OFFICE OF THE DEPUTY PRIME MINISTER
MINISTRY OF LOCAL GOVERNMENT
REPUBLIC OF KENYA

CITY COUNCIL OF NAIROBI

PREPARATORY SURVEY FOR INTEGRATED SOLID WASTE MANAGEMENT IN NAIROBI CITY IN THE REPUBLIC OF KENYA

FINAL REPORT
VOLUME 1 EXECUTIVE SUMMARY

OCTOBER 2010

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD.

NJS CONSULTANTS CO., LTD.

All Kenyan Shilling amounts including project costs shown in this report are stated in 2010 prices unless otherwise indicated. The amounts were estimated based on foreign prices by applying currency exchange rates for interbank rates as of 1st of June 2010; namely, USD1 = KSh 75.8 = JPY 91.35.

PREFACE

In response to a request from the Government of Republic of Kenya, the Government of Japan decided to conduct “The Preparatory Survey for Integrated Solid Waste Management in Nairobi City” and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Masakazu Maeda of CTI Engineering International Co., Ltd. and consisted of experts from CTI Engineering International Co., Ltd. and NJS Consultants Co., Ltd. from October 2009 to October 2010.

The study team held discussions with the Kenyan counterparts and conducted field surveys at the study area. Upon returning to Japan, the study team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the study and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the Kenyan counterparts for their close cooperation extended to the study.

October 2010

Izumi Takashima
Vice-President
Japan International Cooperation Agency

October 2010

Mr. Izumi Takashima
Vice-President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir:

We are pleased to submit herewith the Final Report on the Preparatory Survey for Integrated Solid Waste Management in Nairobi City in the Republic of Kenya.

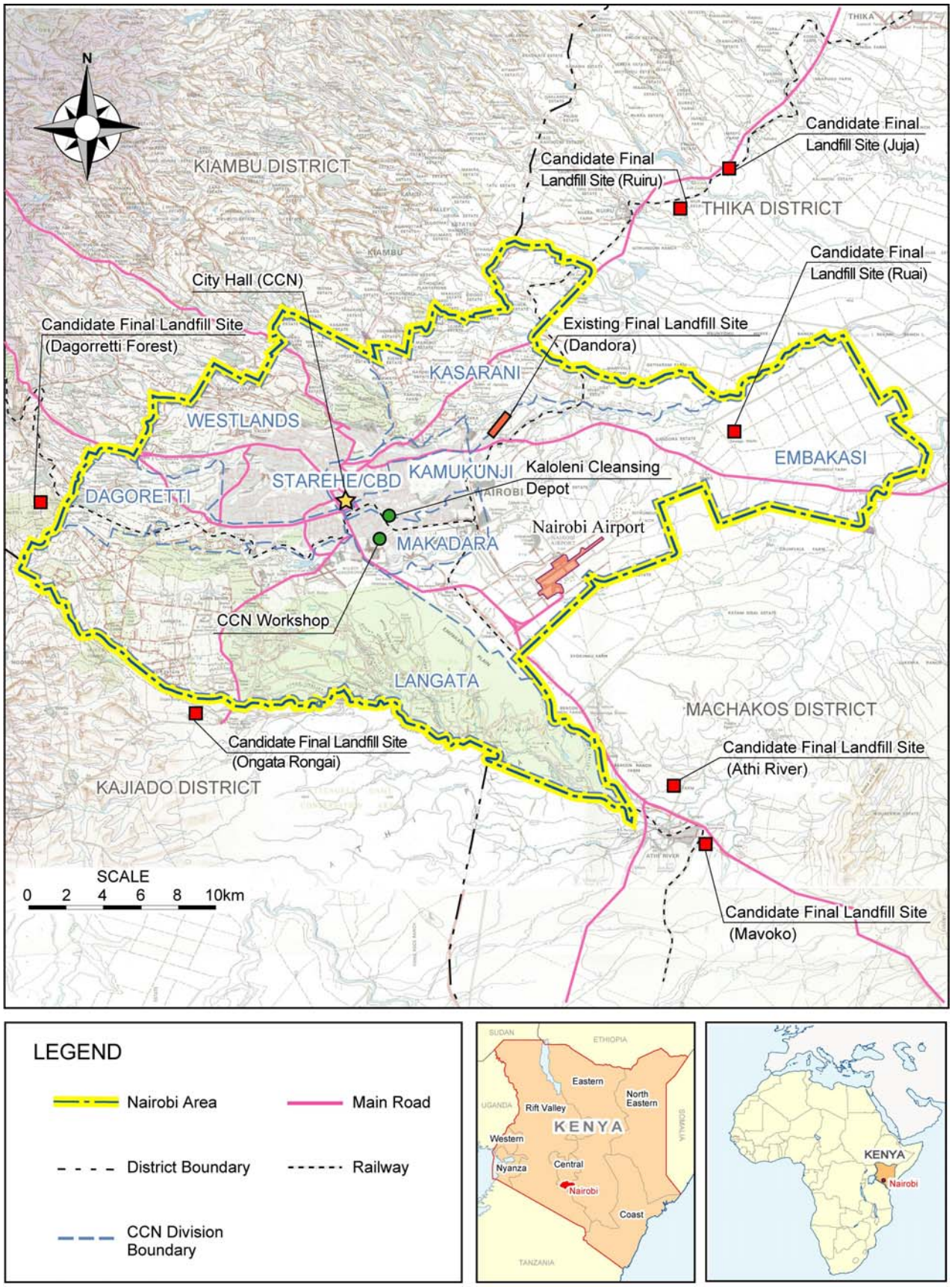
The survey was conducted by CTI Engineering International Co., Ltd. and NJS Consultants Co., Ltd., under a contract with the Japan International Cooperation Agency (JICA) during the period from October 2009 to October 2010. In conducting the survey, particular attention was paid to the review of the previous master plan formulated by JICA in 1998 and to its update to formulate a new master plan of solid waste management (SWM) for Nairobi City. In view of the urgency and necessity to improve public cleanliness and public health and protect the environment, action plans are proposed in the new master plan and technical viability and financial affordability are identified. We recommend that the Government of the Republic of Kenya and the City Council of Nairobi, the executing agency, should promote all of the action plans to the next stage of project implementation at the earliest possible opportunity.

We wish to take this occasion to express our sincere gratitude to the Government of Japan, particularly, JICA, the Ministry of Foreign Affairs, and other offices concerned. We also wish to express our deep appreciation to the Office of the Deputy Prime Minister and the Ministry of Local Government, the City Council of Nairobi and other authorities concerned in the Government of the Republic of Kenya for the close cooperation and assistance extended to the JICA Survey Team during the preparatory survey.

Finally, we sincerely hope that the results of the survey will contribute to the solution and/or mitigation of solid waste management problems in Nairobi City and that the amicable relationship between both our countries will further continue in the future.

Very truly yours,

Masakazu Maeda
Team Leader
Preparatory Survey for Integrated
Solid Waste Management in Nairobi City



LOCATION MAP

COMPOSITION OF FINAL REPORT

Volume 1 EXECUTIVE SUMMARY

Volume 2 MAIN REPORT

Volume 3 SUPPORTING REPORT

- **Section A Waste Amount and Composition Analysis**
- **Section B Organisational, Institutional and Human Resources Development Study**
- **Section C Collection and Transportation Study**
- **Section D 3R and Intermediate Treatment**
- **Section E Final Disposal**
- **Section F Public and Establishment Awareness for SWM**
- **Section G Environmental and Social Considerations**
- **Section H Financial and Economic Aspect**
- **Section I Hazardous Waste Management**

Volume 4 DATA BOOK

OUTLINE OF THE SURVEY

1. GENERAL

1.1 Objective of the Survey

The objectives of the Survey are as follows:

(1) To review the current situation of waste management in Nairobi City and revise the existing Master Plan; and

(2) To develop human resources for solid waste management (hereinafter referred to as "SWM") in the course of the Survey with full commitment of the concerned authorities of the Government of Kenya.

1.2 Survey Area

The Survey covers the whole area of Nairobi City as shown in the Location Map, which includes six (6) landfill candidate sites outside of Nairobi City.

1.3 Types of Solid Waste

The types of solid waste to be surveyed are limited to household waste, market waste, commercial waste, street sweeping waste and office waste. The survey on hazardous waste including medical waste and e-waste is limited to only the policy suggestions and recommendations in the Master Plan.

2. IDENTIFICATION OF KEY ISSUES AND PROBLEMS

There are many causes preventing the City Council of Nairobi (CCN) from conducting better SWM services. The major problems listed below are considered to be the key issues on master plan formulation, but the low rate of waste collection especially in low income and slum areas and the lack of financial sources have been identified in the survey as the two core problems that shall be solved more urgently.

(1) Low level of waste collection rate
(2) Lack of spare parts and long procedure for procurement of parts
(3) Few involvement of CCN on waste reduction and resource recovery
(4) Illegal and uncontrolled disposal of waste
(5) Open dumping and no ample space available at the Dandora Dumpsite
(6) Inefficient institutional and organisational arrangements of CCN
(7) Uncontrolled private sector involvement on waste collection services
(8) Lack of financial sources for investment and operation
(9) Improper budgetary system failing to secure financially sound operation
(10) Lack of public awareness on SWM problems facing the city

3. FRAMEWORK OF THE MASTER PLAN

3.1 Vision of Solid Waste Management in Nairobi City

The vision of solid waste management in Nairobi City is proposed in the UNEP Integrated Solid Waste Management Plan (ISWMP) as follows:

"A healthy, safe, secure and sustainable solid waste management system fit for a world-class city"

3.2 Mission of Solid Waste Management in Nairobi City

The mission of solid waste management in Nairobi City is proposed in the UNEP ISWMP, as follows:

(1) To improve and protect the public health of Nairobi residents and visitors;

(2) To protect ecological health, diversity and productivity; and

(3) To maximise resource recovery through the participatory approach.

3.3 Goals of Solid Waste Management in Nairobi City

The goals of solid waste management in Nairobi City are proposed in the UNEP ISWMP, as follows:

(1) To significantly extend resource recovery, including but going beyond the creation of enabling environments and the development of markets for recyclables;

(2) To build (awareness and capacity for) source separation as essential components of sustainable waste management;

(3) To restructure and extend efficient and equitable collection of source-separated waste streams with the view of protection of public health and the environment; and

(4) To build environmentally sound infrastructure and systems for safe disposal of residual waste, replacing current disposal sites which must be rehabilitated.

3.4 Planning Directions of the Master Plan

The Master Plan of SWM Improvement in Nairobi is formulated in three stages of action plans, namely; the first implementation stage (short-term plan covered from 2011 to 2015); the second implementation stage (mid-term plan covered from 2016 to 2020); and the third implementation stage (long-term plan covered from 2021 to 2030). The Master Plan is formulated through two approaches: (1) technical approach; and (2) institutional and financial approach, and composed of eight programmes as follows:

Technical Approach of Master Plan

Programme 1: Collection and Transportation Plan

Programme 2: 3R and Intermediate Treatment Plan

Programme 3: Final Disposal Plan

Institutional and Financial Approach of Master Plan

Programme 4: Organisational Restructuring and Human Resources Development Plan

Programme 5: Legal and Institutional Reform Plan

Programme 6: Financial Management Plan

Programme 7: Private Sector Involvement Promotion Plan

Programme 8: Community Participation Promotion Plan

4. BASELINE PROJECTION OF POPULATION AND SOLID WASTE GENERATION

The population projection shows the growth rate of approximately 3% per annum from 2008 to 2030, and the future solid waste generation by the year 2030 is estimated based on the field survey results, as shown below.

Baseline Projection of Population and Solid Waste Generation in Nairobi

Year	2009	2010	2015	2020	2025	2030
Nairobi Population ('000)	3,040	3,150	3,760	4,420	5,150	5,940
Waste Generation (ton/day)	1,848	1,924	2,353	2,831	3,378	3,990

Sources: Central Bureau of Statistics Kenya (CBSK) and *"World Economic Outlook"*, 2010, IMF, and the JICA Survey Team

5. FORMULATION OF THE MASTER PLAN

5.1 Main Goals and Major Action Plans

The main goals and action plans of the Master Plan are as tabulated below.

Main Goals and Major Action Plans of the Master Plan

Programme	Main Goals	Major Action Plans
Technical Approach		
Programme 1: Collection and Transportation Plan	• 100% of collection coverage rate in 2030 • Formulation of nine (9) franchisees for the implementation of PPPP (Public-Private-People Partnership)[*1] scheme	• Implementation of urgent waste collection plan • Procurement of waste collection vehicles for CCN/ Solid Waste Management Public Corporation (SWMPC) zones[*2] • Implementation of regular station collection in CCN/SWMPC zones • Construction of access roads to slum areas in CCN/SWMPC zones • Implementation of waste collection PPPP Scheme
Programme 2: 3R and Intermediate Treatment Plan	• Waste reduction ratio of 10% to the potential waste discharge amount in 2030 • Total resource recovery amount of about 450 tons per day or the equivalent ratio of about 16 % to the potential waste collection amount in 2030	• Establishment of 3R & Intermediate Treatment Task Force in DoE • Public campaign and education • Introduction of home composting and community composting • Construction of central composting plants
Programme 3: Final Disposal Plan	• Reduction of secondary pollution from Dandora Dumpsite by urgent improvement work • Operation of an effective sanitary landfill • Preparation of post-closure plan • Minimisation of secondary pollution	• Implementation of Dandora Dumpsite Urgent Improvement Plan • Closure of the existing dumpsite at Dandora • Construction of a new final disposal site at Ruai • Cleanup and closure of illegal dumpsites
Institutional and Financial Approach		
Programme 4: Organisational Restructuring and Human Resources Development Plan	• Establishment of the new public-owned and ring-fenced corporation • Establishment of transparent financial management for SWM services • Improvement of the organisational structure and staff capacities of the public-owned corporation	• Establishment of SWMPC • Creation of SWM Special Account • Implementation of Comprehensive Capacity Development Programme (CCDP) • Formulation of standard working procedures and manuals • Continuous operation of revolving funds and provision of subsidies • Continuous organisational assessment and feedback to organisational improvement of SWMPC • Continuous capacity assessment and feedback to capacity development of SWMPC staff
Programme 5: Legal and Institutional Reform Plan	• Legalisation of establishment of the new SWMPC • Strengthening and modification of monitoring and enforcement functions of the legal framework • Legalisation for simplification of the procurement and contractual process for SWMPC • Legalisation of financial assistance system for the enlargement of investment for private collection services	• Improvement of monitoring and enforcement in SWM By-law • Legalisation of Act for establishment of SWMPC • Amendment of Procurement and Disposal Act • Legalisation of establishment of SWM Special Account • Legalisation of establishment of revolving funds and franchise fees • Legalisation of Public-Private Partnership Act • Legalisation of consolidated SWM Act

Programme	Main Goals	Major Action Plans
Programme 6: Financial Management Plan	• Sustainable and stable increase of revenue with the revision of waste charging system for level and collection system of waste charges • Assurance of fair competition and suitable waste charge level for all SWM service providers with application of the new waste charging system • Improvement of collection rate of waste charge and increase of revenue by monitoring and supervising the collection of waste charges of all SWM service providers	• Establishment of cost accounting system for SWM • Establishment of waste charging system for households • Revision of waste charging system for business establishments • Execution of new waste charging system for SWMPC • Review and revision of waste charging system for SWMPC • Financial review of revolving funds and level of franchise fee
Programme 7: Private Sector Involvement Promotion Plan[*3]	• Delivery of services in low income areas by the concept of cross-subsidy and introduction of new collection service boundaries • Establishment of efficient and reliable private sector involvement scheme for the collection services, and final disposal and intermediate treatment facilities through SWMPC • Establishment of financial assistance system for the enlargement of investment for the improvement of private collection services	• Establishment of PPP (Public-Private Partnership)Structure for Collection and Transport • Establishment of PPP Structure for Sanitary Landfill Site and Intermediate Treatment Facilities • Implementation of Contractual Procedures for Franchise and Service Contracts • Continuous and Long-Term Performance Monitoring of Franchisees and Service Providers • Continuous and Long-Term Management and Auditing of Revolving Funds • Management of PPPP Manifestos
Programme 8: Public Participation Promotion Plan	• Strengthening of coordination among CBOs, CCN and residents on SWM • Enhancement of knowledge of CBOs to improve their collection services • Enhancement of residents' awareness to get their participation in SWM and to promote 3R • Regular collection services given by CBOs • Regular environmental education at primary schools	• Establishment of Public Awareness, Environmental Education and Community Participation (PEC) Unit • Raising Public Awareness through Mass Campaign • Planning, Implementation and Monitoring of Community-Based Organisation's (CBO's) Waste Collection Plan • Planning , Implementation and Monitoring of Environmental Education Plan for Communities and Educational Institutions • Implementation of Comprehensive Community-Based Solid Waste Management

Note: [*1] The PPPP (Public-Private-People Partnership) concept is construed to mean that all parties involved should have equal rights and obligations in accordance with the agreement among them to ensure the sustainability of public services such as solid waste management.

[*2] CCN/SWMPC zones mean the areas where CCN or SWMPC would exclusively collect and transport wastes without the involvement of private service providers.

[*3] The proposed PPPP scheme shall be developed by expanding the traditional PPP (Public-Private Partnership) scheme to also involve the communities concerned.

5.3 Urgent Projects

Action plans have been formulated for each component of the Master Plan; however, the start-up of these plans will take more time due to financial arrangements. To avoid making the city's environmental situation worse than the present, the following plans should be urgently implemented utilising the City Council of Nairobi's own budget, or subsidies from the central government. These costs consist of operation and maintenance cost of the CCN's own vehicles and/or cost of contractout for private service providers.

- Dandora Dumpsite Urgent Improvement Plan (Cost: KSh 680 million, including regular O&M from 2011 to 2016)
- Plan of Cleanup of Illegal Dumpsites (Cost: KSh 23 million in 2014)
- Urgent Waste Collection Plan (Cost: KSh 7 million from 2011 to 2014)

5.4 Preparatory Actions

Establishment of the Solid Waste Management Public Corporation (SWMPC) is an integral part of the Master Plan. To implement the action plans proposed in the Master Plan, especially the preparation for the establishment of the SWMPC, the preparatory actions described in the Recommendation below are required to be conducted by the middle of year 2011.

5.5 Financial and Economic Evaluation

The total project cost based on financial and economic prices is as summarised below.

Project Cost of the Master Plan (in Million KSh)

No.	Name of Project	Project Cost	
		Financial	Economic
1	Collection and Transport Plan (Direct Haul to Ruai)	5,590	4,870
2	3R and Intermediate Treatment Plan	1,018	876
3	Final Disposal Plan	14,487	11,788
4	Community Participation Promotion Plan	328	276
5	Preparatory Survey for the Next Implementation Stage	Not Applicable	150
6	Capacity Development Programme	Not Applicable	367
Total Project Cost		**21,423**	**18,327**

The Financial Internal Rate of Return (FIRR) is figured out to be 5.8%, which is more than the 0.55% cut-off ratio for a project to be considered as financially viable, and the Economic Internal Rate of Return (EIRR) of 11.6% is almost the same as 12.0% as the cut-off ratio to be judged as economically viable in case of the direct waste collection/transportation system and the scenarios of waste charge levels and collection rates given below.

Waste Charge Level of Households by Income Level

Income Level	Waste Charge Level (KSh/Household)	Collection Rate (%)
High	650	70
Middle	300	60
Low	170	50

6. CONCLUSION

The target collection rate of 100% in year 2030 is an ideal goal for all the residents of Nairobi, so that plans for pursuing this goal are to be carried out with dedication and dispatch. To realise the Vision of SWM for Nairobi City, the proposed projects in the Master Plan should be carried out because implementation of the action plans will bring large benefits to the residents of Nairobi.

7. RECOMMENDATIONS

The JICA Survey Team recommends that the Government of the Republic of Kenya and the City Council of Nairobi (CCN) should carry out the action plans proposed in the new Master Plan of Solid Waste Management (SWM MP), from year 2011. The urgent projects, namely; the Dandora Dumpsite Urgent Improvement, the Cleanup of Illegal Dumpsites, and the Urgent Waste Collection, should be conducted by firstly using their own funds while the implementation of some of the other major components are expected to be arranged with financial assistance from foreign donors.

In addition, the Government of the Republic of Kenya as well as the City Council of Nairobi (CCN) should prepare for the establishment of the Solid Waste Management Public Corporation (SWMPC) in order to proceed to the next stage of project implementation at the earliest possible time.

With regard to project implementation, the following actions are recommended to be carried out with dedication and dispatch:

Priority 1: Setup of the Preparatory Unit (PU) in the Department of Environment (DoE) for the SWM Public Corporation (SWMPC);

Priority 2: Preparation for the Construction of New Sanitary Landfill Site and Closure of Dandora Dumpsite;

Priority 3: Preparation for the Creation of SWM Special Account;

Priority 4: Preparation for the Drafting of By-law for the Establishment of SWMPC; and

Priority 5: Preparation for the Introduction of Step-wise Franchise System.

PREPARATORY SURVEY
FOR
INTEGRATED SOLID WASTE MANAGEMENT
IN NAIROBI CITY
IN
THE REPUBLIC OF KENYA

FINAL REPORT

VOLUME 1

EXECUTIVE SUMMARY

TABLE OF CONTENTS

Location Map i
Composition of Final Report iii
Outline of the Survey v
Table of Contents xi
List of Tables xiii
List of Figures xiii
Abbreviations and Acronyms xiv

1. GENERAL S-1
1.1 Background of the Survey S-1
1.2 Necessity of the Survey S-1
1.3 Objectives of the Survey S-2
1.4 Survey Area S-2
1.5 Types of Solid Waste S-3
1.6 Survey Schedule and Staff S-3

2. IDENTIFICATION OF KEY ISSUES AND PROBLEMS S-3
2.1 Institutional, Organisational and Human Resources Development Issues S-3
2.2 Collection and Transportation System S-4
2.3 3R and Intermediate Treatment S-5
2.4 Final Disposal S-6
2.5 Public and Establishments' Awareness of SWM S-7
2.6 Environmental and Social Considerations S-8
2.7 Financial and Economic Aspect S-10
2.8 Hazardous Waste Management S-11

3. FRAMEWORK OF THE MASTER PLAN S-13

3.1 Principles and Guidelines on the Establishment of SWM Framework S-13

3.2 Vision, Mission and Goal of Solid Waste Management in Nairobi City S-14

3.3 Planning Strategy S-15

3.4 Planning Directions of the Master Plan S-15

4. BASELINE PROJECTION OF POPULATION AND SOLID WASTE GENERATION S-16

4.1 Population Projection S-16

4.2 Projection of Waste Generation S-16

5. FORMULATION OF THE MASTER PLAN S-17

5.1 Collection and Transportation Plan S-17

5.2 3R and Intermediate Treatment Plan S-19

5.3 Final Disposal Plan S-21

5.4 Organisational Restructuring and Human Resources Development Plan S-22

5.5 Legal and Institutional Reform Plan S-25

5.6 Financial Management Plan S-27

5.7 Private Sector Involvement Promotion Plan S-29

5.8 Community Participation Promotion Plan S-32

6. URGENT PROJECTS AND PREPARATORY ACTIONS S-34

6.1 Urgent Projects S-34

6.2 Preparatory Actions S-35

7. IMPLEMENTATION SCHEDULE AND COST S-37

8. PROJECT EVALUATION S-41

8.1 Financial Evaluation S-41

8.2 Economic Evaluation S-43

8.3 Technical Evaluation S-45

8.4 Social Evaluation S-46

8.5 Environmental Evaluation S-46

8.6 Organisational and Institutional Evaluation S-46

9. CONCLUSION S-47

10. RECOMMENDATIONS S-47

LIST OF TABLES

Table S2.1	Major Recyclable Materials in Nairobi Domestic Waste	S-6
Table S3.1	Waste Category and Management Responsibility	S-13
Table S3.2	Parties Involved in Solid Waste Management and their Responsibilities	S-14
Table S4.1	Population Projection in Nairobi City	S-16
Table S4.2	Projection of Waste Generation in Nairobi City	S-16
Table S8.1	Scenarios for Waste Charge Level of Households by Income Level	S-41
Table S8.2	Project Cost of the Master Plan (Financial Price)	S-42
Table S8.3	Indicators for Financial Evaluation of the Master Plan	S-42
Table S8.4	Scenario for WTP by Income Level.	S-43
Table S8.5	Project Cost of the Master Plan (Economic Price)	S-44
Table S8.6	Summary of Economic Evaluation of the Master Plan	S-45

LIST OF FIGURES

Figure S7.1	Required Actions and Cost for Implementation of Each Component of the Master Plan (Programme 1 to 4)	S-39
Figure S7.2	Required Actions and Cost for Implementation of Each Component of the Master Plan (Programme 5 to 8)	S-40

ABBREVIATIONS AND ACRONYMS

Organisations, Programmes and Projects

CBO	:	Community-Based Organisation
CBSK	:	Central Bureau of Statistics Kenya
CCDP	:	Comprehensive Capacity Development Programme
CCN	:	City Council of Nairobi
DoE	:	Department of Environment
GOJ	:	Government of Japan
GOK	:	Government of Kenya
JICA	:	Japan International Cooperation Agency
LATF	:	Local Authority Transfer Fund
MoLG	:	Ministry of Local Government
NEMA	:	National Environment Management Authority
NGO	:	Non-Governmental Organisation
NPO	:	Non-Profit Organisation
PEC	:	Public Awareness, Environmental Education and Community Participation
SWMPC	:	Solid Waste Management Public Corporation
UNEP	:	United Nations Environment Programme

Technical Terms

ATP	:	Affordability to Pay
BPO	:	Business Process Outsourcing
CBD	:	Central Business District
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
FIRR	:	Financial Internal Rate of Return
GRDP	:	Gross Regional Domestic Product
IEE	:	Initial Environmental Examination
ISWMP	:	Integrated Solid Waste Management Plan
JPY	:	Japanese Yen
KSh	:	Kenyan Shilling
MDG	:	Millennium Development Goal
MP	:	Master Plan
MRF	:	Material Recovery Facility
PA	:	Preparatory Action
PCM	:	Project Cycle Management
PPP	:	Public-Private Partnership
PPPP	:	Public-Private-People Partnership
PU	:	Preparatory Unit
3R	:	Reduce, Reuse, Recycle
SCF	:	Standard Conversion Factor
SWM	:	Solid Waste Management
USD	:	United States Dollar
VAT	:	Value-Added Tax
WTP	:	Willingness to Pay

1. GENERAL

1.1 Background of the Survey

The City of Nairobi is the capital of the Republic of Kenya and the largest administrative, commercial and industrial centre of the country. The city has been experiencing rapid population growth largely due to rural-urban migration and natural rate of increase, and the population of the city is presently estimated at 3 million people. As a result of this rapid increase in population, the generation rate of solid waste as of 2009 is estimated at approximately 1,850 tons/day.

A half of the present solid waste generation is left uncollected or illegally dumped inside the city and the remaining is carried to a final disposal site. The final disposal site, however, is an open dumping type landfill and this, therefore, has a detrimental effect on the surrounding environment. Since this situation is creating problems in hygienic, environmental as well as aesthetic conditions of Nairobi City, solid waste management is an urgent issue requiring prompt resolution.

From 1996 to 1998, the Government of Japan (hereinafter referred to as "GOJ") carried out ***The Study on Solid Waste Management in Nairobi City in the Republic of Kenya*** through its technical assistance programme. This study included the formulation of a master plan composed of a collection and transportation plan, a waste reduction and recycling plan, and a final disposal plan. A feasibility study was also implemented, and an institutional and legal restructuring plan, a private sector involvement and financial improvement plan, a waste collection system improvement plan, and a construction plan of a new final disposal site were proposed in the study. Based on the master plan and feasibility study results, the City Council of Nairobi (hereinafter referred to as the "CCN") had established environmental regulations, promoted private sector involvement and conducted institutional restructuring, including the reduction of personnel expenses.

On the other hand, the construction of a new landfill site and improvement of waste collection system could not be carried out due to insufficient funds from the Government of Kenya (hereinafter referred to as "GOK"). Under the circumstances, the Ministry of Environment and Mineral Resources, GOK and the United Nations Environment Programme (hereinafter referred to as "UNEP") formulated the ***"Nairobi Rivers Rehabilitation and Restoration Programme"*** in July 2008, aiming to improve the environmental condition in the Nairobi River Basin. Illegal dumping and wastes discharged from many slums along the rivers have resulted in the pollution of rivers in Nairobi, so that an integrated solid waste management system for Nairobi City is essential as one of the components of the Programme.

The GOK had requested technical assistance from the GOJ to formulate the integrated solid waste management plan for Nairobi City and conduct a feasibility study regarding the construction of a new final disposal site and a transfer station for solid wastes. In response to the request, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programmes of the GOJ, had decided to undertake the ***Preparatory Survey on Integrated Solid Waste Management in Nairobi City in the Republic of Kenya*** (hereinafter referred to as "the Survey") in August 2009.

1.2 Necessity of the Survey

Kenya's national economic plan, i.e., Kenya Vision 2030, states in the social strategy that Kenya is to become a clean, secure, and sustainable environment by the year 2030. To realise this strategy, the plan also explains the importance of improvement of pollution and waste management. Additionally, the National Solid Waste Management Strategy drafted by the Office of Deputy Prime Minister and the Ministry of Local Government in 2008 provides a framework to help meet the Kenya Vision 2030 and the Millennium Development Goals (MDGs) in terms of health, poverty reduction and protection of the environment.

In general, the main driving forces for the development and modernisation of solid waste management (SWM) are as portrayed below.

- Public Health
- Environment
- Resource Value of Waste
- Climate Change

Public Health: Uncollected and then accumulated waste in the streets increases contact possibilities and offers very good conditions for the propagation of germs, insects, rats and other disease vectors. Also, those wastes often clog drains and result in the stagnation of water, the breeding of mosquitoes or the contamination of water bodies from which the population normally takes water for consumption, cooking and cleaning.

Environment: Uncollected waste brings contamination of water, air and land, and the same phenomenon might occur even if the waste is collected but uncontrolled. Especially, the contaminated water, leachate, should be minimised and not released into the groundwater and surface water. Moreover, a pile of waste is often burned spontaneously causing the emission of toxic substances to the air like dioxins.

Resource Value of the Waste: Many waste pickers are working on the streets and disposal sites. They collect and use or sell materials recovered from waste. This kind of activity can be seen anywhere in the world and from old times up to now, and it secures the livelihood of millions of people in informal settlements.

Climate Change: Proper waste management and promotion of 3R (reduce, reuse, recycle) will contribute to the reduction of greenhouse gas emissions, such as methane and carbon dioxide. Methane forms when organic materials decompose in the absence of air, a process called anaerobic decomposition. Application of a sanitary landfill method will bring the semi-aerobic conditions of the site and reduce the methane emissions.

As explained in **Chapter 2 of Volume 2, Main Report**, the above four (4) issues coincide with the present situation in Nairobi; in other words, the low level of waste collection rate and the illegal and uncontrolled disposal sites are the two major problems on SWM in Nairobi. Definitely, therefore, the development and modernisation of SWM is required for the implementation of a proper SWM as the result of the review and updating of the previous master plan (1998) in the Survey.

1.3 Objectives of the Survey

The objectives of the Survey are as follows:

(1) To review the current situation of waste management in Nairobi City and revise the existing Master Plan; and

(2) To develop human resources for solid waste management (hereinafter referred to as “SWM”) in the course of the Survey with full commitment of the concerned authorities of the Government of Kenya.

1.4 Survey Area

The Survey covers the whole area of Nairobi City, which includes six (6) landfill candidate sites outside of Nairobi City, as shown in the Location Map.

1.5 Types of Solid Waste

The types of solid waste to be surveyed are limited to household waste, market waste, commercial waste, street sweeping waste and office waste. The survey on hazardous waste including medical waste and e-waste is limited to only the policy suggestions and recommendations in the Master Plan.

1.6 Survey Schedule and Staff

The Survey, in principle, is to be carried out through the field works in Kenya and the home office works in Japan from end of October 2009 to early October 2010. The total duration of the Survey is approximately 11 months. The Survey is divided into three phases, namely; Phase I, which focuses on the dissemination of survey contents and the establishment of the implementation system of the Survey; Phase II, which conducts a basic survey; and Phase III, which includes updating of the current master plan of SWM. Reports are to be submitted in accordance with the schedule. A workshop, seminar and other meetings are to be held in each survey phase.

The organisation for the Survey is composed of the Steering Committee, the Technical Working Group and the JICA Survey Team with the Kenyan counterparts. The function of the Steering Committee and the Technical Working Group is to assure the smooth implementation of the Survey and the effective use of the survey results.

2. IDENTIFICATION OF KEY ISSUES AND PROBLEMS

2.1 Institutional, Organisational and Human Resources Development Issues

(1) Inefficient Organisational Structure and Improper Management

The Department of Environment (DoE) of CCN is primarily responsible for providing and regulating the SWM services in the City of Nairobi. However, the DoE is experiencing difficulties in the efficient provision of SWM services because of chronic organisational, institutional and human resources development constraints. This inefficient operation of the SWM services is attributed to the following inefficient organisational structure and improper management of the solid waste management services:

- Over-staffing under the complicated vertical structure;
- Overlapping and duplication of responsibilities of staff;
- Poor intra-departmental and inter-departmental coordination and communication;
- Unclear individual mandates and job descriptions;
- Unaccountable and slow decision-making of managers;
- Insufficient monitoring of individual work performance; and
- No standardised and planned working procedure.

(2) Improper Zoning for SWM Services

The current zoning for the waste collection and transportation services is basically based on constituency boundaries, and there is currently no concept on the internal cross-subsidising system where revenue from high-income zones is transferred to a fund in order to provide SWM services to the low income zones. At present, private service providers are charging various levels of collection fees in the different zones, reflecting the lack of a proper zoning system for cross-subsidisation.

(3) Lack of Information on Costing for SWM Services by Private Operators

Although a proper tariff setting for private service providers is also essential for the sustainable provision of SWM services, financial and costing information such as variable cost, fixed cost, total

cost and break-even point for the services provided by the private service providers are not accurately calculated.

(4) Vulnerable Private Sector

Private service-providers have difficulties in making their collection vehicles serviceable and in increasing the number of vehicles to improve their collection services due to lack of financial resources. This is partly because overhead and depreciation costs for vehicles are not completely included in their contracts and the payment to private contractors are also often delayed due to the slow payment procedure in CCN.

(5) Complicated Procedures for Procurement of Spare Parts and Maintenance

Due to the complicated procurement procedure adopted by the CCN, it takes a long time for it to repair its grounded collection vehicles. The complicated procedure of procuring spare parts is a critical institutional barrier to the sustainable provision of SWM services. It has been revealed that the main reason for the large number of unserviceable vehicles is the long time it takes for the Treasury Department to provide the necessary budget for the procurement of spare parts due to the complicated procurement process stipulated in the current Procurement and Disposal Act.

(6) Insufficient Budget for SWM Services

There is a chronic shortage of revenue in the CCN with its high independence from subsidies provided by the Central Government. This financial constraint results in:

- The total expenditure of the DoE is far less than the required amount to improve the coverage and level of SWM services;
- The budget for outsourcing to private contractors is severely limited; and
- The budget for maintenance such as the procurement of spare parts and repair of collection vehicles is also extremely limited.

(7) Insufficient On-the-Job Training for SWM-Related Personnel

Due to the insufficient budget for human resources development and training programmes, no budget is presently allocated for the on-the-job training programmes required for the solid waste management sector. Most of the budget for human resources development for personnel of the DoE is spent for dispatching DoE's staff to academic institutions and international conferences.

(8) Insufficient Monitoring and Enforcement of Legal Framework

The monitoring and enforcement of SWM services are currently carried out by the CCN and the National Environment Management Authority (NEMA). However, due to the insufficient monitoring and enforcement system, the current legal framework does not function well. Therefore, it is absolutely necessary to strengthen the system of monitoring, as well as the inspection and enforcement provisions in the current acts, regulations and by-laws related to SWM services.

2.2 Collection and Transportation System

The biggest problem in the present collection and transportation system in Nairobi City might be the low collection rate of only 33%. This fact seems to be due to the complicated technical, financial, legislative, institution and socio-economic issues. The following problems are presumed:

(1) Private Sectors beyond the Control of CCN

There are plenty of actors on collection and transportation, and there are many other actors who are illegally operating and not managed by the CCN. The CCN's lack of operation, resources and

management capacity seems to make the operation of the various actors disorderly. Reorganisation and government control is mandatory for establishing an appropriate SWM.

(2) Lack of Enforcement or Inspection Capacity in Administrative Bodies

The mandate to waste generators, collectors and transporters is clearly stipulated in the law or the by-law, including the mandate to administrators concerning inspection or monitoring of practices on waste generation and discharge of waste generators. Actually, however, the inspection and monitoring capacity seems to be weak. Capacity development of administrators is required to enhance their capability on this aspect.

(3) Inefficient Operation of Collectors and Transporters

It is difficult to state that the collection and transportation practices of the actors are efficient because of the poor performance of their collection vehicles. In addition, waste pickers tend to disturb the unloading operation of transporters at the Dandora open dumping site because of the vehicles without a tipping function which also causes the extremely inefficient operation of the transporters. Improvement and upgrading of vehicles are required.

(4) Illegal Dumping Sites Scattered in a Wide Area

Illegal dumping sites are scattered in a wide area all around the city. Various reasons are presumed, such as the absence of garbage container at those places, the very low collection frequency of collection vehicles, or the residents' weak affordability to pay collection fees to the Community-Based Organisations (CBOs). The installation of containers, improvement of CCN's collection system or the increase of collection frequency is required.

2.3 3R and Intermediate Treatment

(1) Recovery of Recyclable Materials and Biodegradable Waste

Recovery of recyclable materials is carried out by the waste pickers in town, waste collection service workers and the waste pickers at the Dandora Dumpsite, at the junkshops and by the junk dealers/middlemen. The number of waste collection vehicles identified was 256, and each vehicle has 2 to 3 collection workers to collect waste.

CCN carried out a preliminary survey at the Dandora Dumpsite and identified 611 waste pickers in five groups in April 2010. The total number of waste pickers is estimated to be in the range of 1,200 to 1,500. The number of waste pickers in town was not surveyed. The number of junk dealers identified and surveyed was 19 at the Dandora Dumpsite and 24 in town. Junk dealers handling recyclable materials at the Dandora Dumpsite was estimated to be 30 to 40 groups in total.

On average, each junkshop handles about 1.2 tons of recyclable materials per month or 40 kg per day. Each broker trading recyclables from Dandora handles about 370 kg per day while the brokers in town handle about 550 kg per day.

Fifteen (14) recyclers/factories are registered in Nairobi. The total recycling amount by the nine (9) recyclers surveyed reaches 148 tons per day in total, including 67 tons of scrap metal, 50 tons of metal, 23 tons of plastics and 8 tons of paper.

Approximately 30 to 50 groups including CBOs, companies and community groups engage in the composting of biodegradable wastes. Fifteen of the identified composting groups handle raw materials estimated to be 3.4 to 4.4 tons per day. Assuming that the number of composting groups is 40, the current total raw material input is estimated to be about 9 to 12 tons per day.

The major recyclable materials in the Nairobi domestic waste surveyed by the JICA Survey Team for the new SWM Master Plan of 2010 and those recorded by the SWM Master Plan of 1998 are as tabulated below.

Table S2.1 Major Recyclable Materials in Nairobi Domestic Waste

Waste Type	JICA SWM Master Plan, 2010	JICA SWM Master Plan, 1998
Paper	14.0% (weighted average)	10.5 - 19.1%
Plastics	10.9% (weighted average)	4.1 – 16.1%
Glass	1.5% (weighted average)	1.5 – 3.8%
Metals	0.7% (weighted average)	1.3 – 4.2%
Food Waste	62.4% (weighted average)	48.6 - 67.0%

Currently, the overall material recovery ratio is estimated at about 5%, through the survey on junkshops, dealers/middlemen and recyclers/factories. However, the sorting of recyclable materials at the waste generation sources, residential houses and workplaces is not taking place due to the social movement.

(2) Issues on the Implementation of 3R and Intermediate Treatment Plans

The major issues concerning the implementation of the 3R and intermediate treatment plans implicate the following:

- Clear policies, purposes and strategies of 3R and intermediate treatment by CCN and the government agencies concerned;
- Activation of the current inactive status of source segregation by the waste generators including residential, commercial shops, institutional buildings, etc.;
- Support of CCN or the government agency(s) concerned to stabilise the buying/selling price of each type of recyclable material;
- Technical and financial capability of CCN to implement the project for development of intermediate treatment facilities; and
- Technical and financial capabilities of CCN to promote home composting, community composting and central composting through the provision of sufficient information and instructions to the actors, residents, CBOs/NGOs/NPOs and CCN on composting activities.

2.4 Final Disposal

(1) Assessment of Current Condition

The Dandora Dumpsite is the only official dumpsite currently operating in Nairobi and where wastes collected from the city are dumped. It is an open dumping site located at approximately 7.5 km northeast from the centre of Nairobi that commenced land-filling operations in 1981. It covers a large area of approximately 46 ha, but only 2 ha consisting of a former stone quarry filled-in at the start of operations is owned by the City Council of Nairobi (CCN) while the remaining area is privately owned land. The site is adjoined by residential houses on the east and west and a school to the south. The Nairobi River flows past the north side.

The amount of waste carried into the Dandora Dumpsite is weighed by the truck scales installed at the site entrance in 2006. The total amount of waste so far disposed at the site is estimated to be approximately 3,500,000 tons while the landfill volume is estimated to be around 1.8 million m^3. The amount in 2009 was 220,000 tons. Three (3) privately owned heavy equipment were hired to operate at the Dandora Dumpsite; however, earth covering is not carried out and there is hardly any appropriate landfill management being undertaken. There are also approximately 70 illegal dump sites scattered throughout the city and wastes collected by the private collectors are dumped at these sites. Besides, wastes in slums and low income residential areas are dumped illegally along the road sides and in vacant open spaces.

In addition, there is the Kayole temporary dumpsite located at approximately 13 km from the city centre, which used to be a former stone quarry with the capacity of approximately 930,000 m^3. This temporary dumpsite commenced landfill operations in 2009, mainly receiving wastes of

approximately 400 tons per day from the cleaning activities in the Nairobi River, etc. Although the Kayole temporary dumpsite is managed by the National Environment Management Authority (NEMA) and wastes from Nairobi are not supposed to be dumped at this site, in reality, wastes are being dumped there by the private collectors from the city. The site is also an open dumping site on which no management activity apart from weighing is carried out.

(2) Identification of Issues

Since the Dandora is an open dumping site and landfill management is not adequately conducted thereat, negative impacts on the local environment such as health risks among the local residents are being imparted due to the littering of waste and the generation of odour, landfill gas, etc. Accordingly, it is necessary to establish a new landfill site close the Dandora Dumpsite as quickly as possible.

As for the Kayole temporary dumpsite which started operating only in 2009, so far, no negative impact has been confirmed on the local environment. However, if land-filling is continued in the current open dumping state, there is concern over the generation of landfill gas, etc. Accordingly, it is desirable to take improvement measures such as earth covering and installation of gas exhaust pipes.

2.5 Public and Establishments' Awareness of SWM

To know the current waste management situation in the different sectors and the level of awareness of the respondents on SWM, an awareness interview-survey was conducted on (a) households, (b) establishments including commercial establishments, institutions and hospitals, and (c) waste pickers. The major findings of the survey and the evaluations are as summarised below.

(1) Households

(a) The high and middle income areas are well serviced with waste collection. The lowest rate of collection comes from the slum areas where solid wastes are disposed by the residents along the roads, river banks, open spaces, etc.

(b) More than 70% of all respondents have not received any guidance or instruction on methods of proper waste disposal.

(c) Almost 70% of the respondents had not participated in any public education programme on SWM.

(d) From the survey results, it can be concluded that there is a necessity of implementing educational programs to residents to raise or create awareness on proper waste management in Nairobi City.

(2) Establishments, Institutions and Hospitals

Commercial Establishments and Institutions

From the survey, it can be concluded that all of the establishments and institutions sampled are covered with collection services and more than half are satisfied with the service. However, a high rate had never received guidance on SWM, reflecting the low awareness of proper waste management.

Hospitals

From the survey it can be concluded that a high rate of hospitals interviewed contract-out SWM services, such as the collection of general and medical wastes, and hospitals have in-house education programmes on SWM.

(3) Waste Pickers

From the survey it can be concluded that no official registry exists on the number of waste pickers at the Dandora Dumpsite although the number of waste pickers at the Dumpsite is estimated from 1,200 to 1,500. However, some CCN officials had estimated that the number of waste pickers is 600 and that half of them would like to continue scavenging at the site and would protest if the site is closed.

(4) Public Awareness and Environmental Education

The major findings and evaluations of the survey on public awareness and environmental education are as summarised below.

(a) The current curricula of primary education focus on general environment and no specific theme is developed in the sector of SWM.

(b) Teachers of primary schools do not have instruction materials on SWM.

(c) The DoE of CCN does not have at present a unit to implement regular programmes to educate the people on solid waste aspects.

(d) NEMA conjointly with the DoE has developed good initiatives for raising awareness of the general public.

(e) The NGOs are well recognised for their assistance to the communities in the implementation of small projects besides conducting environmental education for awareness creation.

(f) CBOs are playing an important role in providing collection services and in the recycling of garbage, especially in the slum and low income areas.

2.6 Environmental and Social Considerations

The current situation of the environment and the social aspects related to solid waste management in Nairobi City were surveyed utilising available information in the institutions of the sector and through field observation. Major findings and evaluations of the survey are as summarised below.

(1) General Condition

Water

It is concluded that the quality of rivers in Nairobi is being deteriorated by pollutants from the domestic sector (sewage and solid waste), agricultural sector (agrochemicals) and industrial sector (wastewater).

Sewage

The main problem affecting public health is the lack of proper sewage disposal because the area of Nairobi is partially served by sewer lines. It was noted that sewage in the slum areas is diverted to open channels, finally reaching the watercourses thereby deteriorating river water quality.

Air Quality

Main sources of air pollution that affect the City of Nairobi are the vehicles, industries, emissions from the use of charcoal or firewood, open-burning of waste, and the unsanitary waste disposal sites.

(2) Environmental Problems due to Solid Waste

Water Pollution

Leachate is generated at many collection points and at the existing disposal sites, polluting the rivers in Nairobi. It was observed that solid wastes are dumped intentionally along the roads or the riverbanks by the resident. This fact brings as a consequence the transfer of uncollected wastes to the rivers, drains, streams and lowland areas every time Nairobi experiences intensive rains.

Air Pollution

Actually the sources of air pollution in Nairobi City are vehicular emission, factory emission and the haphazard generalised burning of wastes.

Landscape

In the City of Nairobi could be observed the proliferation of illegal disposal sites along the roads, beside the rivers and in open spaces. This fact brings about the degradation of the city environment, presenting an unhealthy landscape to residents and visitors alike.

Soil Contamination

The designated disposal site in Dandora had received in the past not only domestic waste but also hazardous waste due to the lack of control of the public sector. Since there have been no remedial action to restore the place up to the present, it is assumed that the soil is still contaminated with some heavy metals.

(3) Social Problems due to Solid Waste

Situation of Waste Pickers

Waste pickers interviewed by the JICA Survey Team pointed out that their daily income depends on what they obtain from waste, because they have no other option or opportunity to earn money for subsistence. Generally, waste pickers work at the disposal sites without using any kind of equipment and materials to protect them from the unsanitary condition of those sites.

Public Health

Many of the observed solid waste collection points in the city became open temporary disposal sites because CCN could not provide regular collection services. The presence of offensive odour, smoke and disease vectors such as cockroaches, rats, flies and mosquitoes that bring negative impact to public health was noted at these collection points and disposal sites, and, according to the officials of CCN, residents living in and around the dumpsite would like to receive relief from air pollution caused by the burning of waste.

(4) Initial Environmental Examination (IEE)

Ruai Candidate Site for Final Landfill

As a conclusion of the survey, the Ruai site could be used for developing a sanitary landfill with consideration on necessary mitigation measures to be provided. This site is one of the most suitable due to the limited settlements in the vicinity and its large area. In addition, there are no significant socio-economic activities at the site.

Juja Candidate Site for Final Landfill

As a conclusion of the survey, the Juja site could be used for waste disposal taking the provision of the mitigation measures into account. The proximity of the site to Nairobi City and the Thika County Council means that the site could be used by both urban centres with a view to sharing the costs.

Mavoko Candidate Site for Final Landfill

As a conclusion of the survey, the site could be used for developing a sanitary landfill site with due consideration on necessary mitigation measures. This site is one of the most suitable due to its large area and its far location from human settlements. The site could be shared by CCN and the Mavoko Municipality.

Dandora Candidate Site for Transfer Station

As a conclusion of the survey, the Dandora site could be for used for constructing a transfer station and a material recovery facility (MRF) after the sanitary closure of the open dumping site with due consideration on necessary mitigation measures. The public health of the vast population living around the site would improve with the closure of the existing open dumping site.

Langata Candidate Site for Transfer Station

As a conclusion of the survey, the Langata site could be used for constructing a transfer station with due consideration on necessary mitigation measures. Since the site is a sensitive area due to its proximity to tourist areas and recreational facilities, the strict monitoring of operations should be implemented to avoid any negative impact.

Kibera Candidate Site for Transfer Station

As a conclusion of the survey, the Kibera site could be used for constructing a transfer station with due consideration on the necessary mitigation measures. The public health of the vast number of population living in Kibera will improve, together with the improvement of collection and transportation of garbage from the area through the transfer station. An additional land needs to be acquired to meet the requirement of the proposed transfer station.

2.7 Financial and Economic Aspect

(1) Socio-Economic Situation

Population is a major driver of environmental change in Nairobi and is a determinant of other parameters such as solid waste generation rate, land-use pattern and settlement, and water consumption. The population of Nairobi grew from 2.1 million in 2000 to 3.2 million in 2010 at the annual growth rate of 4.3%. The city area has expanded from 18.13 km^2 in 1906 to 696 km^2 in 2005, and population density has increased from 635 person/km^2 to 3,954 person/km^2 during the 99 years from 1906 to 2005.

The City of Nairobi is a major centre of tourism in the region. Its relative proximity to many tourist attractions both in Kenya and East Africa makes it an asset of great importance in the tourism sector. The total number of visitors to parks and game reserves in Kenya was 1,634 thousand, of which 576 thousand were visitors to the Nairobi National Park, the Nairobi Safari Park and the Nairobi Mini Orphanage in 2008.

Manufacturing in Nairobi consists of many small and medium-sized industries. These include industries manufacturing steel products, plastic goods, soap, flour, vegetable oil, canned fruit and fruit juice, horticulture, and dairy and poultry farming. The most vibrant industry in Nairobi City is the service-based industry with business process outsourcing (BPO). The service industry contributes 59.2 percent of Nairobi's GDP as compared to 24 percent from agriculture, followed by the manufacturing industry.

The average annual inflation rate in Nairobi decreased from 13.2 per cent in 2004 to 11.4 per cent in 2005, but increased to 25.9% in 2008. The fall in inflation rate is more pronounced in lower income groups, where the inflation rate decreased from 14.4 to 11.7 per cent over the same period of 2004 to 2005.

(2) Affordability and Willingness to Pay

The affordability to pay (ATP) is estimated at 89.7 KSh/month for slum areas, 152.9 KSh/month for low income areas, 328.6 KSh/month for low-middle income areas, 768.8 KSh/month for middle income areas and 1,017.4 KSh/month for high income areas. The willingness to pay (WTP), on the other hand, is estimated at 7.7 KSh/month for slum areas, 31.9 KSh/month for low income areas, 35.3 KSh/month for low-middle income areas, 96.2 KSh/month for middle income areas and 193.0 KSh/month for high income areas. It became clear that the ATP and the WTP are closely related to the income level so that the new waste charging system has taken into account the ATP and the WTP by income level. The ATP and WTP of business establishments are estimated at 20,197 KSh/month and 692 KSh/month respectively. Waste charges for business establishments are comparable to the existing waste charging system and the ATP and WTP.

(3) Financial Situation of CCN for WM

In 2010/2011, the share of the total revenue and expenditure of DoE in the CCN is 0.29% and 5.1%, respectively, which are low allocations in the CCN in comparison with the other fifteen departments. These shares have been mostly constant these years due, mainly, to (i) the existing budgeting system of CCN where lower priority is given to the budget for DoE including solid waste management; (ii) no revenue from household waste in low income and slum areas because the collection of waste is focused on the Central Business District (CBD); and (iii) no direct financing from the GoK such as the Local Transfer Authority Fund (LATF) to the DoE.

(4) Waste Charging System

The CCN have not collected waste charges from households since 2002 when the water supply and sewerage works was privatized, but it has been collecting waste charges from business establishments since 2008. The CCN's system is set by unit rate per ton of waste by the category of business establishment, ranging from 100 KSh/ton to 5,000 KSh/ton. CCN collects waste charges from business establishments based on its unit rate. The collection and transportation subcontractors of CCN are paid on the basis of unit rate per ton of waste.

Private companies pay business permit fees to the CCN and permit fees for waste transportation to the National Environment Management Agency (NEMA). They execute contracts with the households and private corporations for the collection and transportation of waste and collect service fees. The average waste charges to households is 1,000 KSh/month for business establishments, 200 KSh/month for low income areas, 400 KSh/month for middle income areas and 600 KSh/month for high income areas. Judging from their financial statements, their financial situation is mostly profitable.

The CBOs collect wastes and transport them to the designated stations. They also collect waste charges from the waste generators based on their contract. The CBOs financial condition is also assumed to be profitable.

2.8 Hazardous Waste Management

(1) Present Condition of Hazardous Waste Management in Nairobi City

At present, the City Council of Nairobi (CCN) has no by-law to guide it in the management of hazardous waste, and it does not manage hazardous medical and industrial wastes effectively. The Environmental Management and Coordination Act of 1999 being enforced by NEMA deals with waste management through the provisions for setting of standards, licensing of waste disposal sites and control of hazardous waste, but no concrete guidelines and policies on the treatment and disposal of hazardous waste under the NEMA's management system has been implemented.

Medical Waste

There are 409 healthcare facilities operated by the government and private sectors in Nairobi City. The survey conducted by the JICA Survey Team estimated the generation of hospital waste at 1.68 kg/bed. This amount was computed based on the public awareness survey conducted for the current survey where the average waste generation amount from the 10 hospitals is about 345 kg/day while the average number of beds per hospital is 205. Based on the total number of 6,269 hospital beds in Nairobi and the waste generation rate mentioned before, the total medical waste is estimated to be approximately 11 ton/day.

Industrial Waste

There are 501 industries in Nairobi City. Based on the data collected from the industries, hazardous wastes being generated range from 1,100 kg/month to 1,330 kg/month. This gives an average of 40 kg/day of hazardous waste generated by each industry in Nairobi City, and the total amount is estimated to be approximately 20 tons per day.

E-Waste

A baseline e-waste study was conducted between December 2007 and April 2008 by the Kenya ICT Action Network. According to the report, the total e-waste generated from computers, monitors, and printers is about 3,000 tons per year, which is the result of the 200% rise recorded in 2007 compared with the previous year. The absence of a policy, legislative framework and a practical management system may cause a lot of e-waste remaining in storage and recycling or disposal in an unsafe and unsustainable manner.

(2) Evaluation of Current Hazardous Waste Treatment and Disposal System

The total generation of hazardous waste in Nairobi City is estimated at about 30 ton/day. The present hazardous waste generation amount is still within the incineration capacity of the private recyclers in Nairobi City. Residual ashes from incineration are dumped at the Dandora open dumping site at present. After the closure of the existing Dandora open dumping site, no disposal site for hazardous wastes will be available. Therefore, it may be necessary to provide a separate disposal cell in the new disposal site to accept the residual wastes after ensuring their harmless condition.

(3) Recommendations

The recommendations for improvement and development of the hazardous waste management system in connection with the implementation of the SWM Master Plan for Nairobi City are as summarised below.

(a) Legislative arrangement is required to clarify the responsibilities and obligations of the concerned parties, the central government, the local government units, the waste generators and the operators of treatment and disposal facilities.

(b) In order to effectively implement the provisions of Section 91 of the Environmental Management and Coordination Act of 1999, definite arrangement is required to standardise and enforce the following:

- Review of the current definition of hazardous waste under the Solid Waste Management Regulation of 2006 and standardise the handling methods.
- Annual update of the list of hazardous waste generators and regulate a quarterly-based reporting system to NEMA and to the local government units.
- Policies and regulations specifically on e-waste should be enacted and enforced. These should govern the handling process from collection to final disposal, and licensing of the handlers.

- In addition, the regulations on e-waste should clarify the responsibilities of the manufacturer and the importer, including second-hand goods, shops, and the consumers for disposing e-waste, and the charges for the cost of treatment and disposal. Developing an e-waste management system should be made under a multi-stakeholder process established with the participation of society.

(c) Provide a separate cell at the proposed sanitary landfill for the disposal of residual ashes from incinerators.

(d) As for the disposal of incineration residual ashes, receiving standards shall be prepared for each toxic substance and certified for final disposal by the accredited laboratory.

3. FRAMEWORK OF THE MASTER PLAN

3.1 Principles and Guidelines on the Establishment of SWM Framework

(1) Categories of Waste

CCN is responsible for the management of municipal waste. Municipal waste is defined in the Solid Waste Management By-law of 2007 as "waste which is the responsibility of the Council whether under these by-laws or under any other law to collect, treat and otherwise dispose of, and includes refuse." It is suggested that, for practical purposes, the types of municipal waste should be more clearly defined as the same types as those in the JICA Master Plan of 1998, as follows:

(a) Household waste
(b) Business waste of small amounts (less than 50 kg)
(c) Waste generated from public institutions such as schools
(d) Market waste
(e) Hospital waste that does not require any treatment
(f) Dead animals excluding domesticated animals (cows and pigs)
(g) Street waste excluding demolition waste dumped on streets
(h) Other wastes accepted by CCN as municipal waste

Non-municipal waste is waste that is not under CCN's responsibility but the responsibility of waste generators. Waste categories are as summarised in the table below.

Table S3.1 Waste Category and Management Responsibility

Kinds of Waste	Management Responsibility	Remarks
1. Municipal waste	CCN	CCN collects bulky waste upon receipt of a request from residents, by charging a special tariff.
2. Non-municipal waste 2-1 Non-hazardous industrial waste and commercial waste of large amount 2-2 Demolition waste 2-3 Discarded vehicles 2-4 Hazardous waste including infectious hospital waste	Generators of waste (CCN should monitor generators' management of non-municipal waste until they establish a proper management system for these wastes.)	CCN may accept waste 2-1 and 2-2 at its disposal site on full cost recovery basis. The central government should setup hazardous waste management (treatment) facilities.

(2) Responsibility of Central Government, CCN, Business Waste Generators and Residents

CCN must have the power and responsibility for organising solid waste management. There are other organisations involved in solid waste management in Nairobi as listed below.

- Central Government
- CCN
- Contractors
- Business (Industrial and Commercial) Waste Generators
- Residents

The principal responsibilities proposed for the respective organisations are given in the table below.

Table S3.2 Parties Involved in Solid Waste Management and their Responsibilities

Involved Parties	Responsibilities
1. Central Government	1) To formulate a national policy with respect to waste reduction, recycling and solid waste management. 2) To enact national SWM laws. 3) To set technical standards. 4) To research on solid waste management. 5) To ensure that the laws and regulations are enforced. 6) To provide guidance to local governments.
2. City Council of Nairobi	1) To formulate a local policy and prepare local strategies and plans (short and long term). 2) To finance SWM. 3) To levy a waste tax. 4) To formulate regulations. 5) To formulate guidelines with respect to: a) methods of discharging waste (types of containers to be used); b) the waste reporting requirements of business waste generators; and, c) recycling (types of waste to be recycled).
3. Contractors	1) To provide waste collection, haulage and street sweeping services under contractual arrangements.
4. Business (Industrial and Commercial) Waste Generators	1) To manage (collection, treatment and disposal) their waste except those accepted by the local government as municipal waste. 2) To submit reports on their waste (types, quantity, pre-treatment and other information) as required by the municipal regulations.
5. Residents	1) To reduce generation of waste. 2) To recycle. 3) To comply with the local government's waste collection procedure. 4) Not to litter waste. 5) To dispose discarded vehicles by using commercial enterprises.

3.2 Vision, Mission and Goal of Solid Waste Management in Nairobi City

(1) Vision of Solid Waste Management in Nairobi City

The vision of solid waste management in Nairobi City is proposed in the UNEP Integrated Solid Waste Management Plan (ISWMP), as follows:

"A healthy, safe, secure and sustainable solid waste management system fit for a world-class city"

(2) Mission of Solid Waste Management in Nairobi City

The mission of solid waste management in Nairobi City is proposed in the UNEP ISWMP, as follows:

(a) To improve and protect the public health of Nairobi residents and visitors;

(b) To protect ecological health, diversity and productivity; and,

(c) To maximise resource recovery through the participatory approach.

(3) Goal of Solid Waste Management in Nairobi City

The goal of solid waste management in Nairobi City is proposed in the UNEP ISWMP, as follows:

(a) To significantly extend resource recovery, including but going beyond the creation of enabling environments and the development of markets for recyclables;

(b) To build (awareness and capacity for) source separation as essential component of sustainable waste management;

(c) To restructure and extend efficient and equitable collection of source-separated waste streams with the view of protecting public health and the environment; and

(d) To build environmentally sound infrastructure and systems for safe disposal of residual waste, replacing current disposal sites which must be rehabilitated.

3.3 Planning Strategy

To achieve the goals, the strategic approach to formulate the SWM Master Plan for CCN are proposed with the following six (6) items in consideration of solving the implicated constraints of the city towards improvement of technical and institutional deficiencies:

- Financial strengthening of SWM
- Institutional capacity development
- Improvement of SWM operational capacity
- Enhancement of PPPP (Public-Private-People Partnership) in SWM
- Public awareness and participation of CBOs and NGOs
- Promotion of 3R (reduce, reuse, recycle)

3.4 Planning Directions of the Master Plan

(1) PCM Workshop

In order to further analyse the existing situation, the full-scale *"problem analysis"* as well as *"objective analysis"* using the PCM (Project Cycle Management) method was conducted on the occasion of the 2nd workshop on the 24th of March 2010. *"Problem Analysis"* is a method for graphically displaying the problematic environment related to the issues. The analysis lays problems out in a cause and effect tree with roots and branches showing relationships between problems. Roots represent causative factors and branches represent consequent effects. One problem in a tree is one of the causes of the problem located above as well as the effect of the problem located beneath. The participants came from various stakeholders, including CCN and central government officials, CBOs and NGOs.

In addition to this workshop, a workshop for CBOs was also held on the 26th of March 2010 with about 150 CBOs in Nairobi. Participants in this workshop came exclusively from the CBOs in Nairobi and they carried out *"Problem Analysis"* to identify problems encountered in their own communities.

As a result of these workshops, the major constraints on SWM in Nairobi were identified and confirmed, and the required components in the master plan were developed, as described below.

(2) Components of the Master Plan

The Master Plan of SWM Improvement in Nairobi was formulated in three stages of action plans, namely; the first implementation stage (short-term plan covered from 2011 to 2015); the second implementation stage (mid-term plan covered from 2016 to 2020); and the third implementation stage (long-term plan covered from 2021 to 2030). The Master Plan was formulated through two approaches: (1) technical approach; and (2) institutional and financial approach. The major planning items of the Master Plan as the result of the PCM Workshop are summarised as the following eight programmes.

Technical Approach to the Master Plan

Programme 1: Collection and Transportation Plan

Programme 2: 3R and Intermediate Treatment Plan

Programme 3: Final Disposal Plan

Institutional and Financial Approach to the Master Plan

Programme 4: Organisational Restructuring and Human Resources Development Plan

Programme 5: Legal and Institutional Reform Plan

Programme 6: Financial Management Plan

Programme 7: Private Sector Involvement Promotion Plan

Programme 8: Community Participation Promotion Plan

4. BASELINE PROJECTION OF POPULATION AND SOLID WASTE GENERATION

4.1 Population Projection

Based on the Polynomial Model for 2008 to 2030, the population projection shows a growth rate of approximately 3% per annum.

Table S4.1 Population Projection in Nairobi City

(Unit: 1,000)

Year	2008	2009	2010	2015	2020	2025	2030
Kenya	35,265	35,884	36,508	39,710	42,569	45,408	48,438
Nairobi	2,930	3,040	3,150	3,760	4,420	5,150	5,940
Share	8.31%	8.47%	8.63%	9.47%	10.38%	11.34%	12.26%

Source: Central Bureau of Statistics Kenya (CBSK) and *"World Economic Outlook"*, 2010, IMF, and the JICA Survey Team

4.2 Projection of Waste Generation

Solid waste generation by the year 2030 has been estimated based on the field survey results.

Table S4.2 Projection of Waste Generation in Nairobi City

Unit: ton/day

Year	2009	2015	2020	2025	2030
Residential	1,318	1,747	2,025	2,419	2,860
Commercial	439	538	675	806	953
Road	(60)	60	60	60	60
Market	90	111	131	152	176
Total	1,848	2,352	2,831	3,378	3,990

5. FORMULATION OF THE MASTER PLAN

5.1 Collection and Transportation Plan

(1) Objective

The overall objective of the Collection and Transportation Plan is to improve or expand the collection service coverage to the whole area of Nairobi City in order to maintain public health and cleanliness, and to protect the City's environment.

(2) Planning Policy

The basic policy of the Collection and Transportation Plan is to prioritise the optimum system, taking into consideration a timeframe of development and proper allotment of collection and transportation system synchronising with other sectors (especially transportation sector). For the low income and slum areas, the existing issues shall be identified and reflected in the planning to eliminate the obstacles for providing appropriate collection and transportation services.

(3) Strategy

(a) Technical alternatives of the collection and transportation system shall be studied to determine if they can bring the most efficient effect in terms of collection and transportation of solid waste from generation source to final disposal, as well as evaluated from the viewpoint of less impact on society and the environment.

(b) The development plan for collection and transportation vehicles or equipment shall be studied to determine if it corresponds to the most optimum system of collection and transportation including transfer system.

(c) The reformation of private sectors shall be required to enhance the administrative leadership of CCN in controlling the current disorder of their collection and transportation services. The administrative control of their services by zone or district could be one of the solutions. A more detailed approach towards better management of private sectors shall be discussed in the planning in parallel with the establishment of its organisation and institutional framework.

(d) As for the solid waste management in low income and slum areas, the key issues shall be identified in terms of waste generation, collection and transportation through the problem analysis approach such as group discussions for CBOs who are the main actors in these areas. Based on the results of identification, the optimum system of discharge and collection shall be studied in combination with the improvement of transportation system to be provided by CCN or its subcontractors to eliminate the factors causing illegal dumping at these areas.

(e) An action plan shall be prepared in a time frame of short, mid and long term to implement the most suitable development option of collection and transportation.

(f) The capital, operation and maintenance costs of collection and transportation in the above time frame shall be studied to examine the economical and financial viability of the solid waste management project.

(4) Goal

Short-Term Plan (2011-2015)

- Increase of collection rate from the current 33% up to 50% in 2015.
- Improvement of the city’s sanitary environment through the cleanup of littered wastes along the roadsides and on vacant lots.

- Formation of three (3) private franchisees for implementation of the PPPP scheme.
- Improvement of collection and transportation system through procurement of collection vehicles and introduction of the container system.

Mid-Term Plan (2016-2020)

- Increase of collection rate up to 65% in 2020.
- Formation of six (6) franchisees for implementation of the PPPP scheme.
- Improvement of collection and transportation system through procurement of collection vehicles and introduction of the container system.

Long-Term Plan (2021-2030)

- Increase of collection rate up to 100% in 2030.
- Formation of nine (9) franchisees for implementation of the PPPP scheme.
- Improvement of collection and transportation system through procurement of collection vehicles and introduction of the container system.

(5) Recommendations

- Comprehensive collection and transportation improvement to significantly improve the collection rate of wastes should be premeditatedly planned, implemented and monitored.
- The required collection vehicles and equipment to meet the massive demand of the comprehensive collection and transportation improvement plan should be deliberately procured.
- In order to significantly increase the collection rate of wastes in low income and slum areas, the station collection should be implemented on the regular basis.
- The accessibility to low income and slum areas should be significantly improved with proper investment.
- A well-organised collaboration with the private sector on collection services should be systematically implemented under the proposed PPPP scheme in the Private Sector Involvement Promotion Plan.

(6) Action Plan

Short-Term Plan (2011-2015)

- Formulation of Collection and Transportation Implementation Plan
- Monitoring of Implementation of Collection and Transportation Plan (Phase I)
- Implementation of Urgent Waste Collection Plan
- Procurement of Waste Collection Vehicles for the CCN/SWMPC Zone* (Phase I)
- Implementation of Regular Station Collection in the CCN/SWMPC Zone (Phase I)
- Construction of Access Road to Slum Areas in the CCN/SWMPC Zone (Phase I)
- Implementation of Waste Collection PPPP Scheme (Phase I)

Note:* CCN/SWMPC zones mean the areas where CCN or SWMPC would exclusively collect and transport wastes without the involvement of private service providers.

Mid-Term Plan (2016-2020)

- Monitoring of Implementation of Collection and Transportation Plan (Phase II)
- Procurement of Waste Collection Vehicles for the CCN/SWMPC Zone (Phase II)

- Implementation of Regular Station Collection in the CCN/SWMPC Zone (Phase II)
- Construction of Access Road to Slum Areas in the CCN/SWMPC Zone (Phase II)
- Implementation of Waste Collection PPPP Scheme (Phase II)

Long-Term Plan (2021-2030)

- Monitoring of Implementation of Collection and Transportation Plan (Phase III)
- Procurement of Waste Collection Vehicles for the CCN/SWMPC Zone (Phase III)
- Implementation of Regular Station Collection in the CCN/SWMPC Zone (Phase III)
- Construction of Access Road to Slum Areas in the CCN/SWMPC Zone (Phase III)
- Implementation of Waste Collection PPPP Scheme (Phase III)

5.2 3R and Intermediate Treatment Plan

(1) Objective

The 3R and Intermediate Treatment Plan is composed of the plans for waste reduction, recovery of resources, reuse, recycling and intermediate treatment. The objectives are as follows:

(a) The objective of the Waste Reduction Plan is to lighten the cost burden of CCN through the reduction of solid waste amount for collection and disposal.

(b) The objective of the 3R Plan is to save finite resources and minimise landfill space as a result.

(c) The objective of the Intermediate Treatment Plan is the stabilisation and reduction of residuals in addition to resource recovery through waste conversion.

(2) Planning Policy

(a) The Waste Reduction Plan shall be formulated under the condition that it will perform the role of each party, i.e., the role of the Government, local authorities and the beneficiaries.

(b) Solid waste recycling shall make use of the existing functions of the residents, junk shops, community-based organisations, NGOs and the recycling industries (recyclers) to the maximum extent.

(c) The Intermediate Treatment Plan shall be formulated with consideration on the applicable technology in Kenya so as not to cause a financial burden on SWM.

(3) Strategy

(a) Waste reduction shall be carried out to reduce discharge of domestic, commercial and other business wastes through participation of the consumers, shops, workplaces, CCN, and the government agencies concerned.

(b) CCN shall have the primary responsibility for promoting, guiding and assisting the residents, community groups, enterprises, and all other stakeholders for the establishment of recovery, reuse and recycling systems.

(c) Practical and initial solid waste recycling activities shall be carried out mainly through materials recovery by the waste generators at sources and the activities of waste pickers, waste collection workers and junkshops in town.

(d) Small-scale intermediate treatment shall be promoted through home composting and community level composting for recycling biodegradable waste.

(e) Large-scale intermediate waste treatment or waste conversion shall be introduced in the future.

(4) Goal

Short-Term Plan (2011-2015)

- Waste reduction ratio of 5% (0% in 2009) to the potential waste discharge amount in 2015.
- Total resource recovery amount of about 180 tons per day (86 tons per day in 2009) or the equivalent ratio of about 10% (5.3% in 2009) to the potential waste collection amount in 2015.

Mid-Term Plan (2016-2020)

- Waste reduction ratio of 10% to the potential waste discharge amount in 2020.
- Total resource recovery of amount about 270 tons per day or the equivalent ratio of about 12.5% to the potential waste collection amount in 2020.

Long-Term Plan (2021-2030)

- Waste reduction ratio of 10% to the potential waste discharge amount in 2030.
- Total resource recovery amount of about 450 tons per day or the equivalent ratio of about 16 % to the potential waste collection amount in 2030.

(5) Recommendations

- A Special Task Force to play the primary role of implementing the action plans on 3R and intermediate treatment should be established.
- Action plans requiring involvement of residents, communities and societies should be carried out in collaboration with the action plans of the Community Participation Plan.
- CCN should take the primary role in the promotion of 3R activities through the establishment of a linkage, coordination, support and incentives to the waste generators, communities, CBOs, NGOs, recycling industries, and government agencies.
- Enhancement of recovery of recyclable materials and biodegradable waste should be carried out through activation and enhancement of the existing systems to the maximum extent.
- Legislative measures should be considered for implementing effective and efficient waste reduction, waste recovery and waste recycling activities.
- Annual reports should be prepared for reporting the activities of the 3R and intermediate plans through accumulation of data, survey, analysis and evaluation of the activities.

(6) Action Plan

Short-Term Plan (2011-2015)

- Establishment of 3R and Intermediate Treatment Task Force
- Formulation of 3R Implementation Plan
- Formulation of Intermediate Treatment Implementation Plan
- Monitoring of Implementation of 3R Plan (Phase I)
- Monitoring of Implementation of Intermediate Treatment Plan (Phase I)
- Implementation of Waste Reduction Plan (Phase I)
- Implementation of Waste Recovery, Reuse and Recycling Plan (Phase I)
- Implementation of Intermediate Treatment Plan (Phase I)

Mid-Term Plan (2016-2020)

- Monitoring of Implementation of 3R Plan (Phase II)

- Monitoring of Implementation of Intermediate Treatment Plan (Phase II)
- Implementation of Waste Reduction Plan (Phase II)
- Implementation of Waste Recovery, Reuse and Recycling Plan (Phase II)
- Implementation of Intermediate Treatment Plan (Phase II)

Long-Term Plan (2021-2030)

- Monitoring of Implementation of 3R Plan (Phase III)
- Monitoring of Implementation of Intermediate Treatment Plan (Phase III)
- Implementation of Waste Reduction Plan (Phase III)
- Implementation of Waste Recovery, Reuse and Recycling Plan (Phase III)
- Implementation of Intermediate Treatment Plan (Phase III)

5.3 Final Disposal Plan

(1) Objective

In the concept of final process of solid waste management (SWM) system, the objective of the Final Disposal Plan is to have the solid waste stabilised and be hygienic to prevent secondary pollution.

(2) Planning Policy

The sanitary landfill is evaluated to be the most appropriate disposal method from both economic and environmental viewpoints. Therefore, the final disposal plan for the construction and operation of a sanitary landfill shall be formulated. Altogether, the closure plan for Dandora and the existing illegal dumping sites has to be considered as sanitarily as possible where the present reclamation is being performed.

(3) Strategy

(a) The scale of sanitary landfill facilities and their operation shall take financial availability into consideration. Due to financial constraints concerning SWM financing, the phased construction of the disposal site shall be also considered. (see **Volume 2, Main Report, page 4-58**.)

(b) The closure plan for Dandora and the existing illegal dumping sites shall take economical efficiency into consideration as if the influence on surrounding environment is made to reduce.

(4) Goal

Short-Term Plan (2011-2015)

- Reduction of secondary pollution from Dandora Dumpsite by urgent improvement works on the site.
- Preparation and commencement of construction of the new sanitary landfill site at Ruai.
- Reduction of number of illegal dumpsites in the city.

Mid-Term Plan (2016-2020)

- Minimisation of secondary pollution from Dandora Dumpsite by the closure work of the site.
- Preparation of a post-closure land use plan at Dandora.
- Operation of an effective sanitary landfill at Ruai.
- Elimination of major illegal dump sites in the city.

Long-Term Plan (2021-2030)

- Minimisation of adverse effects from the new landfill site by proper operation and management.

(5) Recommendations

- The Dandora dumpsite should be urgently improved.
- Construction of a new landfill site and closure of the Dandora Dumpsite should be carried out as quickly as possible.
- The sanitary landfill system should be introduced on the new landfill site.
- Illegal dumpsites in the city should be eliminated.

(6) Action Plan

Short-Term Plan (2011-2015)

- Formulation of the Dandora Dumpsite Closure Plan.
- Implementation of Dandora Dumpsite Urgent Improvement Plan (Phase I).
- Formulation of the New Landfill Site Construction Plan at Ruai (First Portion covered by 2025).
- Construction of the New Landfill Site at Ruai (First Portion covered by 2025) (Phase I).
- Cleanup of Illegal Dumpsites.

Mid-Term Plan (2016-2020)

- Implementation of Dandora Dumpsite Urgent Improvement Plan (Phase II).
- Implementation of Closure Work of the Dandora Dumpsite.
- Construction of the New Landfill Site at Ruai (First Portion covered by 2025) (Phase II).
- Operation and Maintenance of the New Landfill Site at Ruai (Phase I).
- Closure of Illegal Dumpsites.

Long-Term Plan (2021-2030)

- Formulation of the New Landfill Site Construction Plan at Ruai (Second Portion for utilisation after 2026).
- Construction of the New Landfill Site at Ruai (Second Portion for utilisation after 2026).
- Operation and Maintenance of the New Landfill Site at Ruai (Phase II).

5.4 Organisational Restructuring and Human Resources Development Plan

(1) Objective

The Organisational Restructuring and Human Resources Development Plan have two objectives, as follows:

(a) To comprehensively reorganise functions of the Department of Environment to the ring-fenced new public organisation so that it can effectively and efficiently manage its responsibilities and the solid waste management services; and

(b) To comprehensively strengthen the human resources capacity of candidate staff and workers to support the new organisation's functions.

(2) Planning Policy

(a) For the establishment of the new organisation in charge of solid waste management services, the function of the Department of Environment should be comprehensively reviewed in terms of organisational and individual capacity assessment;

(b) Responsibilities and obligations of the new organisation should not be fragmented or overlapping among the staff and workers;

(c) Linkages and coordination arrangements between the different departments in the new organisation should be efficient and effective;

(d) The organisational structure should be optimised in line with the selected structure of the Public-Private Partnership;

(e) The functions of the Department of Environment should be smoothly transferred to the new organisation; and

(f) Human resources development for providing solid waste management services should be comprehensively designed and implemented based on the results of the capacity assessment.

(3) Strategy

(a) The organisation of the Department of Environment should be comprehensively restructured to establish the new organisation based on the following concepts:

- Efficient and rationalised organisational structure with clear reporting lines, reasonable spans of control and number of levels of staff and workers, and the appropriate vertical structure to attain the operational efficiency of solid waste management;
- Clear assignment and delegation of responsibility and adequate authority to managers and supervisors with accountability for individual performance as well as simple workflow for a quick decision process;
- Streamlined workflow based on practical basis to avoid overlapping of the organisational structure;
- Clear-cut directing of functions from the strategic level down to middle management and supervisors;
- Effective and appropriate management information systems and other procedures;
- Periodic assessment and feedback of managers' performance and private operators based on the agreed performance targets and criteria; and
- Streamlined zoning of the service areas for the cross-subsidisation which makes the enlarged services to poorer areas possible.

(b) The following functions should be additionally performed by the new organisation:

- Management and regulation of the proper Public-Private Partnership (PPP) scheme; and
- Uplift of public awareness on best practices in solid waste management such as recycling, segregation, re-use and recovery, inculcating the culture of waste reduction and proper storage among producers and consumers.

(c) More practical human resources development including on-the-job training program based on the capacity assessment and feedback system to share job skills among staff and workers should be implemented.

(4) Goal

Short-Term Plan (2011-2015)

- Establishment of the new public-owned and ring-fenced corporation in charge of the overall solid waste management services by the end of 2014.
- Establishment of the preparatory organisation for the new public-owned corporation inside the Department of Environment by the middle of 2011.
- Establishment of transparent financial management for solid waste management services by the new public-owned corporation by the end of 2011.
- Strengthening of technical and managerial capacities of candidate staff of the new public-owned corporation with the support of external technical cooperation through implementation of a comprehensive capacity development programme during the 5-year period from 2011 to 2015.

Mid-Term Plan (2016-2020)

- Improvement of the organisational structure of the new public-owned corporation based on the feedback of results of the mid-term performance monitoring and assessment.
- Improvement of staff capacities of the new public-owned corporation based on the feedback of results of the mid-term performance monitoring and assessment on the capacity development programme.

Long-Term Plan (2021-2030)

- Improvement of the organisational structure of the public-owned corporation based on the feedback of results of the long-term performance monitoring and assessment.
- Improvement of staff capacities of the new public-owned corporation based on the feedback of results of the long-term performance monitoring and assessment on the capacity development programme.

(5) Recommendations

- The new publicly-owned SWM corporation should be established together with its preparatory organisation, replacing the current Department of Environment on time for the commencement of operation of SWM services under the new PPP scheme.
- In parallel with the establishment of the new corporation, the current practices and functions of the Department of Environment including the recommendations in the previous Master Plan should be implemented.
- A separate and transparent SWM account associated with the financial assistance mechanism to support capital investment on the improvement of collection and transport should be introduced.
- The comprehensive capacity development programme which is a wide range of multi-expertise capacity improvement mainly targeting the candidate staff of the new corporation, followed by the additional specific training programme, should be implemented.
- Continuous monitoring and assessment of the achievement level of the organisation restructuring should be periodically carried out to rectify the performance of the new corporation.

- Continuous monitoring and assessment of the achievement level of the human resources development should be periodically carried out to rectify the performance of the capacity development of the staff of the new corporation.

(6) Action Plan

Short-Term Plan (2011-2015)

- Establishment of the Preparatory Unit for Solid Waste Management Public Corporation (SWMPC).
- Establishment of the SWMPC.
- Rectification of Remaining Functions of DoE.
- Creation of SWM Special Account.
- Implementation of Comprehensive Capacity Development Programme (CCDP).
- Consideration of Incomplete Action Plans of the Previous Master Plan.
- Formulation of Standard Working Procedures and Manuals.

Mid-Term Plan (2016-2020)

- Start of Operations of Revolving Funds and Provision of Subsidies.
- Mid-Term Organisational Assessment and Feedback to SWMPC.
- Mid-Term Organisational Restructuring of SWMPC.
- Implementation of Ex-Post Mid-Term Performance Monitoring and Assessment on Comprehensive Capacity Development Programme (CCDP).
- Implementation of Skill-Targeted Follow-up Training Programme.

Long-Term Plan (2021-2030)

- Continuous Management of the Revolving Funds and Provision of Subsidies.
- Long-Term and Continuous Organisational Assessment and Feedback to SWMPC.
- Long-Term and Continuous Organisational Restructuring of SWMPC.
- Implementation of Long-Term Performance Monitoring and Establishment of Feedback System on CCDP.
- Long-Term and Continuous Staff Deployment and Redeployment of Staff of SWMPC.

5.5 Legal and Institutional Reform Plan

(1) Objective

The objective of the Legal and Institutional Reform Plan is to formulate and propose the most suitable legal arrangement which will enable the new organisation to effectively and efficiently regulate the solid waste management activities in Nairobi City.

(2) Planning Policy

(a) SWM-related Acts, Regulations and By-laws should be improved for better enforcement.

(b) The monitoring system should be strengthened for the better enforcement of acts, regulations and by-laws.

(c) Policy documents and guidelines should be transformed into actual enforcement.

(3) Strategy

(a) Enactment of the basic by-law for the establishment of the new organisation in charge of solid waste management services.

(b) Establishment and implementation of the system of inspection, enforcement and monitoring of solid waste management activities.

(c) Preparation of operation manuals with respect to the solid waste management services which must comply with the relevant acts, regulations and by-laws.

(d) Introduction of regulations to setup the basic PPP structure, proper zoning, tariff setting and cross-subsidisation for the proposed PPP scheme.

(4) Goal

Short-Term Plan (2011-2015)

- Legalisation of establishment of the new public-owned and ring-fenced corporation as well as transparent financial management for the solid waste management services.
- Strengthening and modification of monitoring and enforcement functions of the legal framework related to solid waste management.
- Legalisation of simplification of procurement and contractual process for the new public-owned corporation.
- Legalisation of financial assistance system for the enlargement of investment for the improvement of collection and transportation services by the private sector.

Mid-Term Plan (2016-2020)

- Selection and implementation of the optimum public-private partnership scheme through the arrangement of a comprehensive legal framework and procedures.
- Improvement of SWM-related acts, regulations and by-laws based on the feedback of the results of mid-term performance monitoring and assessment on the status of legal enforcement.

Long-Term Plan (2021-2030)

- Achievement of efficient legal enforcement by consolidating the SWM-related acts, regulations and by-laws into the comprehensive SWM legal framework.
- Improvement of the SWM-related acts, regulations and by-laws based on the feedback of results of the long-term performance monitoring and assessment of the status of legal enforcement.

(5) Recommendations

- A clear-cut process for monitoring and enforcement of the SWM-related legal framework should be additionally included in the SWM-related legal framework to strengthen the provisions of current acts, regulations and by-laws.
- The mandates, missions and functions of the new public-owned corporation should be formally legalised to enable it to legitimately provide the SWM services.
- For the new corporation to achieve an efficient procurement process, special legal arrangements to simplify the procurement procedure should be introduced.
- Financial mechanisms to support the new corporation and the private service providers based on the collected charges associated with proper auditing should be formally legalised.

- A comprehensive legal arrangement for more stable and long-term Public-Private Partnership should be formally introduced.
- A comprehensive legal arrangement for more efficient and long-term enforcement of the SWM-related legal framework should be formally introduced.

(6) Action Plan

Short-Term Plan (2011-2015)

- Improvement of Monitoring and Enforcement in the CCN SWM By-law 2007.
- Improvement of Monitoring and Enforcement in other SWM-related Legal Frameworks.
- Minor Modification of the CCN SWM By-law 2007.
- Legalisation of the Act for the Establishment of the SWMPC.
- Amendment of the Procurement and Disposal Act 2005.
- Legalisation of Establishment of SWM Special Account.
- Legalisation of Establishment of the SWM Capital Revolving Fund and SWM Operation and Management Revolving Fund.
- Legalisation of Franchise Fee.
- Legalisation of Operational Regulations on Subsidy Provision to Franchisees.

Mid-Term Plan (2016-2020)

- Legalisation of the PPP Act.
- Legal Arrangement of Auditing for the SWMPC and Revolving Funds.

Long-Term Plan (2021-2030)

- Legalisation of Consolidated SWM Act.
- Long-Term Monitoring and Enforcement of SWM-related Acts, Regulations and By-Laws.

5.6 Financial Management Plan

(1) Objective

The objective of the Financial Management Plan is to improve and strengthen the financial condition of SWM services and to support sound or sustainable operations.

(2) Planning Policy

(a) Suitable revenue should be secured for the effective operation and maintenance of SWM services.

(b) Cost effectiveness should be improved in the operation of SWM services.

(c) Financial planning for SWM services should be improved.

(3) Strategy

(a) Establishment of Financial Autonomy of SWM

Since generation of the general tax revenue by CCN is severely constrained and the situation is likely to remain for a considerable lapse of time, the Department of Environment must secure its own revenue for the operation of SWM services by establishing a special account whose revenue is

restricted to expenditures for SWM activities only. Especially, a cost accounting system should be established for the effective management of solid waste.

(b) Increase of Revenue through Charges

The expansion of collection area is the first priority to increase revenue from waste charges. It is necessary to improve the existing waste charging system for business establishments, especially the charge collection method, by raising the accuracy to measure the volume of collected wastes. The new waste charging system for households should take into account the willingness to pay, the affordability to pay, and the operation and management cost of solid waste management.

(c) Increase of Budgetary Allocation to SWM

The allocation for SWM in the DoE has a low priority and is not secured through direct allocation from the LATF. A thorough review on priority allocation of the budget is indispensable to increase the allocation for SWM and the DoE.

(d) Private Sector Involvement

Contracting a part of SWM services to private companies is expected to improve cost performance of the services as a whole and to contribute to the decrease of shortages of operational funds.

(4) Goal

Short-Term Plan (2011-2015)

- More detailed analysis of cost of waste treatment for a more cost-oriented waste charging system through the establishment of the cost accounting system.
- Increase of revenue of CCN/SWMPC with the establishment of the new waste charging system for households.
- Increase of revenue with the revision of the waste charging system for business establishments for sustainable and stable financial conditions.

Mid-Term Plan (2016-2020)

- More efficient SWM service provision through the newly established independent accounting system for SWMPC.
- Improvement of rationale and suitable relationship between waste charge and cost of waste management with the review of the cost accounting system for SWMPC.
- Further increase of revenue with the review of the waste charging system in relation to the level and the collection system for waste charges.

Long-Term Plan (2021-2030)

- Sustainable and stable increase of revenue with the revision of the waste charging system in relation to the level and the collection system for waste charges.
- Assurance of fair competition and suitable waste charge level for all SWM service providers with the application of the new waste charging system.
- Improvement of collection rate of waste charge and increase of revenue with the monitoring and supervision of the collection system of waste charges by all SWM service providers.

(5) Recommendations

- The cost accounting system for SWM should be established as soon as possible in order to establish the waste charging system that will be able to cover the cost for SWM.

- The current waste charging system for business establishments should be reviewed, and a new waste charging system for households should be created, if necessary.
- The Solid Waste Management Public Corporation (SWMPC) should be created, and a sustainable funding system should be established.
- The financial soundness and sustainability of the SWMPC should be assured.
- The cost accounting system for SWM should be reviewed, and the waste charging systems should be revised, if necessary.
- Application of the new waste charging systems should be tried by all SWM service providers and their management systems should be monitored and supervised by the CCN/SWMPC to determine the most suitable management system.

(6) Action Plan

Short-Term Plan (2011-2015)

- Establishment of SWM Cost Accounting System.
- Establishment of Waste Charging System for Households.
- Revision of Waste Charging System for Business Establishments.

Mid-Term Plan (2016-2020)

- Financial Review of Revolving Funds (Phase I).
- Financial Review of Level of Franchise Fees (Phase I).
- Execution of New Waste Charging System (SWMPC).
- Review of the SWMPC Cost Accounting System (Phase I).
- Review of the SWMPC Waste Charging System (Phase I).
- Revision of the SWMPC Waste Charging System (Phase I).
- Monitoring and Supervision of the SWMPC Waste Charging System for all SWM Service Providers (Phase I).

Long-Term Plan (2021-2030)

- Financial Review of Revolving Funds (Phase II).
- Financial Review of Level of Franchise Fees (Phase II).
- Execution of Revised SWMPC Waste Charging System.
- Review of the SWMPC Cost Accounting System (Phase II).
- Review of the SWMPC Waste Charging System (Phase II).
- Revision of the SWMPC Waste Charging System (Phase II).
- Monitoring and Supervision of the SWMPC Waste Charging System for all SWM Service Providers (Phase II).
- Application of the SWMPC Waste Charging System to all SWM Service Providers.

5.7 Private Sector Involvement Promotion Plan

(1) Objective

The objective of the Private Sector Involvement Promotion Plan is to establish the optimum "PPP (Public-Private Partnership) Model" for the purpose of providing the best solid waste management services based on optimum partnership between the public sector and the private sector.

(2) Planning Policy

(a) Utilisation of past experiences on the success and failure of the Public-Private Partnership.

(b) Selection of the optimum Public-Private Partnership option based on the comparative analysis of alternative options.

(c) Further extension of concept of Public-Private Partnership (PPP) to Public-Private-People Partnership (PPPP) with the involvement of communities.

(3) Strategy

(a) Maximisation of Benefits by PPP

The extent to which the private sector can bring benefits is reflected by the level of competition in this sector. Usually, private sector management brings a number of benefits, including:

- a more committed and innovative management;
- better management skills and more effective decision-making;
- improved resource management of assets and human resources;
- more efficient financing and management of capital investment;
- motivated workforce;
- quick management decision;
- higher labour productivity; and
- more efficient operational procedures.

(b) Formulation of New Public-Private Partnership based on Long-Term, Stable and Win-Win Basis

The key objective of involving the private sector is to explore a new source of capital financing. Private sector companies should be provided an incentive to make investments for improving the level of services for a long-term, stable and win-win based PPP scheme.

(4) Goal

Short-Term Plan (2011-2015)

- Establishment of efficient and reliable private sector involvement scheme for the collection and transportation services, and the construction and management of sanitary landfill sites and intermediate treatment facilities through the new SWM public corporation.
- Establishment of financial assistance system for the enlargement of investments for the improvement of collection and transportation services by the private sector.

Mid-Term Plan (2016-2020)

- Delivery of services in lower income areas through the concept of cross-subsidy and the introduction of new collection service boundaries for the first three zones.
- Securing transparency and accountability of contracts and tendering processes with private service providers based on the feedback of results of the mid-term performance monitoring and assessment of private service providers after their 5-year operations.
- Achievement of transparency and accountability of the financial assistance to the private sector based on the feedback of results of the mid-term performance monitoring and assessment.

Long-Term Plan (2021-2030)

- Securing transparency and accountability of contracts and tendering processes with private service providers based on the feedback of results of the long-term performance monitoring and assessment of private service providers after their 10-year operations.
- Improvement of collection and transportation services in low income areas by expansion of the new collection service boundaries for the additional six zones.
- Achievement of transparency and accountability of the financial assistance to the private sector based on the feedback of results of the long-term performance monitoring and assessment.
- Achievement of the long-term agreement on solid waste management among the public sector, the private sector and the communities based on the concept of public-private-people partnership.

(5) Recommendations

- The step-wise franchise system associated with proper zoning based on the cross-subsidy concept should be introduced as the optimum private sector involvement on the collection and transportation services.
- Taking into account the large-scale financial resources with long-term contractual risks, a concessional loan scheme associated with the service contract should be adopted for constructing and operating the sanitary landfill site and the intermediate treatment facilities.
- The private sector involvement schemes such as franchise and service contracts should be comprehensively monitored and assessed to achieve long-term sustainability of the provision of SWM services.
- The financial assistance scheme to the private sector for the investment on collection vehicles through the provision of subsidies should be managed and audited in a transparent manner.
- In addition to the clear contracts between “public” and “private,” clear manifestos describing the obligations of the three parties, “Public”, “Private” and “People,” should be created and periodically updated to sustain the long-term “Public-Private-People” partnership (PPPP).

(6) Action Plan

Short-Term Plan (2011-2015)

- Establishment of PPP Structure for Collection and Transportation.
- Establishment of PPP Structure for Sanitary Landfill Site and Intermediate Treatment Facilities.
- Implementation of Contract Procedures for Franchise Contracts and Service Contracts.

Mid-Term Plan (2016-2020)

- Mid-Term Monitoring of Franchise Zone Management.
- Mid-Term Performance Monitoring of Franchisees and Service Providers.

Long-Term Plan (2021-2030)

- Auditing of Franchisees, Service Providers and Revolving Funds.
- Continuous and Long-Term Performance Monitoring of Franchisees and Service Providers, and Enlargement of Franchise Zones.
- Long-Term Management of Revolving Funds and Provision of Subsidies.
- Management of PPPP Manifestos.

5.8 Community Participation Promotion Plan

(1) Objective

The objective of the Community Participation Promotion Plan is to raise awareness of the residents on their cooperation in solid waste management.

(2) Planning Policy

(a) The Plan shall be formulated to promote better understanding of residents through public and school environmental education by establishing a workable implementation system within CCN.

(b) The Plan shall be formulated to promote more involvement of CBOs in the provision of collection services especially in the informal settlements.

(3) Strategy

(a) New Section within the CCN

To achieve the objective, the Section of Public Awareness, Environmental Education and Community Participation should be established to raise the awareness of people on SWM and to facilitate the involvement of more CBOs in the collection of solid waste.

(b) Communications Strategy

The CCN has to inform the public of the measures to be taken to improve SWM services in the city. A properly structured communications strategy is to be proposed.

(c) Public Environmental Education

A public environmental education and awareness programme should be carried out to raise public awareness on the involvement of the public in the initiatives for a better SWM in the city.

(d) Primary Environmental Education

The introduction of SWM in the current primary education curricula should be implemented to make school children more aware on solid waste issues. In addition, the development of educational materials for teachers and students of primary education is considered essential as a tool to promote environmental education and awareness creation among the educational community.

(4) Goal

Short-Term Plan (2011-2015)

- Strengthening of coordination among CBOs, CCN and residents on SWM.
- Enhancement of knowledge of CBOs to improve their collection services.
- Enhancement of residents' awareness to get their participation in SWM and to promote 3R.
- Commencement of collection services given by CBOs with full participation of the community.
- Enhancement of knowledge of teachers and students in primary education on SWM.
- Commencement of recycling in primary schools.
- Commencement of composting activities by CBOs.

Mid-Term Plan (2016-2020)

- Proper maintenance of coordination among CBOs, CCN and residents on SWM.
- Continuation of knowledge enhancement of CBOs to improve their collection services.
- Continuation of residents' awareness enhancement to get their participation in SWM and to promote 3R.
- Continuation of collection services provided by CBOs with full participation of the community.
- Continuation of knowledge enhancement of teachers and students in primary education on SWM.
- Continuation of recycling in primary schools.
- Continuation of composting activities by CBOs.

Long-Term Plan (2021-2030)

- Attainment of sustainable proper coordination through the establishment of a committee among CBOs, CCN and residents.
- Attainment of a Proper CBO Training System operated by CCN with the collaboration of trained CBOs and NGOs.
- Attainment of a proper Awareness Creation System operated by CCN with the collaboration of NGOs and Residents' associations.
- Attainment of Proper Training System on SWM for schools teachers and students by CCN in collaboration with KIE.
- Promotion of obligatory recycling system in all Nairobi primary schools by CCN.
- Establishment of the Compost Producers CBO Association which conjointly with CCN will continue promoting the insertion of more CBOs in composting activities.

(5) Recommendations

- The new organisation in charge of public awareness' raising as well as the community support should be established.
- Comprehensive institutional mechanisms as well as the implementation plan through CBOs and NGOs to support primary collection in the communities should be established and carried out.
- Comprehensive institutional mechanisms for public awareness raising and environmental education among various stakeholders as well as the implementation plan should be established and carried out.
- Comprehensive institutional mechanisms as well as the implementation plan through CBOs and NGOs to support 3R activities in communities and educational institutions should be established and carried out.

(6) Action Plan

Short-Term Plan (2011-2015)

- Establishment of the Public Awareness, Environmental Education and Community Participation (PEC) Unit.
- Contract with Local Consultants for Support on the PEC Unit.
- Procurement of Equipment and Materials for the PEC Unit.
- Formulation of Training Programme for PEC Unit Personnel.

- Formulation of CBOs' Waste Collection Implementation Plan.
- Formulation of Environmental Education Implementation Plan.
- Implementation of CBOs' Waste Collection Plan (Phase I).
- Implementation of Environmental Education Plan (Phase I).
- Mass Campaign for Raising Public Awareness.
- Implementation of Community-Based Solid Waste Management (Phase I).

Mid-Term Plan (2016-2020)

- Review of CBOs' Waste Collection Implementation Plan (Phase I).
- Review of Environmental Education Implementation Plan (Phase I).
- Implementation of CBOs' Waste Collection Plan (Phase II).
- Implementation of Environmental Education Plan (Phase II).
- Implementation of Community-Based Solid Waste Management (Phase II).

Long-Term Plan (2021-2030)

- Review of CBOs' Waste Collection Implementation Plan (Phase II).
- Review of Environmental Education Implementation Plan (Phase II).
- Implementation of CBOs' Waste Collection Plan (Phase III).
- Implementation of Environmental Education Plan (Phase III).
- Implementation of Community-Based Solid Waste Management (Phase III).

6. URGENT PROJECTS AND PREPARATORY ACTIONS

6.1 Urgent Projects

Action plans have been formulated for each component of the Master Plan. However, start-up of these plans will take more time due to financial arrangements. To avoid making the city's environmental situation worse than the present, some of the plans should be urgently implemented through the City Council of Nairobi's own budget or subsidies from the central government. Urgent implementation projects are considered to be in the following plans. These costs consist of operation and maintenance cost of the CCN's own vehicles and/or cost of contractout for private service providers.

- Dandora Dumpsite Urgent Improvement Plan
- Plan of Cleanup of Illegal Dumpsites
- Urgent Waste Collection Plan

(1) Dandora Dumpsite Urgent Improvement Plan

Dandora is not operated in a sanitary way, which brings severe adverse impacts to the surrounding areas. Urgent measures for the Dandora Dumpsite, specifically, covering soil, should be purchased and onsite road construction should be carried out. In addition to these urgent countermeasures, regular operation and maintenance will also need to be carried out separately by efficiently using the three existing heavy equipment for levelling the waste and applying covering soil.

The work above will be required to start shortly after the budget of CCN has been secured and then have to continue until year 2017 when the new landfill site is expected to start operating. The cost for civil work of the urgent improvement work is estimated to be KSh 431 million between 2011 and 2016. The cost for regular operation and maintenance of the site will be about KSh 33 to

43 million annually and KSh 249 million will be necessary in total between 2011 and 2016. The total cost of the urgent improvement work is therefore estimated to be KSh 680 million.

(2) Cleanup of Illegal Dumpsites

The DoE had confirmed the existence of 74 illegal dumpsites distributed all over the city area. Since these dumpsites impart negative impacts such as littering, odour, landfill gas, leachate, etc. throughout the local areas, there is an urgent need to take countermeasures.

CCN, therefore, shall plan to remove the wastes with wheel loaders and to transport them to the Dandora Dumpsite. The plan shall target the 71 illegal dumpsites other than the three quite large sites, Mathare North, Zimerman and Gathundeki. To ensure that illegal dumpsites do not revert to their original state after cleanup, the cleanup activities shall be carried out in 2014 when waste collection containers will have been installed as part of the effort to strengthen the collection setup. The total cost of the cleanup will be approximately KSh 23 million.

(3) Urgent Waste Collection Plan

CCN should carry out the cleanup of scattered wastes along the road sides. The monitoring of scattered wastes will be also CCN's mandate. This cleanup work requires Ksh 7 million for the operation and maintenance of CCN collection vehicles from 2011 to 2014.

In addition, to improve the waste collection rate mainly in low income areas where private collectors seldom operate, CCN should cover the waste collection work in these areas with the procurement of waste collection vehicles as well as containers. Although budgetary arrangement, designing and tendering by CCN are required, a loan or grant-aid from foreign donors will be one of options of the financial support for the procurement in the long term. The required number of vehicles and containers in 2013 is estimated to be 1 dump truck, 10 pick-up trucks, 22 container carriers and 47 containers, and the procurement cost of these vehicles and containers is estimated to be KSh 214 million.

6.2 Preparatory Actions

Establishment of the Solid Waste Management Public Corporation (SWMPC) is an integral part of the Master Plan. To implement the action plans mentioned above, especially the preparation for the establishment of the SWMPC, the following actions are required to be conducted by the middle of year 2011:

(1) Priority 1: Setup of the Preparatory Unit (PU) in the Department of Environment (DoE) for the SWM Public Corporation (SWMPC)

- The SWMPC should be established by the beginning of 2015 to start operation from the beginning of 2016. A one-year preparation period will be required by SWMPC for the tendering process after its establishment. The Preparatory Unit for SWMPC should be urgently established inside the DoE.
- The detailed concept of the organisational structure of the Preparatory Unit is recommended in Section B of the Supporting Report of this JICA Master Plan Final Report.
- The preparatory unit will be the target of the proposed Comprehensive Capacity Development Programme (CCDP).
- To initiate the CCDP, the following priority actions (PA) are required to be carried out:

- **PA-1-1:** Selection of 3 Unit Managers and 13 Subunit Chiefs in accordance with this JICA Master Plan Final Report
- **PA-1-2:** Selection of Staff of each Unit
- **PA-1-3:** Setup of the Preparatory Unit Office (The Office of the JICA Survey Team is recommended to be utilised as the office of the Preparatory Unit.)
- **PA-1-4:** Official Declaration of Setup of the Preparatory Unit
- **PA-1-5:** Formulation of Detailed Job Descriptions of Staffs of the Preparatory Unit in accordance with the Recommendation in this JICA Master Plan Final Report
- **PA-1-6:** Preparation of Provision of Incentive for the Additional Tasks of the Selected Unit Managers, Chiefs and Staff
- **PA-1-7:** Application of the Budget of the Preparatory Unit for the Financial Year 2012

(2) Priority 2: Preparation for the Construction of New Sanitary Landfill Site and Closure of Dandora Dumpsite

- To construct a new landfill site and close the existing Dandora on time, the following actions are required to be carried out:
  - **PA-2-1:** Preparation for the Implementation of Environmental Impact Assessment (EIA) for Constructing the New Sanitary Landfill Site at Ruai
  - **PA-2-2:** Preparation for the Implementation of Environmental Impact Assessment (EIA) on the Decommissioning of the Dandora Dumpsite

(3) Priority 3: Preparation for the Creation of SWM Special Account

- To create the SWM Special Account, the following actions are required to be carried out:
  - **PA-3-1:** Formation of Task Force for SWM Cost Accounting System
  - **PA-3-2:** Request to the Ministry of Local Government (MoLG) to Create the SWM Special Account
  - **PA-3-3:** Preparation of a List of Revenue and Expenditure Items
  - **PA-3-4:** Preparation for the Transfer of the Current SWM Budget to the SWM Special Account
  - **PA-3-5:** Preparation for the Legalisation of the SWM Special Account

(4) Priority 4: Preparation for the Drafting of By-law for the Establishment of SWMPC

- In order to smoothly draft the By-law for the Establishment of SWMPC, the following preparatory works should be initiated:
  - **PA-4-1:** Review of Water Act 2002
  - **PA-4-2:** Conduct of Prior Consultation with MoLG
  - **PA-4-3:** Listing of Major Sections and Clauses of the Draft By-law on the Establishment of SWMPC

(5) Priority 5: Preparation for the Introduction of the Step-wise Franchise System

- To establish the zones for the franchise system, the following actions are required to be carried out:

- **PA-5-1:** Drafting of Boundaries of Franchise Zones by using the Zoning Map based on the Recommendation in this JICA Master Plan Final Report
- **PA-5-2:** Rough Estimate of Population of Franchised Zones (If the latest Census data is available, the population of the Zones should be updated based on the new data.)

7. IMPLEMENTATION SCHEDULE AND COST

Actions and costs required for the implementation of each component of the Master Plan are summarised in **Figures S7.1 and S7.2**.

Action Plan (Programme 1 to 4)	Cost (thousand KSh)		Short-Term Plan						Mid-Term Plan					Long-Term Plan									
	CCN/Gov't*	External Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Programme 1: Collection & Transportation Plan																							
1-1 Formulation of Collection & Transportation Implementation Plan																							
1-2 Monitoring of Implementation of Collection & Transportation Plan																							
1-3 Implementation of Urgent Waste Collection Plan	7,344																						
1-4 Procurement of Waste Collection Vehicles for CCN/SWMPC Zones	1,510,890	463,693																					
1-5 Implementation of Regular Station Collection in CCN/SWMPC Zone	3,237,034																						
1-6 Construction of Access Road to Slum Areas in CCN/SWMPC Zone	39,528	332,145																					
1-7 Implementation of Waste Collection PPPP Scheme																							
Sub-Total of Programme 1	**4,794,796**	**795,838**																					
Programme 2: 3R & Intermediate Treatment Plan																							
2-1 Establishment of 3R & Intermediate Treatment Task Team		incl. CCDP																					
2-2 Formulation of 3R Implementation Plan		incl. CCDP																					
2-3 Formulation of Intermediate Treatment Implementation Plan		incl. CCDP																					
2-4 Monitoring of 3R Implementation Plan		incl. CCDP																					
2-5 Monitoring of Intermediate Treatment Implementation Plan		incl. CCDP																					
2-6 Implementation of Waste Reduction Plan		incl. CCDP																					
2-7 Implementation of Waste Recovery, Reuse and Recycling Plan		incl. CCDP																					
	119,210	115,372				MRF Centre (Design)			MRF Centre (Construction)														
2-8 Implementation of Intermediate Treatment Plan [Home Composting]	21,148	incl. CCDP				Home composting																	
[Central Composting]	285,697	476,722						Central composting															
Sub-Total of Programme 2	**426,055**	**592,094**																					
Programme 3: Final Disposal Plan																							
3-1 Formulation of Dandora Dumpsite Closure Plan		46,167																					
3-2 Implementation of Dandora Dumpsite Urgent Improvement Plan	680,229																						
3-3 Formulation of New Final Landfill Site Construction Plan at Ruai (First Portion)		198,880																					
3-4 Construction of New Final Landfill Site at Ruai (First Portion)		4,176,480																					
3-5 Clean Up of Illegal Dumpsites	23,164																						
3-6 Implementation of Closure Work of Dandora Dumpsite		1,538,900																					
3-7 Operation & Maintenance of New Landfill Site at Ruai	6,010,406	140,300																					
3-8 Closure of Illegal Dumpsites		44,704																					
3-9 Formulation of New Final Landfill Site Construction Plan at Ruai (Second Portion)	73,975																						
3-10 Construction of New Final Landfill Site at Ruai (Second Portion)	1,553,475																						
Sub-Total of Programme 3	**8,341,249**	**6,145,431**																					
Programme 4: Organisational Restructuring and Human Resources Development Plan																							
4-1 Establishment of the Preparatory Unit for SWMPC		incl. CCDP																					
4-2 Establishment of the SWMPC		incl. CCDP																					
4-3 Rectification of Remaining Functions of DoE		incl. CCDP						=> Launch of SWM Public Corporation															
4-4 Creation of SWM Special Account		incl. CCDP																					
4-5 Implementation of Comprehensive Capacity Development Programme (CCDP)		368,200																					
4-6 Consideration of Incomplete Action Plans of the Previous Master Plan		incl. CCDP																					
4-7 Formulation of Standard Working Procedures and Manuals		incl. CCDP																					
4-8 Start of Operations of Revolving Funds and Provision of Subsidies																							
4-9 Mid-Term Organisational Assessment and Feedback to SWMPC																							
4-10 Mid-Term Organisational Restructuring of SWMPC																							
4-11 Implementation of Ex-Post Mid-Term Performance Monitoring and Assessment on CCDP																							
4-12 Implementation of Skill-Targeted Follow-up Training Programme																							
4-13 Continuous Management of the Revolving Funds and Provision of Subsidies																							
4-14 Long-Term and Contiuous Organisational Assessment and Feedback to SWMPC																							
4-15 Long-Term and Contiuous Organisational Restructuring of SWMPC																							
4-16 Implementation of Long-term Performance Monitoring and Establishment of Feedback System																							
4-17 Long-term and Continuous Staff Deployment and Redeployment of Staff of SWMPC																							
Sub-Total of Programme 4		**368,200**																					
Total of Programme 1 to 4	**13,562,100**	**7,901,563**																					

Figure S7.1 Required Actions and Cost for Implementation of Components of the Master Plan (Programme 1 to 4)

To be conducted with local funds
To be conducted with Technical Assistance
To be conducted with Loan (Engineering and Construction including Supervision)

Action Plan (Programme 5 to 8)	Cost (thousand KSh)		Short-Term Plan						Mid-Term Plan					Long-Term Plan									
	CCN/Gov't*	External Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Programme 5: Legal and Institutional Reform Plan																							
5-1 Improvement of Monitoring and Enforcement in CCN SWM By-law 2007		incl. CCDP																					
5-2 Improvement of Monitoring and Enforcement in other SWM-related Legal Frameworks		incl. CCDP																					
5-3 Minor Modifications of the CCN SWM By-law 2007		incl. CCDP																					
5-4 Legalisation of the Act for the Establishment of the SWMPC		incl. CCDP																					
5-5 Amendment of the Procurement and Disposal Act 2005		incl. CCDP																					
5-6 Legalisation of Establishment of SWM Special Account		incl. CCDP																					
5-7 Legalisation of Establishment of the SWM Capital Revolving Fund and SWM ORF		incl. CCDP																					
5-8 Legalisation of Franchise Fee		incl. CCDP																					
5-9 Legalisation of Operational Regulations on Subsidy Provision to Franchisees		incl. CCDP																					
5-10 Legalisation of PPP Act																							
5-11 Legal Arrangement of Auditing for the SWMPC and Revolving Funds																							
5-12 Legalisation of Consolidated SWM Act																							
5-13 Long-term Monitoring on Enforcement of SWM-related acts, regulations and by-laws																							
Sub-Total of Programme 5																							
Programme 6: Financial Management Plan																							
6-1 Establishment of SWM Cost Accounting System		incl. CCDP																					
6-2 Establishment of Waste Charging System for Households		incl. CCDP																					
6-3 Revision of Waste Charging System for Business Establishments		incl. CCDP																					
6-4 Financial Review of Revolving Funds																							
6-5 Financial Review of Level of Francise Fees																							
6-6 Execution of New Waste Charging System (SWMPC)																							
6-7 Review of the SWMPC Cost Accounting System																							
6-8 Review of the SWMPC Waste Charging System																							
6-9 Revision of the Waste Charging System																							
6-10 Monitoring and Supervising of the Waste Charging System for All SWM Service Providers																							
6-11 Application of the SWMPC Waste Charging System to All SWM Service Providers																							
Sub-Total of Programme 6																							
Programme 7: Private Sector Involvement Promotion Plan																							
7-1 Establishment of PPP Structure for Collection and Transportation		incl. CCDP																					
7-2 Establishment of PPP Structure for Sanitary Landfill Site and Intermediate Treatment Facilities		incl. CCDP							☆ => Launch of New Zoning System														
7-3 Implemetation of Contract Procedures for Franchise Contracts and Service Contracts		incl. CCDP																					
7-4 Mid-Term Monitoring of Franchised Zone Management																							
7-5 Mid-Term Performance Monitoring of Franchisees and Service Providers																							
7-6 Auditing of Franchisees, Service Providers and Revolving Funds																							
7-7 Continuous and Long-Term Performance Monitoring of Franchisees and Service Providers and																							
7-8 Long-Term Management of Revolving Funds and Provision of Subsidies																							
7-9 Management of PPPP Manifestos																							
Sub-Total of Programme 7																							
Programme 8: Community Participation Promotion Plan																							
8-1 Establishment of PEC Unit		incl. CCDP																					
8-2 Contract with Local Consultants for Support on the PEC Unit		25,536																					
8-3 Procurement of Equipment & Materials for the PEC Unit		7,650																					
8-4 Formulation of Training Programme for PEC Unit Personnel		incl. CCDP																					
8-5 Formulation of CBO's Waste Collection Implementation Plan		incl. CCDP																					
8-6 Formulation of Environmental Education Implementation Plan		incl. CCDP																					
8-7 Implementation of CBOs' Waste Collection Plan	14,589	13,811																					
8-8 Review of CBOs' Waste Collection Plan																							
8-9 Implementation of Environmental Education Plan	26,745	7,732																					
8-10 Review of Environmental Education Plan																							
8-11 Mass Campaign for Public Awareness Raising	92,690																						
8-12 Implementation of Community-Based Solid Waste Management	102,572	37,014																					
Sub-Total of Programme 8	**236,596**	**91,743**																					
Total of Programme 5 to 8	**236,596**	**91,743**																					
Grand Total	**13,798,696**	**7,993,306**																					

Figure S7.2 Required Actions and Cost for Implementation of Each Component of the Master Plan (Programme 5 to 8)

To be conducted with local funds
To be conducted with Technical Assistance
To be conducted with Loan (Engineering and Construction including Supervision)

8. PROJECT EVALUATION

8.1 Financial Evaluation

(1) Period of Evaluation

The period of evaluation of the Master Plan is presumed to be twenty (20) years from 2011 to 2030, including the period for the construction of the final landfill site, transfer station and intermediate treatment facilities, as well as the procurement of trucks and containers for waste collection.

(2) Setup of Alternatives

Two alternatives are setup for the financial evaluation of the final landfill site and the waste collection system, as follows:

- Case-A: The final landfill site (Ruai) and the direct haul system of waste collection/transportation.
- Case-B: The final landfill site (Ruai) and the transfer-transportation system of waste collection/transportation.

(3) Basic Assumptions

(a) Discount Rate

The discount rate as the cut-off ratio to judge the financial viability is 0.55%, as setup by international financial institutions.

(b) Waste Charge Level of Households

The three (3) scenarios set for the waste charge level of households by income level are as shown in **Table S8.1**.

Table S8.1 Scenarios of Waste Charge Level for Households by Income Level

Scenario for Waste Charge Level	Income Level	Waste Charge Level (KSh/Household)	Collection Rate (%)
Low	Low	60	30
	Middle	150	40
	High	300	50
Medium	Low	120	40
	Middle	250	50
	High	500	60
High	Low	170	50
	Middle	300	60
	High	650	70
Existing Charge Level of Private Companies	Slum	7 to 100	30 to 90
	Low	100 to 200	
	Middle	200 to 300	
	High	300 to 700	

Source : JICA Survey Team

(c) Waste Charge Level of Business Establishments

No data on willingness to pay and affordability to pay was available for the business establishment awareness survey conducted by the JICA Survey Team. Therefore, the willingness to pay and the affordability to pay were not considered for business

establishments. The waste charge level of business establishments was setup also on the basis of the operation and maintenance per ton. This waste charge level is assumed to increase at the same rate of 5% per annum, per capita GRDP (Gross Regional Domestic Product) of Nairobi City.

(d) Tipping Fees

The average unit rate of existing tipping fees is assumed to be KSh 35 per ton of disposed waste during the period 2010-2016. After the final landfill site (Ruai) is completed in the year 2017, the tipping fees are estimated to be 164 Ksh/ton based on the total amount of disposed wastes (9.5 million tons) and the O&M cost of the final landfill site (Ruai) during the period 2017-2030.

(4) Project Cost

The project cost of the Master Plan will differ according to the composition of the two alternatives of collection/transportation system, the direct collection/transportation system (Case-A) and the collection/transport through transfer station (Case-B), as shown in **Table S8.2**.

Table S8.2 Project Cost of the Master Plan (Financial Price)

No.	Name of Project	Project Cost (Ksh Million)	Case-A	Case-B
1	Collection and Transport Plan (Direct Haul to Ruai)	5,590	●	×
2	Collection and Transport Plan (Transfer Station in Dandora)	13,396	×	●
3	3R and Intermediate Treatment Plan	1,018	●	●
4	Final Disposal Plan	14,487	●	●
5	Community Participation Promotion Plan	328	●	●
Total Cost			**21,423**	**29,229**

Note: ● Item of the project component is to be considered in the Master Plan.
× Item of the project component is not to be considered in the Master Plan.

Source: JICA Survey Team

(5) Results of Evaluation

The results of the evaluation are given in **Table S8.3**. The financial internal rate of return (FIRR) of Case-A.3 is figured out to be 5.8%, more than the 0.55% cut-off ratio to be financially viable in case of direct waste collection/transport system and the high scenario for waste level and collection rate of charges.

Table S8.3 Indicators for Financial Evaluation of the Master Plan

Case	Case No.	Scenario	FIRR (%)	NPV (Million KSh)	B/C
A (Direct Haul)	A.1	Low	-	-12,799.9	0.37
	A.2	Medium	-12.6	-5,009.5	0.75
	A.3	High	5.8	3,681.8	1.18
B (Transfer Station)	B.1	Low	-	-20,184.2	0.27
	B.1	Medium	-	-12,393.8	0.55
	B.3	High	-4.2	-3,702.5	0.87
		Waste Charge (1.1 times of Case-B.3)	0.55	0.0	1.00

Source: JICA Survey Team

8.2 Economic Evaluation

(1) Methodology of Economic Evaluation

The economic evaluation for this project was carried out based on the "with-the-project" and "without-the-project" concepts. In this method, the project was evaluated from the economic viewpoint by comparing the costs and benefits in case that the project is implemented (i.e., "with-the-project") and in case that the project is not implemented (i.e., "without-the-project").

(2) Period of Evaluation

The period of evaluation for the Master Plan is twenty-one (21) years from 2010 to 2030, including the period for the construction of final landfill site, transfer station and intermediate treatment facilities, as well as the procurement of trucks and containers for waste collection.

(3) Setup of Alternatives

The two (2) alternatives set for the financial evaluation on the final landfill site and the waste collection system are as follows:

- Case-A: The final landfill site (Ruai) and the direct haul system of waste collection/transportation.
- Case-B: The final landfill site (Ruai) and the transfer-transportation system of waste collection/transportation.

(4) Basic Assumptions

(a) Discount Rate: 12.0%

(b) Economic Benefits

(i) Improvement of Living Environment of Residents of Nairobi

This was estimated on the basis of Willingness to Pay (WTP). WTP was estimated by income level and by zone on three (3) growth scenarios, as shown in **Table S8.4**.

Table S8.4 Scenario for WTP by Income Level

Scenario of WTP Level	Income Level	WTP (KSh/HH/Month)
Low	Low	10
	Middle	30
	High	100
Medium	Low	20
	Middle	40
	High	150
High	Low	30
	Middle	60
	High	300

Source: JICA Survey Team

(ii) Savings on Waste Disposal Cost at Final Landfill Site

The savings on waste disposal treatment cost include the savings on O&M cost and construction cost of the final landfill site at Ruai. These cost savings were estimated based on the unit cost of waste disposal treatment of 1,191 KSh/ton multiplied by the difference between the amount of waste with-the-project and without-the-project situations. The

total amount of disposed waste between with and without is 1,967,166 tons from 2017 to 2030, and the total cost saved is KSh 2,343 million.

(iii) Other Benefits

The other benefits such as preservation of natural environment and improvement of public health are also important benefits of this project. However, these benefits are difficult to be quantified, so that they were not included in the benefits for the calculation of economic internal rate of return (EIRR) in the Master Plan.

(c) Economic Costs

(i) Exclusion of Transfer of Expenditure Items

VAT (Value-Added Tax) of 16% is deducted from the local currency portion.

(ii) Present Value-Based Cost

The project cost was evaluated at 2010 prices. Inflationary cost elements incurred during the construction period were excluded.

(iii) Standard Conversion Factor (SCF)

The local currency portion for materials including machinery and equipment were converted into economic prices by applying the standard conversion factor of 0.968.

(iv) Opportunity Cost of Unskilled Labour

The opportunity cost of unskilled labour was assumed to be 0.60 of the financial price as the conversion factor by taking account of the unemployment rate of around 40% in Kenya.

(5) Project Cost

The project costs of the Master Plan in economic prices according to the composition of the two alternatives of collection/transportation system, i.e., the direct collection/transportation system (Case-A) and the collection/transport through transfer station (Case-B), are shown in **Table S8.5**.

Table S8.5 Project Cost of the Master Plan (Economic Price)

No.	Name of Project	Project Cost (KSh Million)	Case-A	Case-B
1	Collection and Transport Plan (Direct Haul to Ruai)	4,870	●	×
2	Collection and Transport Plan (Transfer Station in Dandora)	11,776	×	●
3	3R and Intermediate Treatment Plana	876	●	●
4	Final Disposal Plan	11,788	●	●
5	Community Participation Promotion Plan	276	●	●
6	Preparatory Survey for the Next Implementation Stage	150	●	●
7	Capacity Development Programme	367*	●	●
Total Cost			**18,327**	**25,233**

Note: ● Item of the project component is to be considered in the Master Plan.
× Item of the project component is not to be considered in the Master Plan.
* The project cost of "Capacity Development Programme" does not include costs of pilot projects that will be carried out in the Programme.

Source : JICA Survey Team

(6) Results of Economic Evaluation

The EIRR of Case A-3 wais figured out to be 11.6%, which is almost the same as 12.0% as the cut-off ratio for a project to be economically viable in case of the direct waste collection/transportation system and the high scenario of waste level and collection rate of charges. The results of the evaluation are shown in **Table S8.6**.

Table S8.6 Summary of Economic Evaluation for the Master Plan

Case	Case No.	Scenario	FIRR (%)	NPV (Million KSh)	B/C
A Direct Haul	A.1	Low	-9.1	-3,072.1	0.47
	A.2	Medium	1.5	-2,070.8	0.65
	A.3	High	11.6	-114.9	0.98
B Transfer Station	B.1	Low	-	-5,324.1	0.34
	B.2	Medium	-6.7	-4,322.8	0.47
	B.3	High	4.5	-2,366.9	0.71
		Waste Charge (1.4 times of Case-B.3)	12.0	-1.5	1.00

Source: JICA Survey Team

8.3 Technical Evaluation

(1) Collection and Transportation

Based on the comparative study mentioned before, the collection and transportation plan does not include large-scale civil works because the construction of transfer station is not a better option than the direct haul system. Additionally, since the railway transportation requires additional transfer facilities for loading and unloading wastes, the additional burden for operation and management of these facilities may bring other unexpected constraints, such as mechanical trouble and negative impacts on the surrounding environment. Not only from the economic and financial points of view as explained before, but the direct haul using vehicles will be the best option to reduce these risks.

Although the waste collection and transportation activities will be mostly conducted by private collectors, CCN should cover the low income areas including informal settlements, at least up to year 2030. The degree of CCN's involvement in collection work for low income areas will depend mainly on business performance of the franchised private companies from year 2016. At any rate, the waste collection and transportation system in each community should be organised and managed by CBOs in cooperation with CCN, and this is an integral part of the new Master Plan. Pilot projects for the promotion of CBOs' waste collection plan in some designated informal settlements should be carried out in the next stage of project implementation with appropriate environmental education in the same location.

(2) 3R and Intermediate Treatment

Promotion of 3R is the key issue for ISWM all over the world these days. Considering the locality of Nairobi, the promotion of composting is the best option, while the mechanisation with power generation, in other words, "waste to energy" option is considered to be still a potential alternative if such feasibility is studied with proper surveys and reviews. Composting does not require any special mechanisation and huge investment, and three types of composting, namely, "Home Composting", "Community Composting", and "Central Composting" will be introduced depending on income level, type of housing, location and volume of the waste. Workability of these composting programmes should be examined by the implementation of pilot projects in the next stage.

(3) Final Disposal

The present official disposal site in Nairobi, the Dandora Dumpsite, should be decommissioned and a new landfill site should be operated accordingly. Ruai is selected as the new landfill site in consideration of collection and transportation system efficiency, and it will be operated on a sanitary manner and managed by proper technologies. The planned area at Ruai is owned by the City Council of Nairobi and thus no land acquisition will be necessary.

8.4 Social Evaluation

It is expected that some of the waste pickers will move to the new disposal site after the closure of Dandora. Keeping all the waste pickers out of the site would be difficult and careful control is required by the managers at the site. The material recovery facility (MRF) centre will be built in Dandora to accommodate the remaining waste pickers for sorting and segregation work. In addition, a CBO at the nearest location where the waste pickers in Dandora live will be established to assign some jobs for the operation of waste collection, transportation and composting in the area. The existing Dandora open dumping site can be used also as a park or football ground after closure. Those measures will mitigate the negative impacts of the closure work.

The candidate site in the Ruai area is located next to a sewage treatment facility. There are few houses located around the site, but there is no house inside the candidate site of 80 hectares in area. Therefore, it is expected that the location in Ruai will cause few impacts from the social viewpoint.

As for the introduction of the container system especially in low income areas and areas of apartment houses, the system would be effective if the people are well informed about the places for waste dumping and collection. The awareness of proper waste disposal, in any case, should be improved.

Promotion of composting will entail cooperation and actual operation by the residents. Therefore, the CBOs should be organised well. This will foster social solidarity and much deeper understanding of the importance of sanitation and proper SWM.

If the financial situation of the newly established Solid Waste Management Public Cooperation (SWMPC) and the franchised private collectors results in a better position than expected, the collection rate can be gradually increased to match the improvement of finances without so much difficulty. The most important thing is to prove to the residents that CCN/SWMPC can improve its performance to obtain their confidence. Once CCN/SWMPC has obtained trust from the people, it is expected that CCN/SWMPC could initiate much more cooperation as well as higher charges from the people who will be benefited by its SWM services.

8.5 Environmental Evaluation

The decommissioning of Dandora will bring better environmental conditions on the surrounding areas and a post closure plan of utilisation of the reclaimed land will result in much comfortable scenery, landscaping and recreational opportunities for the residents as well.

The new final disposal site at Ruai is expected to eliminate or decrease the factors influencing public health and the environment by utilising the method of sanitary landfill. In addition, the site is designed with technical considerations to minimise environmental impacts. In terms of the construction of the new final landfill site, Environmental Impact Assessment (EIA) would be required.

The container system would reduce negative impacts including dust, noise, traffic jam and odour in the waste collection.

8.6 Organisational and Institutional Evaluation

With regard to the sustainability of SWM, the new Master Plan proposes the framework of a win-win-win relationship among the three parties: the Public (Government or City Council of Nairobi), the Private (private waste collectors), and the People (Nairobi residents). This “PPPP

(Public–Private–People–Partnership) Model" will function through establishment of effective and sustainable provision of SWM services, incorporating community-based SWM activities, introduction of new zoning and franchised waste collection system, and establishment of the new SWM Public Cooperation (SWMPC) in early 2015, in order to secure efficiency, transparency and accountability.

One of the most important actions to implement the proper SWM through the PPPP scheme is to establish and operate the SWMPC. Most actions proposed in the Master Plan are formulated based on the establishment of SWMPC. Although many obstacles and constraints will be expected on the creation of the new organisation, and it seems to be a big challenge for CCN, this sort of drastic change is required for achieving the goal in cooperation with the other foreign technical assistance programmes.

9. CONCLUSION

The target collection rate of 100% in year 2030 is an ideal goal for all the residents of Nairobi, so that the plans for pursuing this goal should be carried out with dedication and dispatch. To realise the Vision of SWM for Nairobi City, the proposed projects in the Master Plan should be carried out since implementation of these projects will bring large benefits to the residents of Nairobi.

Almost half of the residents in Nairobi are living in low income areas and informal settlements at present. Waste collection in these areas is the bottom line to realise sustainability of the SWM proposed in the Master Plan. A community-based SWM especially in these areas is proposed with the cooperation of CBOs. The 3R activities will enhance the support of CBOs, and they are integral parts of the new Master Plan. Public awareness raising and the implementation of environmental education are indispensable for the promotion of 3R even if the visible effects on SWM will take quite a long time to appear.

With regard to the sustainability of SWM, the new Master Plan proposes the framework of a win-win-win relationship among the three parties, namely; the Public sector (Government or City Council of Nairobi); the Private sector (private waste collectors); and the People (Nairobi residents). This "PPPP (Public–Private–People–Partnership) Model" will function through the establishment of effective and sustainable provision of SWM services, incorporating community-based SWM activities, introduction of new zoning and franchised waste collection system, and establishment of the new SWM Public Cooperation (SWMPC) in early 2015, in order to secure efficiency, transparency and accountability.

One of the most important actions to implement a proper SWM through the PPPP scheme is to establish and operate the SWMPC, because most of the actions proposed in the new Master Plan are formulated based on the establishment of SWMPC. Although many obstacles and constraints are expected in the creation of this new organisation, and it seems to be a big challenge to CCN, this sort of drastic change is required for achieving the goal, in cooperation with the other foreign technical assistance programmes.

Simultaneously, the Government of the Republic of Kenya, including the City Council of Nairobi (CCN), should consider that some financial arrangements are indispensable for the implementation of the action plans. The financial resources should, therefore, come not only from foreign countries but also from their own funds. It should also be recognised that the implementation of a proper SWM requires to some extent a financial burden from the government, but the responsibility should be shared equally by the government or public sector, the private collectors or private sector, and the residents or people.

10. RECOMMENDATIONS

The JICA Survey Team recommends that the Government of the Republic of Kenya and the City Council of Nairobi (CCN) should carry out the action plans in the Master Plan from year 2011. The

urgent projects, namely; the Dandora Dumpsite Urgent Improvement; the Cleanup of Illegal Dumpsites; and the Urgent Waste Collection, should be conducted firstly by using the Government and CCN's own budget while implementation of some of the other major components is expected to be arranged through foreign donors.

In addition, the Government of the Republic of Kenya including the City Council of Nairobi (CCN) should prepare for the establishment of the SWMPC in order to proceed to the next stage of project implementation at the earliest possible time.

With regard to project implementation, the following actions are recommended to be carried out with dedication and dispatch:

Priority 1: Setup of the Preparatory Unit (PU) in the Department of Environment (DoE) for the SWM Public Corporation (SWMPC);

Priority 2: Preparation for the Construction of New Sanitary Landfill Site and Closure of Dandora Dumpsite;

Priority 3: Preparation for the Creation of SWM Special Account;

Priority 4: Preparation for the Drafting of By-law for the Establishment of SWMPC; and

Priority 5: Preparation for the Introduction of Step-wise Franchise System.