain of command and the chain of report as show in Figure 5.8. With this chain of management, the SWM can be executed effectively and efficiently.

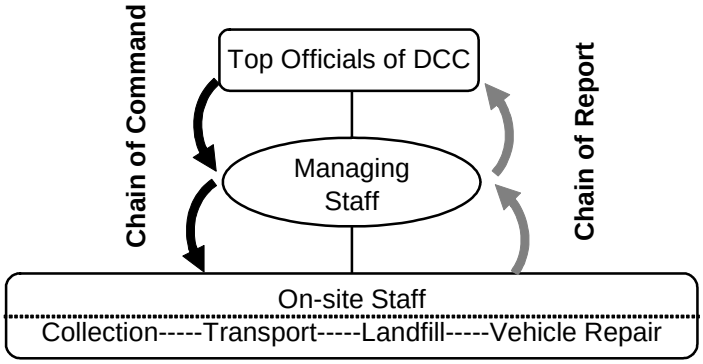


Figure 5.8 Structure of Management Chain in SWM

DCC currently has a well-connected chain of command; however, it does not have the opposite direction, the chain of report. To cope with the defect, the pilot project B for Management Information Acquisition (MIA) was initiated under the financial assistance of JICA. Although the pilot project B finished in February 2005, DCC will still have more to do as shown below.

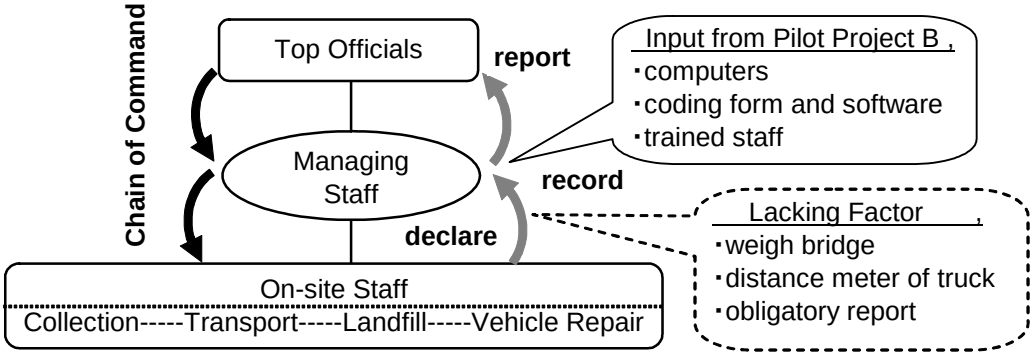


Figure 5.9 Lacking Factors for Chain of Report

Among the three lacking factors, installation of weigh-bridge and distance meters inevitably will take time; however, obligatory report will then be able to get ready at any moment. Therefore, the early start of obligatory reporting in SWM is recommended as part of management system reform. This reform is destined to form the job descriptions for those sections that handle waste.

In line with formation of the chain of report, it is recommended that DCC should determine job descriptions for those sections engaged in solid waste management. The job description should be authorized as the standard for every DCC staff to follow. The standard is the basis for DCC to acquire the following abilities:

- To adopt safe and effective manner of cleaning
- To evaluate the contribution of individual staff,

- To make maximum use of resources,
- To solve uneven burden of work among staff

For the standardization of cleaning work, a committee should be established to discuss all the aspects of works by reflecting interests of concerned staff. WMD should assist the committee by preparing the draft job description for the discussion at the committee. In principle all the jobs of those sections which handle waste are regarded as the target of the job description. However, it is recommended at first to start determination of job description with the following two groups considering the larger size of budget allocation:

- Secondary collection/transport job (workers and managing staff)
- Road/drain cleaning job (workers and managing staff)

(3) Setting up of Operation and Management Plan

The following technical alternatives are to be examined to set up Operation and management plan under the initiative of WMD.

- Improvement of waste container,
- Phase-out of dustbins and appropriate setup of waste container network,
- Development of Geographic Information Systems (GIS) for SWM,
- Introduction of mechanized cleaning equipment
- Surface drain construction
- Shortening time for vehicle repair

(4) Capacity Development of Cleaners and Drivers

Capacity development of the staff, not only collection and transport staff but also all the staff engaged in SWM services, shall be carried out based on the authorized job description.

(5) Mitigation of Health Risks to Cleaners/Drivers

Measures shall be taken to address the following issues for the sake of protecting the cleaners from health risks:

- preventing cleaners from getting injured during daily cleaning work,
- preventing cleaners from getting hit by vehicles during daily cleaning work,
- raising awareness for sanitation,
- supplying the appropriate tools and working clothes & outfits periodically, and
- assisting/compensating cleaners suffered from occupational disease.

(6) Pursuit of Privatization of Collection and Transport

A pilot project of private contract to cover entire cleaning work is still going on in two Zones. As the time duration so far executed is less than 2 years, it is still necessary to continue the project for accumulation of information on performance to evaluate. DCC should wrap up the results of the projects at due time for the future decision on privatization.

(7) Coordination with Recycle Industry

DCC should open a channel to recycle industry for having periodical dialogue with them. The topics of major concern with SWM are:

- Time sharing between secondary collection and recycle activity
- Work sharing in cleaning the place of DCC container/dustbin after recycling
- Coordination with compost makers
- Provision of information to waste pickers on vocational health

5.3 Final Disposal

(1) Three-step improvement of disposal sites

DCC is using three dumping sites (Matuail, Berri Band and Uttara) in the manner of open dumping without covering soil. It is crucial that Berri Band and Uttara are used without Environmental Clearance Certificate (ECC) that is enforced by Environmental Conservation Rule of 1997. Even for Matuail, it will become necessary to obtain the ECC because it will be used as dumpsite from now on.

Solid waste in the landfill site shall be covered by soil under an appropriate landfill operation and management plan. It is recommended that Berri Band and Uttara dumpsites be closed with proper post-closure work such as surrounding bank and covering soil when new landfill site comes into operation. Afterward all final disposal shall be upgraded through the following three steps. The concept is described in Figure 5.9.

a. To make Matuail dumpsite into a model of sanitary landfill through improvement of landfill facilities and operation
b. To secure and construct new landfill sites to dispose of solid waste until 2015.
c. Berri Band and Uttara dumpsites shall be closed after new landfill site is opened. Safety measures shall be done to reduce environmental pollution.

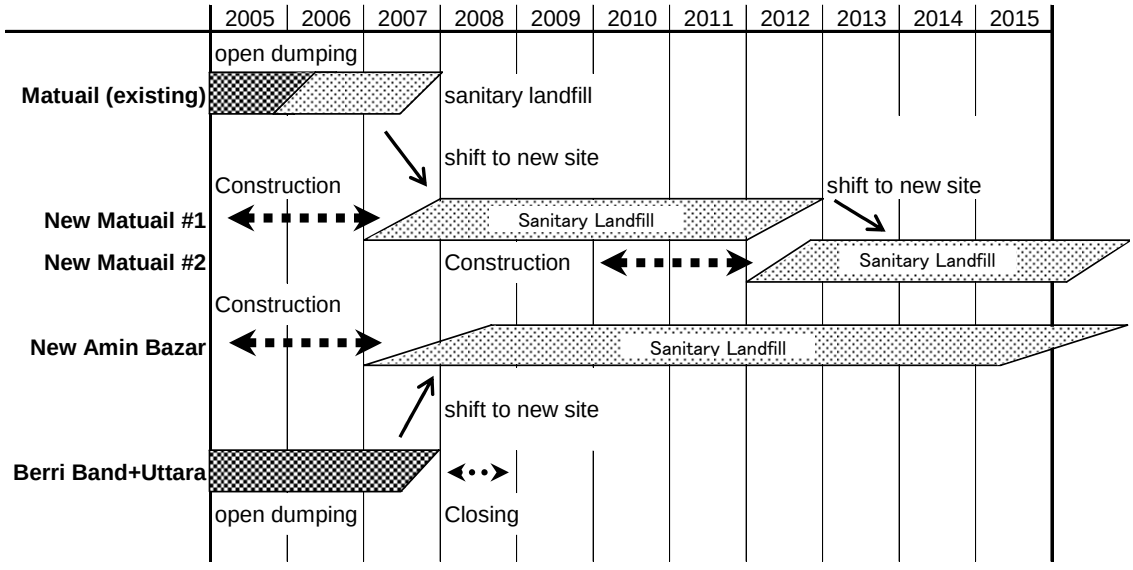


Figure 5.9 Concept of Step-wise Landfill Improvement

(2) Improvement of Matuail Dump Site

The first step of improvement shall be the establishment of a model to sanitary landfill at Matuail and then spread to every of new of final disposal site in future. The model shall have the following facilities, functions, and improved operation to reduce environmental pollution:

- Surrounding embankment to resist flood and to secure boundary
- Control of entering waste at entrance with weigh-bridge and hearing
- Periodical covering soil (material: debris and/or old waste in the site)
- Leachate retention with aeration & re-circulation
- Drainage system to reduce leachate amount
- Gas removal system
- Management organization & building

It is noted that the subsurface of the site is covered by 8-12 meters clay layer. This clay layer is expected to be a natural liner to prevent groundwater pollution out of landfill site.

(3) Securing Future Landfill Sites

From 2005 to 2015, a total of 9.3 million tons of solid waste will be disposed of. As the existing site of Matuail has a remaining capacity of 1.1 million tons, it will serve for only about two more years until the end of 2006. DCC has a plan to expand Matuail landfill site and construct Amin Bazar landfill site by year 2007. Another extension of Matuail landfill site will be necessary again to meet the demand of disposal until 2015. Capacity of each site is planned as shown below.

Table 5.8 Required Landfill Site until Year 2015

Landfill site	Location of disposal (year to be used)	Disposal amount (Capacity)
Matuail	Existing (2005,2006)	1.1 million tons
	Extension (2007-2012)	3.1 million tons
	Further extension (2013- - - - - -)	(3.1 million tons)
Amin Bazar	New establishment (2007- - - - - -)	(3.1 million tons)
Berri Band	Existing (2005,2006)	0.5 million tons

Source: estimated by the study team

(4) Establishment of Management Organization for Final Disposal

a) Temporary Organization

As a temporary management organization, a special task force shall be set up for landfill operation. The staff should be basically recruited from those are now engaged in landfill operation: for example, Conservancy Department and operators of Mechanical Division 2. The necessary staff is assumed as shown in Table 5.9.

Table 5.9 Necessary Manpower of Taskforce at Matuail Landfill Site

Assignment	Role	Required number
Chief (Site manager)	Site manager (Engineer)	1 person
Assistant staff to manager	Give assistance to site manager (technician)	2 shifts x 1 person
Maintenance staff	Mechanical technician (Temporary)	1 person
Reception and control staff	Measurement of weight and check of waste	2 shifts x 2 persons
Dumping platform instructor	Instruction to trucks	2 platforms x 2 shifts x 2 persons
Heavy equipment operator	Operator	2 shifts x 10 persons
Guard	entrance control	3 shifts x 2 persons

b) Permanent Organization

The task force for Matuail landfill site shall be developed in the permanent organizations of two future landfill sites as shown below.

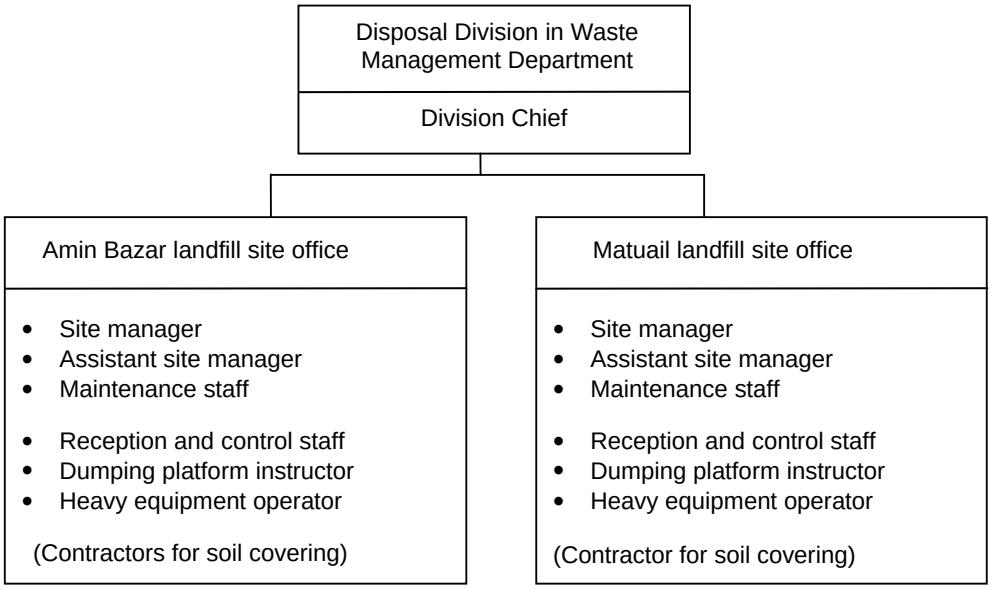


Figure 5.10 Future Organization for Management of Final Disposal

(5) Capacity Building for Final Disposal

Capacity building for final disposal shall be executed through actual improvement of Matuail landfill site. Training programs shall be prepared by DCC in collaboration with the international agency that has suitable experience in the said field.

5.4 Legal Aspects

(1) Clear and Equitable Responsibility Allocation with DCC and Waste Generators

a) Responsibility of DCC to Install Containers at Proper Locations

As is currently done, for the determination of the proper locations of containers, discussion with Commissioners and/or Ward SWM Committees is inevitable. Since

containers may cause some nuisance to the residents nearby, close discussion with residents and primary collection service providers are required. Before discussion with Commissioners or Ward SWM Committees, DCC has to prepare standards for allocation of containers among wards. Number of containers *per Population* and *Longest Distance to Containers from a Building* will be the indicators for the standards.

b) Responsibility to Remove and Dispose of Business Waste

The DCC Ordinance of 1983 does not make any difference in responsibility allocation by type of waste generators. It is recommended that DCC should transfer the responsibility to business entities in the long term because DCC will have to cope with the huge volume of waste in future.

(2) Proper Disposal and Compliance with Environmental Conservation Act/ Rules and Preservation Act

a) Responsibility of DCC for Proper Disposal

Responsibility of DCC for proper disposal of domestic waste as well as street/drain waste should be clearly stipulated in the Ordinance and (Municipal) Solid Waste (Management) Handling Rules.

b) Environmental Management Plan

DCC should immediately start preparation of Environmental Management Plan (EMP) according to the Rules and Guidelines for Environment Impact Assessment under Environmental Conservation Rules of 1997. The target site should be limited to Matuail dump site alone because it is not realistic to prepare EMP for Berri Band or Uttara. These sites should be immediately closed after the commissioning of Amin Bazar Disposal Site.

c) Compliance with Preservation Act

It would be better for DCC to ask RAJUK for judgement/recommendation on the compliance after design of civil works is fixed.

d) Establishment and Implementation of Procedure for Punishment against Illegal Throwing and Dumping

Prevention of throwing garbage may require three measures; i) community activities, including door-to-door collection, ii) environmental education, and iii) enforcement. The legal task group proposes establishment of a by-law regarding the punishing procedure and “administrative charge”.

(3) Legal Training to DCC Staff

The following program is recommendable.

Table 5.10 Legal Training Program

Target Trainee	Topic	Duration
Top Managers (Members of Waste Management Committee) (around ten persons)	* Basic Concept on Environmental Conservation Act (1995), Rules (1997) and Guidelines for Environmental Impact Assessment * Basic Concept on Preservation Act (2000) and Required Procedure for the Compliance * Basic Concept on Relevant Part of the Ordinance * Basic Concept on (Draft) (Municipal) Solid Waste (Management) Handling Rules * Discussion and Determination on What to do to Comply with the Laws/Regulations * Discussion on Responsibility Demarcation on Business Waste and DCC Strategy for Responsibility Re-allocation	One Day Seminar
Conservancy Officers, Supervising Inspectors and Inspectors, etc. (Around 120 persons)	* Basic Concept on Relevant Part of the Ordinance, including the Part of Offense and Punishment * Basic Concept on Environmental Conservation Act (1995), Rules (1997) and Preservation Act (2000) * Required Procedure for the Compliance of the Ordinance * Planning for Implementation of the Procedure for Relevant Areas and Presentation of the Result	One Day Seminar and One Day Workshop
Junior Engineers and Officers in charge of SWM (around 50 persons, two circles, around 25 persons)	* Basic Concept on Environmental Conservation Act (1995), Rules (1997) and Guidelines for Environmental Impact Assessment * Basic Concept on Relevant Part of the Ordinance * Basic Concept on Preservation Act (2000) and Required Procedure for the Compliance * How to Prepare Environmental Management Plan * Required Procedure for the Compliance of the Ordinance	One Day Seminar and One Day Workshop

5.5 Organization

(1) Strengthening Planning/Coordinating/Monitoring/Evaluation Capability

Since the functions for implementation of SWM components are scattered in several departments in DCC, a consolidated planning and monitoring/evaluation should be adopted. In addition the procedure should be in accord with the budget compilation procedure. DCC objectives in the master plan have to be broken down into department-wise objectives, and then into objectives of divisions/zones. Division/zone-wise objectives should further be broken down into smaller units if necessary. Lower level organs will at first prepare the concrete operation plans. The upper level organs have to check the consistency among different operation plans of the lowers within the authority. Inter-departmental operation is to be negotiated at the competent higher level of respective departments.

(2) Improvement of Field Organizations

a) Shift of Collection and Transport Functions to Zone Office

Vacant posts of Conservancy Inspectors and Conservancy Supervising Inspectors in zone offices should be fully assigned immediately. Plans for container installation and re-deployment of cleaners should be formulated by the initiative of zone personnel assisted by staff of the headquarters. It is recommendable to create posts of 'Conservancy Sub-inspectors', one for 20-30 road cleaners. The control of drivers/conservancy trucks as well as refueling should be transferred to Zone Offices where each driver has to report starting/finishing collection of waste in assigned area (route) and getting fuel tickets.

b) Improvement in Vehicle and Equipment Maintenance

Waste Management Division should start preparation of manuals for the inspections as well as procurement plans for periodical change of spare parts. After the preparation of inspection manual, a few mechanics as well as helpers will have to move to conservancy pool from the workshop. For accelerating the approval process of outsourcing, the following measures are recommendable:

1) Past records on repair works should be analyzed at first.
2) The mechanical workshops should prepare a conservative annual procurement plan based on the analysis.
3) Repair service can be outsourced with short-cut procedure within the limit of the approved plan and budget
4) After a few years, possibility for packaged contracts for maintenance and repair service of a group of same type vehicle should be discussed.
5) Frequency of bid for contracting should be increased to once a month.

(3) Plan of Organization Reform

a) Phased Development of the Future Organization

To enhance DCC's capability for integrated SWM, scattered functions should be combined into one department. The following phased development is recommended.

Phase I: [blue coloured part of Figure 5.11]
i) to change the name of the Department,
ii) to organise Administrative, Planning and Community Solid Waste Management Divisions, and
iii) to enhance zone office for cleaning and collection;

Phase II: [green coloured part of Figure 5.11]
iv) to merge Conservancy Pool and to organise Zone Management Support Div., Zone Waste management Div.
v) to enhance maintenance functions, and

Phase III:	vi) to organise Disposal Div.; [yellow coloured part of Figure 5.11]
Phase IV:	[pink coloured part of Figure 5.1]
	vii) to include functions of vehicle/heavy equipment purchase and repair (to organise Mechanical Sections in Zone Management Support and Disposal Divisions;

b) Change in Composition of Waste Management Committee

The Waste Management Committee (WMC) should take its functions as a deliberative organization. Accordingly, composition of WMC is to be varied as the circumstances require. Possible range of members is representative from academic institutes, Ward Commissioners/Ward SWM Committees, RAJUK, business associations, residents near disposal sites and NGOs.

c) Transition to the New Department and Divisions

DCC should execute the organizational transition by using existing human resources at maximum extent and by enhancing capacity of existing staff in the fields which are new to them.

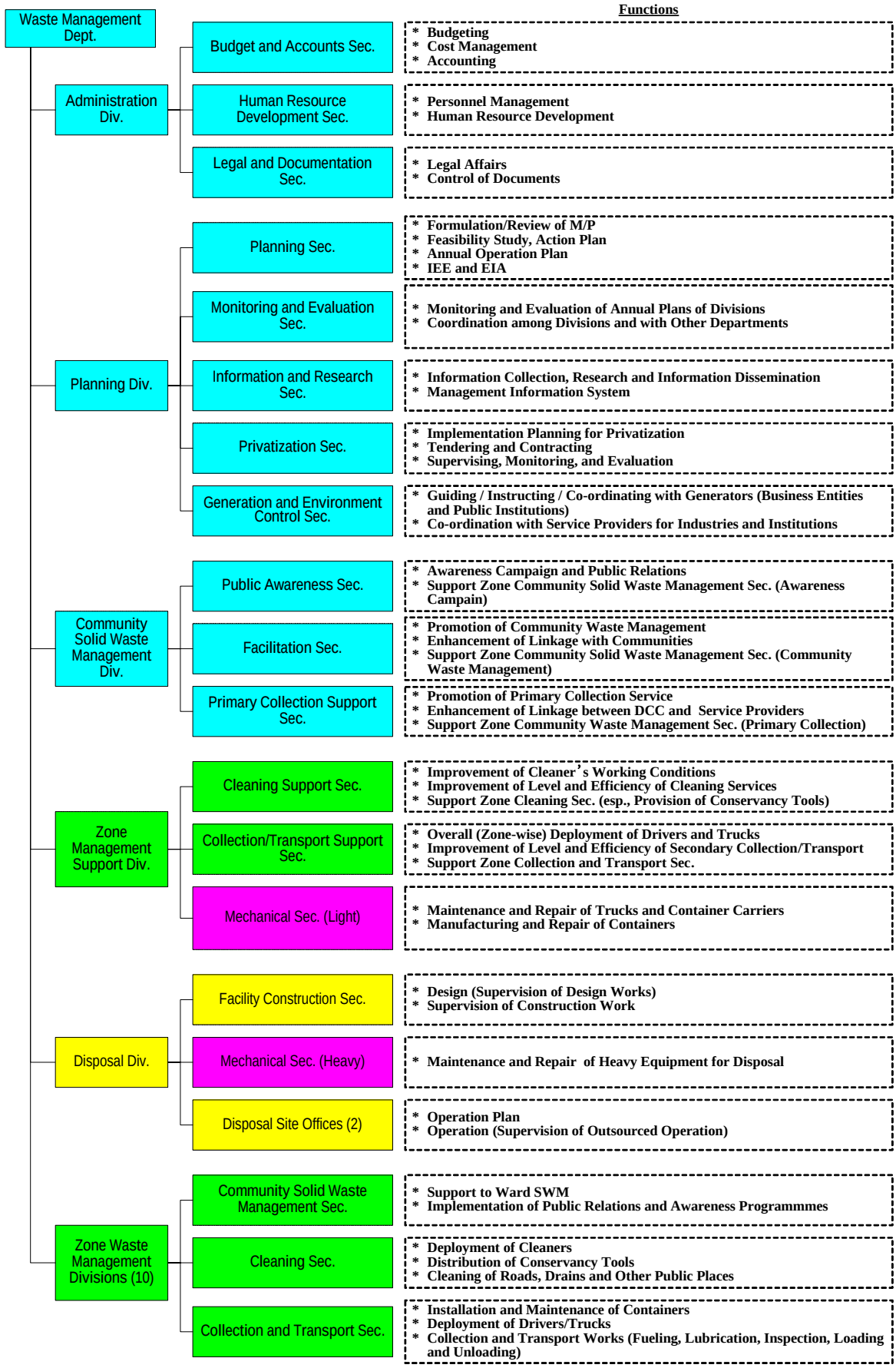


Figure 5.11 Proposed Future Organization Structure of Waste Management Department

5.6 Financial Management

(1) Simplified Accounting System for Actual SWM Cost (Standardized SWM Cost)

A simplified accounting system for actual SWM cost should be established that could be easily understood and computed by all DCC staff. For this purpose, so-called 'Standardized SWM cost' is designed as a model accounting in digitized form for WMD and the counterpart. The cost components of Standardized SWM Cost are shown below.

Table 5.11 Cost Component of Standardized SWM Cost

Cost component	Department-wise				Operation-wise			
	Conservancy	Transport	Mech-1	Mech-2	Cleaning	Collection /Transport	Final Disposal	Repair Works
Personnel	*	*	*	*	*	*	*	*
Repair/Maintenance	-	-	*	*	-	*	*	-
Fuel	-	*	-	*	-	*	*	-
Utility	-	*	*	*	-	*	-	*
Supply	*	*	*	-	*	*	*	-
Development	*	-	-	-	*	-	-	-
Depreciation	-	-	-	-	-	*	*	-

Note: Marked * means respective cost component.

(2) Financial Planning for Master Plan

a) Financial Consequence of Overall SWM Cost

Primarily, overall SWM Cost must be covered entirely by DCC's own SWM revenues. However, the financial situation of SWM is characterized by negative balance to a considerable amount every year. Provided the current revenue level continues, DCC can not afford to bear the overall SWM cost of the Master Plan as shown below.

Table 5.12 Forecast DCC Financial Condition by Current Revenue Level

(Taka million)

Items	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
Current Revenue level (Conservancy Rate)	180	180	180	180	180	180	180	180	180	180	180
Development & Procurement cost	839	701	305	0	263	0	686	322	478	0	0
O&M Cost	509	472	539	519	570	532	564	539	631	589	594
Overall SWM Cost	1,348	1,173	844	519	833	532	1,250	861	1,109	589	594
SWM Financial Balance	▲1,168	▲993	▲664	▲339	▲653	▲352	**▲1,070**	▲681	▲929	▲409	▲414

b) Financial Recovery of O&M Cost

By putting in effect the 3 revenue enhancement measures, Conservancy Rate Revenue could finally cover SWM O&M Cost. The assumed revenue enhancement measures and annual balance estimate are shown in Table 5.13. SWM financial balance turns into surplus at first in 2006/07 then in 2008/09 and 2011/12 by taxation rate revision and periodic reassessment every 5 years.

Table 5.13 Recovery Planning of SWM O&M Cost

(Taka in million)

Items	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
SWM Revenue Enhancement Measures											
Reassessment*	-	Increase by 2.5 times					Increase by 13 %				
Taxation Rate**	Currently: 2 %			Increase to 2.5 %					Increase to 3 %		
Tax Collection**	70 %	75 %					80%				
Revenue from Conservancy Rate	180	480	480	600	600	600	730	730	870	870	870
O&M Cost	509	472	539	519	570	532	564	539	631	589	594
Balance after O&M Cost	▲329	+8	▲59	+81	+30	+68	+166	+191	+239	+281	+276
Development & Procurement Cost	839	701	305	0	263	0	686	322	478	0	0
Final Balance	▲1,168	▲693	▲364	+81	▲233	+68	▲520	▲131	▲239	+281	+276

Note: * Reassessment scheme of annual value of the properties using self assessment system has stated last year and tax collection based on the reassessed value will start from the financial year of 2006/07. Increase of 13% tax collection from 2011/12 is estimated based on the recent tendency in increase of real estate value.

** Revision of Conservancy Tax Rate as well as tax collection ratio are proposed by the Study Team.

Source: Estimates by the JICA Study Team

c) Sources of Funds for Development and Procurement Cost

Development and Procurement Cost should be also primarily covered by DCC own SWM revenues and then, if difficult, other sources will be taken into account as alternatives. The size of Conservancy Rate Revenue is not enough to cover all Development and Procurement Cost as shown in Table 5.13. The predictable sources of funds are summarized in Table 5.14.

WMD should carefully study the Grant Scheme of Central Government and Foreign Government, and execute the procedures in a proper manner to advance it in line with the respective Governments budget schedules.

Table 5.14 Sources of Funds for Development and Procurement Cost

Project	Source of Funds (Taka million)		
	SWM Own Revenues	Grant from Central or Foreign Gov't	Total
New Landfill Development	- - - 136 (2012/13)	630 (2005/06) 396 (2006/07) 282 (2011/12) 131 (2012/13)	1,575
Existing Landfill Improvement	- -	181 (2005/06) 290 (2006/07)	471
Closure of Berri Band	11	-	11
Container Carrier & Truck Procurement	- 30 (2009/10) 166 (2011/12) 239 (2013/14)	172 (2007/08) 233 (2009/10) 238 (2011/12) 239 (2013/14)	1,317
Heavy Equipment Procurement	55 (2012/13)	107 (2007/08)	162
Community Activities	- - -	28 (2005/06) 16 (2006/07) 15 (2007/08)	59
Total	637	2,958	3,595

Source: Estimates by the JICA Study Team

5.7 Privatization

During the continuation of the outsourcing pilot project, the following items are to be examined. Based on the results of the evaluation of the pilot project, the privatization projects have to be improved and expanded.

a) Period of Contracts
b) Scope of Contract
c) Area of Outsourcing
d) Survey on Capability of the Private Sector
e) Performance Monitoring/Evaluation

CHAPTER 6 PRIORITY PROJECTS AND PROGRAMS

6.1 Priority Projects and Programs

The proposed master plan focuses on four major aspects of waste management that is mandated to DCC. Out of the entire master plan, the priority projects and programs are extracted as shown in Table 6.1. These projects and programs are considered of urgent need of implementation as the core of "Clean Dhaka Master Plan." The projects and programs will be the key to open the new era in which DCC will promote SWM to the highest level ever achieved by its own capacity.

Table 6.1 Priority Projects and Programs

Title of Program		Executing Body	Concerning Body	Time of Execution
Primary Collection/Public Involvement				
1	Program for Institutionalization of Ward SWM System	WMD	CD	2005-2007
2	Program for Establishing a System of Approval and Monitoring of Primary Collection Service Providers	WMD	CD	↑
3	Program for Supporting Primary Collection Service Providers	WMD	CD	↑
4	Program for Initial Implementation of Ward Solid Waste Management System (20 Wards)	WMD	CD	↑
5	Organization of Bangladesh Solid Waste Management Conference	WMD	DCC, CCC, RCC, KCC	2005-2007
Secondary Collection/Transport and Road/Drain Cleaning				
1	Procurement of New Containers and Carriers	ED	CD, TD	2005-2015
2	Increase of Drivers and Container Cleaners	CD, TD	-	↑
3	Formation of Chain of Management in SWM	WMD	CD, TD, ED	2005-2007
4	Setting up Operation and Management Plan	WMD	CD, TD	2005-2015
5	Capacity Development of Workers	WMD	CD, TD	2005-2010
Final Disposal				
1	Improvement of Existing Matuail Dump Site	WMD	CD, ED	2005-2007
2	Securing Future Landfill Site	WMD	CD, ED	2005-2012
3	Closure of Berri Band Dump Site	WMD	CD, ED	2007-2010
4	Establishment of Management Organization for Final Disposal	WMD	CD, ED, TD	2005-2007
5	Capacity Development of Disposal Section	WMD	CD, ED	2005-2007
Legal Aspect				
1	Compliance with Environmental Conservation Act/ Rules and Preservation Act	WMD	CD, ED	2007-2015
2	Legal Training to DCC Staff	WMD	CD, ED, TD, UPD	2005-2015
3	Enforcement of Section 150 against Illegal Throwing and Dumping	CD	WMD, Magistrates	2007-2015

Title of Program		Executing Body	Concerning Body	Time of Execution
Organization Aspect				
1	Preparation of Annual Operation Plan according to Master Plan	WMD	CD, ED, TD, AD	2005-2007
2	Improvement of Operational Organization	WMD	CD, TD, ED	↑
3	Reforming Organization for SWM	WMD	CD, TD, ED, UPD, AD, ESD	2007-2015
4	Training of DCC Staff for SWM	WMD	CD, ED. TD, UPD	2007-2015
Financial Aspect				
1	Modification of Accounting system to Exhibit Actual SWM Cost explicitly	WMD	AD	2005-2012
2	Financing for Master Plan Implementation	WMC, WMD	AD	2005-2015
Privatization				
1	Continuation of Pilot Project on Privatization with In-depth Evaluation	WMD	CD, TD, UPD	2005-2007

Note: WMC (Waste Management Committee); WMD（Waste Management Division/Department in future）; CD (Conservancy Department); ED (Engineering Department); TD (Transport Department); UPD (Urban Planning Department); AD (Accounts Department); ESD (Establishment Department); SDD (Slum Development Department); MOPME (Ministry of Primary and Mass Education); DCC (Dhaka City Corporation); CCC (Chittagong City Corporation); RCC (Rajshahi City Corporation); KCC (Khulna City Corporation)

6.2 Schedule for the Implementation

The priority projects and programs have urgent need of execution as the next action with the joint efforts of the Bangladesh side and the JICA study team. The Bangladesh Government decided to establish the Waste Management Committee and Waste Management Division (WMD) in DCC in July, 2004. In response to the decision of LGRD&C, DCC selected the personnel for WMD in November, 2004 and sent it to the Government for concurrence of the competent authorities. On the other hand, residents in Ward 6 and Ward 65 have started active participation in the pilot project for community level waste management program as demonstrated in the event "Mirpur Declaration" where thousands of citizens gathered and resolved "Clean Mirpur for Our Children."

These surrounding circumstances indicate that it is the time to get the "Clean Dhaka Master Plan" started without any delay. Some of the priority projects and programs need immediate commencement in accordance with a desirable time schedule as shown in Table 6.2.

Table 6.2 Implementation Schedule of Priority Projects and Programs

	Priority Projects and Programs	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Primary Collection/Public Involvement												
1	Institutionalization of Ward Solid Waste Management System											
2	Establishing a System of Approval and Monitoring of Primary Collection Service Providers											
3	Supporting Primary Collection Service Providers											
4	Initial Implementation of Ward Solid Waste Management System (20 Wards)											
5	Organization of Bangladesh Solid Waste Management Conference											
Secondary Collection/Transport and Road/Drain Cleaning												
1	Inctrease of New Containers and Trucks											
2	Increase of driver and truck cleaner											
3	Formation of Chain of Management in SWM											
4	Setting up Operation and Management Plan											
5	Capacity Development of Workers											
Final Disposal												
1	Improvement of Existing Matuail Dump Site											
2	Securing Future Landfill Site											
3	Closure of Berri Band Dump Site											
4	Establishment of Management Organization for Final Disposal											
5	Capacity Development of Disposal Section											
Legal Aspects												
1	Compliance with Environmental Conservation Act/ Rules and Preservation Act											
2	Legal Training to DCC Staff											
3	Enforcement of Section 150 against Illegal Garbage Throwing and Dumping											
Organization Aspects												
1	Preparation of Annual Operation Plan according to Master Plan											
2	Improvement of Operational Organization											
3	Reforming Organization for SWM											
4	Training of DCC Staff for SWM											
Financial Aspect												
1	Modification of Accounting system to Exhibit Actual SWM Cost explicitly											
2	Financing for Master Plan Implementation											
Privatization												
1	Continuation of Pilot Project on Privatization with In-depth Evaluation											

6.3 Financial Requirement

(1) Development & Procurement Cost for the Master Plan

The total Development and Procurement Cost until 2015/16 is estimated at Tk. 3,595 million. Sources of funds for Development and Procurement Cost are summarized in Table 6.3. Some of the funds are already budgeted and the rest is a proposal of the study team.

Table 6.3 Proposed Sources of Funds for Development and Procurement Cost

Project	Source of Funds (Taka in million)		
	SWM Own Revenues	Grant from Central or Foreign Government	Total
① New Landfill Development	-	670	1,575
	136	769	
② Existing Landfill Improvement	-	471	471
③ Closure of Berri Band	11	-	11
④ Container Carrier and Truck Procurement	435	882	1,317
⑤ Heavy Equipment Procurement	55	107	162
⑥ Community Activities	-	59	59
Total	637	2,958	3,595

Source: Estimates by the JICA Study Team

(2) O&M Cost for the Master Plan

On the other hand, the total O&M Cost until 2015/16 is estimated at Tk. 6,058 million which means an average of Tk. 551 million a year, composed of personnel cost 70%, fuel cost 8%, etc. O&M unit cost (Taka/Ton = O&M cost/collected solid waste amount) is summarized in Table 6.4. The unit cost is assumed to continuously decrease due to cost efficiency in spite of growing waste collection.

Table 6.4 SWM O&M Cost per Ton

Items	Unit	Actual	Master Plan			
		04/05	05/06	10/11	15/16	Average
SWM O&M Cost	Taka. In million	487	509	532	594	-
Collected Solid Waste Amount	1000Ton/Year	511	548	749	1,030	-
Taka/Ton		953	929	710	577	703

Source: Estimates by JICA Study Team

CHAPTER 7 EVALUATION AND CONCLUSIONS

7.1 Evaluation of Master Plan

(1) Technical Aspects

The technical system to be explored for the future SWM is summarized along with the process of waste stream as shown in Table 7.1. For the primary collection and road/drain cleaning, the conventional methods are assumed to be adopted continually. For the secondary collection and transport, the conventional combinations of dust bin & open truck, container & container carrier & trailer with tractor are proposed to be in use at the beginning. As the time elapses, existing vehicles become old and reduce in number. Since the replacement of retired open trucks is planned with container carriers accompanied by new containers, the two combinations namely container/carrier and trailer/tractor will survive to the end of the planning period. These systems do not require DCC cleaning staff, residents or private stakeholders additional special efforts, but require a more organized management system to adapt to them.

Table 7.1 Technical System Assumed in the Master Plan

process	primary collection	road cleaning drain cleaning	secondary collection	transport	final disposal
measure	rickshaw	manual cleaning with wheel barrow	● dust bin & open truck ● container/carrier, ● tractor/trailer ↓ ● container/carrier, ● tractor/trailer	● open truck ● container/carrier, ● tractor/trailer ↓ ● container/carrier, ● tractor/trailer	● open dumping ↓ ● control dumping ↓ ● sanitary landfill

Regarding the final disposal, it is proposed that the conventional open dumping activities should be changed into a control dumping and sanitary landfill system as the priority projects and programs progress. This transition requires DCC staff in charge to learn technical features and practice of upgraded landfill method. In addition, DCC needs to spend much more money for improving the structure of the dump site and deploying much more heavy equipment for daily operation. These requirements are a sort of trial for DCC; however, the extent is not as large as it can not be overcome by the efforts for expanding financial capacity. Some neighboring countries have already introduced sanitary landfill for years. Some of counterpart personnel were sent to one of such countries in 2004 to observe such technologies adopted there including sanitary landfill. Technical assistance from those countries which have advanced experience will be available under certain conditions. Thus the master plan is evaluated as technically viable.

(2) Economic Aspects

The total investment cost of the Master Plan is estimated at Tk 3,595 million for activities during forthcoming 11 years. Although this amount is equivalent to almost half of the total budget for the financial year 2004/2005, the size of investment is not a remarkable impact on the economy of the whole society. DCC's special efforts and introduction of innovative

polices to increase the government revenue is highly recommended. There is a possibility to double the current revenue to reassess the basis of property values. In this sense, the Master Plan is evaluated as economically viable.

(3) Social Aspects

One of the key issues of the master plan is social mobilization to improve SWM. The plan encourages local people to participate in primary collection of their waste and improvement of behavior to keep their place clean. The required activity is planned to disseminate to all residents under the initiative efforts of community leaders assumed to represent the smaller unit of town in the ward. The activities of local units will lead to better amenity of the area and more cooperative community than they recognized before execution of the master plan. The projects and program will not only contribute to cleaner environment in a certain area, but also contribute to formulating a community unit in which the residents have a sense of solidarity through achieving the common target of clean home town. In this sense the master plan is evaluated as socially viable

(4) Environmental Aspects

The master plan aims at cleaning city as a whole as the title "Clean Dhaka Master Plan" says. The implementation of the plan makes those areas surrounding a water body and voluntary or official dump sites more clean and hygienic by reducing illegal dumping and conducting sanitary landfill. Those people around such areas presently suffer from adverse environmental conditions caused by the current incomplete waste management. However, the situation will be definitely improved by the implementation of the master plan. In this sense, the master plan is evaluated as environmentally viable.

7.2 Conclusions

In October 2004, Ministry of Environment and Forest (MOEF), the Government of Bangladesh, organized a SAARC workshop on SWM. At the conclusion of the event, the delegates from five countries (India, Pakistan, Nepal, Bhutan and Bangladesh) announced "the Dhaka Declaration on Waste Management 2004" with the unanimous consensus of all the participants. The declaration at first refers to the required nature of SWM as effective, efficient, affordable, safe and sustainable which the member countries are to promote. The declaration also pointed out several details to promote in member countries. It should be noted that most of them are in accord with the direction of the master plan concluded in this study as summarized below. MOEF is the authority to regulate the SWM at national level and it took the initiative in issuance of the declaration. The accord observed in the master plan and the declaration suggests that the plan substantially complies with the national policy.

- Open dumping should be stopped immediately and be replaced with new safe options like control dumping.
- Incineration as well as unproven technologies such as Plasma should not be considered as an option for the treatment of municipal solid waste for low calorific value and environmental pollution potential. However, some appropriate incineration

technologies may be considered for the treatment of infectious/hazardous bio-medical waste in absence of an appropriate non-burn technology.

- Informal waste picking practice should be improved by improving working conditions of the waste pickers and thereby reducing the occupational health hazards.
- Encourage NGOs and private companies to establish community based segregation at source, and to separate collection and resource recovery from waste with particular focus on composting.
- Hospital waste may be treated as a special waste and managed separately. Joint efforts with health-related organizations/authorities should be explored to develop a proper management system.
- The cost of SWM should be rationalized with the view to increase revenue in order to make the system financially viable.
- Waste collection, treatment and disposal may be privatized to allow greater mobilization of capital.

7.3 Recommendations

For the implementation of the master plan, it is recommended for DCC to take the followings into consideration:

(1) To accelerate functioning of WMD with capable and practical personnel assigned exclusively to the required position.

(2) To acquire the government grant for the expense of specific project and program as soon as possible.

(3) To assign all the members of WMD to objective tasks stated in the master plan.

(4) To pursue foreign assistance for implementation of each project and program particularly for the training of DCC staff engaged in various assignments.

(5) To have regular contact with SOB over the use of GIS database for SWM.

(6) To keep regular contact with MOEF over the improvement of final disposal.

(7) To take consideration of the recommendations on industrial waste management and medical waste management presented in the appendix of this report.

APPENDIX

APPENDIX A SPECIAL RECOMMENDATION FOR INDUSTRIAL AND MEDICAL WASTE

Concerted efforts are required to institute and improve environmental condition, and especially controls, to keep a large amount of waste generated from some specific industries and wastes containing hazardous substances including hazardous medical wastes out of the municipal waste management system. Most importantly, potential sources of hazardous materials in industrial wastes, whether they are served by public or private waste collectors including CBOs and NGOs, must be identified, registered, and targeted for appropriate management.

A.1 Industrial Waste

Currently there is no legislation to control industrial and hazardous waste management directly in Bangladesh. Although the laws controlling industrial and hazardous wastes are normally enacted at the governmental level, DCC has the key role in monitoring the generation of industrial and hazardous waste in its jurisdiction, identifying suitable sites for environmentally safe disposal and monitoring of the collection and disposal operations. In particular, incoming wastes are required to keep hazardous industrial wastes out of waste dumping site currently operated at Matuail since there is neither engineering consideration to protect surrounding environment nor appropriate operational standards for waste deposit. The most critical requirements arise in relation to hazardous wastes from small-scale industries, as so many are operated in DCC, which are practically impossible to prevent from entering the normal waste stream.

A large-volume-waste-generator, if identified, requires some measures to control its waste coming to the DCC dumpsite since those wastes may consume the capacity of dumpsite so quickly. Estimation of this study shows the amount of industrial waste generation is 200 tons/day, of which 150 tons/day are from tannery industry, and this is not so large compared to a total waste generation of 3,200 tons/day in the Study area. Although some of the tannery wastes are recycled to produce fish or animal feeds, most of them are considered to be directed to the dumpsite. The number of establishments in textile and garment industry is large in DCC and thus the amount of wastes produced is likely large because of inactive reuse and recycling of those wastes.

To improve industrial wastes management is currently proving to be an obstacle to DCC's waste management system; hence, intensive negotiations and coordination among stakeholders are required to formulate a better system. The Ministry of Industry, associations of specific industries and DCC may have major roles and responsibilities for this coordination and integration of policy. Planning issues for a formulation of appropriate industrial waste management system to improve current practice include the following:

- Demarcation of role and responsibility to control industrial waste between central government and DCC;
- Definition of industrial waste which DCC handles,

- Collection and tipping fee;
- Discharge/Storage/Collection method;
- Land disposal planning; and
- Countermeasures for hazardous waste.

A.2 Medical Waste

Special attention must also be given to the management of infectious waste originating from hospitals and clinics. There is an urgent need for planning and implementation of medical waste management systems, and for the integration of appropriate procedures and methods into both health care and waste management systems for appropriate medical waste management both in healthcare establishments and in waste handling sectors such as DCC. Coordination and integration of both entities are indispensable for medical waste management. And consistency or conformity in policy and technologies employed at both entities are also required.

Figure A.1 shows some approaches for medical waste management in the Study area. In these approaches, institutional and technical developments and human resources development need to be strengthened for both medical establishments and DCC. Also, introduction of new system for safe disposal of segregated and collected hazardous hospital wastes is proposed. Intensive segregation of hazardous waste at sources is essential for better hospital waste management. The share of hazardous waste to total hospital wastes is 10%~20% in general hospitals, so that, if segregated thoroughly, the amount of waste requiring special attention for handling is less. To do this training to hospital worker including doctors, nurses, and supporting staff is required. This training also contributes to raise their awareness to hospital waste and thereby, infection caused by inappropriate handling of infectious waste may be prevented.

In-house treatment of hazardous waste should be encouraged especially for a large hospital. Hazardous hospital wastes from middle and small hospitals that are incapable of owning an on-site treatment system are to be stored appropriately in hospitals and collected by waste collection vehicle exclusively designed for medical waste hauling and transported for centralized treatment or disposal. Setup of such facilities, number of facilities, technologies, ownership, procurement of initial cost, treatment fee, management system, etc. are issues among stakeholders.

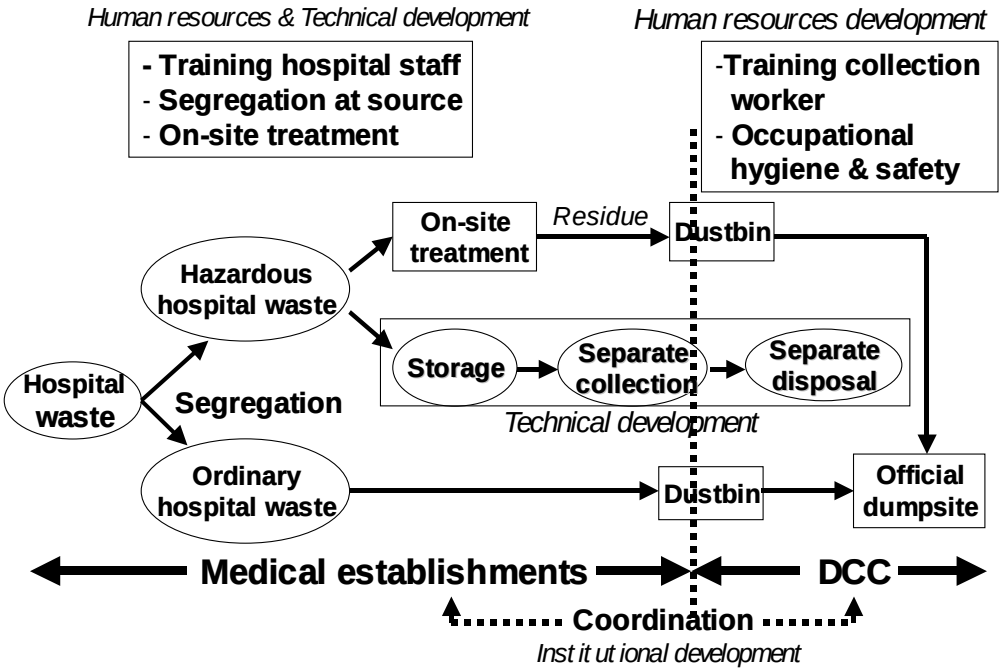


Figure A.1 Approaches for Appropriate Medical Waste Management in DCC.

Training for waste handlers in DCC is also necessary as a program of human resources development, irrespective of handling only medical wastes or ordinary domestic wastes. Targeted trainees include WMD in DCC as well as wards officers in charge of inspection of waste management, waste collection workers, and workers at dumpsites. This training is required for ensuring occupational hygiene and safety. Especially in handling hazardous hospital wastes, awareness and correct knowledge are needed for waste handlers to prevent epidemics of infectious diseases originating from hospital wastes.

APPENDIX B SUMMARY OF MASTER PLAN

Based on the envisaged strategies for each technical and institutional component, projects and programs have been identified; these strategies can be materialized through concrete actions to be taken by key stakeholders as well as DCC. These recommended programs and projects are tabulated below under seven headings: Primary Collection, Secondary Collection, Final Disposal, Legal Aspect, Organization, Financial Management, and Privatization:

B.1 Primary Collection and Public Involvement

Table B.1 Projects/Programs of Primary Collection/Public Involvement

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Program for Institutionalization of Ward Solid Waste Management System**	**WMD**	**CD**	**2005-2007**
1)	Evaluation of Pilot Project A conducted in the Master Planning Study		CD	↑
2)	Formulation of legal framework and guidelines for implementing Ward Solid Waste Management System		CD	↑
3)	Development of a manual for implementing Ward Solid Waste Management System		CD	↑
4)	Implementation of training of staff of Community Solid Waste Management Section of WMD		CD	↑
5)	Implementation of training for DCC Community Coordinators of Zone Offices		CD	2005-2010
6)	Implementation of training for staff of Zone Offices (CO, CSI&CI)		CD	2005-2007
7)	Implementation of training for DCC decision makers (CCO, DCCO, ACCOs, Division Manager and Section Managers of WMD)		CD	↑
2	**Program for Establishing a System of Approval and Monitoring of Primary Collection Service Providers**	**WMD**	**CD**	↑
1)	Formulation of legal framework and guidelines for primary collection service system		CD	↑
2)	Development of a manual for primary collection service		CD	↑
3	**Program for Supporting Primary Collection Service Providers**	**WMD**	**CD**	↑
1)	Development of micro credit scheme for primary waste collection		CD	↑
2)	Development of facilities/equipment for efficient primary collection and for linkage with secondary collection		CD	↑
3)	Implementation of training for primary collection service providers		CD	↑
4)	Organizing technical conferences on primary collection			2005-2007

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
4	**Program for Initial Implementation of Ward Solid Waste Management System (20 Wards)**	**WMD**	**CD**	↑
1)	Training for Ward Solid Waste Management Organizations		CD	↑
2)	Training for primary collection service providers		CD	↑
3)	Baseline surveys		CD	↑
4)	Planning workshops at ward level		CD	↑
5)	Making agreements between Ward SWM Committee and primary collection service providers		CD	↑
6)	Coordination conferences among stakeholders		CD	↑
7)	Community meetings to develop/improve primary collection activities		CD	↑
8)	Improvement of rickshaw vans, community containers and DCC containers		CD	↑
9)	Implementation of awareness program		CD	↑
5	**Program for Expansion of Ward Solid Waste Management System Citywide**	**WMD**	**CD**	**2007-2015**
6	**Slum Solid Waste Management Program**	**WMD**	**CD, SDD**	↑
1)	Implementation of awareness program integrated with health education		CD, SDD	↑
2)	Implementation of slum solid waste management project integrated with slum development project		CD, SDD	↑
7	**Program for Promoting IEC Activities for Raising People's Awareness**	**WMD**	**CD**	**2007-2010**
1)	Establishment of Public Awareness Section under Community Solid Waste Management Division		CD	↑
2)	Training for staff of Public Awareness Section		CD	↑
3)	Development and Production of IEC Materials		CD	↑
8	**Strengthening of School Education on Solid Waste**	**MOPME**	**WMD**	**2007-2015**
1)	Development of curricula regarding solid waste		WMD	↑
2)	Training for school teachers		WMD	↑
9	**Organization of Clean Dhaka Ward Contest**	**WMD**	**CD**	**2007-2010**
10	**Organization of Bangladesh Solid Waste Management Conference**	**WMD**	**CD of DCC, CCC, RCC, KCC**	**2005-2007**

Note: WMD（Waste Management Division/Department in future）; CD (Conservancy Department); SDD (Slum Development Department); MOPME (Ministry of Primary and Mass Education); DCC (Dhaka City Corporation); CCC (Chittagong City Corporation), RCC (Rajshahi City Corporation); KCC (Khulna City Corporation)

B.2 Secondary Collection/Transport and Road/Drain Cleaning

Table B.2 Projects/Programs of Secondary Collection/Transport and Road/Drain Cleaning

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Increase of Collection/Transport Capacity**			
1)	Procurement of New Trucks & Waste Containers	ED	CD, TD	2005-2015
2)	Increase of Drivers and Container Cleaners	CD, TD	-	↑
2	**Formation of Management Chain in SWM**	**WMD**	**CD, TD**	**2005-2007**
3	**Setting up Operation and management Plan**			
1)	Improvement of Waste Container	↑	CD, TD, ED	2005-2007
2)	phase-out of dustbins and appropriate setup of containers	↑	CD, TD, ED	2005-2015
3)	development of GIS for SWM	↑	CD, TD, UPD	↑
4)	Introduction of Mechanized Cleaning Equipment	ED	CD, TD	↑
5)	Surface Drain Construction	↑	CD, TD	↑
6)	shortening time for vehicle repair	↑	CD, TD	↑
4	**Capacity Development of Driver and Cleaner**	WMD	**CD, TD**	**2005-2010**
5	**Mitigation of Health Risks to Cleaners and Drivers**	↑	**CD, TD**	**2005-2010**
6	**Pursuit of Privatization of Collection/Transport**	↑	**CD, TD**	**2005-2010**
7	**Coordination with Recycle Industry**	↑	**CD**	**2005-2010**

Note: ED (Engineering Department); WMD（Waste Management Division/Department in future）; CD (Conservancy Department); TD (Transport Department), UPD (Urban Planning Department)

B.3 Final Disposal

Table B.3 Projects/Programs of Final Disposal

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Improvement of Existing Matuail Dump Site**	**WMD**	**CD, ED**	**2005-2007**
2	**Securing Future Landfill Site**	**WMD**	**CD, ED**	**2005-2015**
3	**Closure of Berri Band Dump Site**	**WMD**	**CD, ED**	**2007-2010**
4	**Establishment of Management Organization for Final Disposal**	**WMD**	**CD, ED, TD**	**2005-2007**
5	**Capacity Development of Disposal Section**	**WMD**	**CD, ED**	**2005-2007**

Note: ED (Engineering Department); WMD（Waste Management Division/Department in future）; CD (Conservancy Department); TD (Transport Department)

B.4 Legal Aspect

Table B.4 Projects/Programs of Legal Aspect

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Clarifying Responsibility Allocation with DCC and Waste Generators**	**WMC, WMD**	**UPD, CD**	**2005-2010**
1)	standardization of procedure for container deployment		UPD, CD	2005-2007
2)	change of responsibility allocation for removal and disposal of business waste		LGD, MOEF	2007-2010
2	**Compliance with Environmental Conservation Act/ Rules and Preservation Act**	**WMC, WMD**	**CD, ED**	**2007-2015**
1)	fulfilling responsibility for proper disposal		CD, ED	↑
2)	formulation and implementation of Environmental Management Plan (EMP) for Matuail dump site in accordance with Environmental Conservation Rules		CD, ED	↑
3)	reconfirmation of compliance of new landfill sites with Preservation Act		CD, ED	2005
3	**Enforcement of Section 150 against Illegal Garbage Throwing and Dumping**	**CD**	**WMD, Magistrates**	**2007-2015**
4	**Legal Training to DCC Staff**	**WMD**	**CD, ED, TD, UPD**	**2007-2015**

Note: WMC (Waste Management Committee), WMD（Waste Management Division/Department in future); CD (Conservancy Department); TD (Transport Department), ED (Engineering Department); UPD (Urban Planning Department), AD (Accounts Department), LGD (Local Government Division in the Ministry of Local Government, Rural Development and Co-operatives); MOEF (Ministry of Environment and Forests)

B.5 Organization

Table B.5 Projects/Programs of Organization

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Preparation of Annual Operation Plan according to Master Plan**	**WMC, WMD**	**CD, ED, TD, AD**	**2007-2015**
2	**Improvement of Operational Organization**	**WMC, WMD**	**CD, TD, ED**	**2005-2010**
1)	transfer transport functions to Zone Office		CD, TD	2007-2008
2)	improvement of vehicle and equipment maintenance		CD, TD, ED	2005-2010
3	**Reforming Organization for SWM**	**WMC, WMD**	**CD, TD, ED, UPD, AD, ESD**	**2005-2012**
1)	one department with planning/monitoring and implementing functions related to SWM (phased development of future organization)		CD, TD, ED, UPD, AD, ESD	2005-2012
2)	change composition of WMC		CD	2007-2012
4	**Training of DCC Staff for SWM**	**WMD**	**CD, ED. TD, UPD**	**2007-2015**
1)	technical training for junior engineering staff		CD, ED. TD, UPD	↑
2)	preparation of reference library for research and self-study		CD, ED. TD, UPD	2007-2015

Note: WMC (Waste Management Committee), WMD（Waste Management Division/Department in future）; CD (Conservancy Department); TD (Transport Department), ED (Engineering Department); UPD (Urban Planning Department), AD (Accounts Department), ESD (Establishment Department)

B.6 Financial Management

Table B.6 Projects/Programs of Financial Management

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Modification of Accounting system to Exhibit Actual SWM Cost explicitly**	**WMD**	**AD**	**2005-2012**
2	**Financing for Master Plan Implementation**	**WMC, WMD**	**AD**	**2005-2015**

Note: WMC (Waste Management Committee), WMD（Waste Management Division/Department in future）; AD (Accounts Department)

B.7 Privatization

Table B.7 Projects/Programs of Privatization

	Title of Program/ Program Components	Executing Body	Concerning Body	Time of Execution
1	**Continuation of Pilot Project on Privatization with In-depth Evaluation for Expansion of Privatization**	**WMD**	**CD, TD, UPD**	**2005-2012**

Note: WMD（Waste Management Division/Department in future）; CD (Conservancy Department); TD (Transport Department), UPD (Urban Planning Department)