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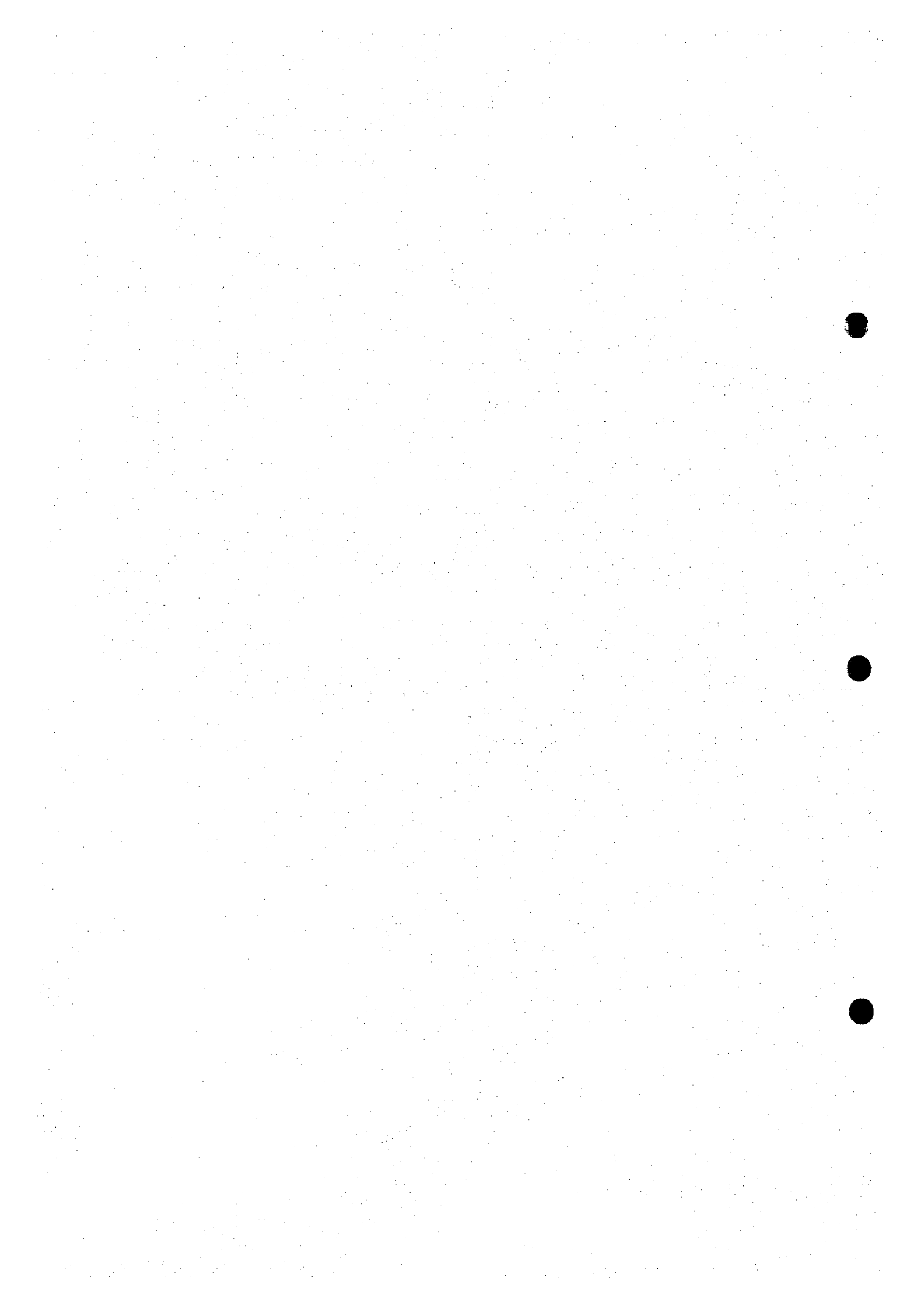
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**CHAPTER 9**

**OVERALL EVALUATION  
FOR PRIORITY PROJECTS**

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## CHAPTER 9

### OVERALL EVALUATION FOR PRIORITY PROJECTS

#### 9.1 Financial and Economic Evaluation

##### 9.1.1 General

In Chapter 7, the financial analysis was conducted for the priority projects in the First Implementation Stage (1998-2003). The analysis was made on the assumption that all initial investment costs are financed by grant aid. (See Section 7.4, Financing Source of Initial Investment for detailed reasons of this assumption.

This section evaluates financial affordability of the priority projects based on the above said analysis.

##### 9.1.2 Affordability of the Required Costs and Charges

Waste collection rate would be maintained at 60% in 2000-2003 period. As analysed in Chapter 7, the initial investment cost including engineering amounts to Kshs. 3,854 million (US\$65.5 million), which is assumed to be financed by grant aid. Average charge for households should be collected at 211 Kshs/month in order to cover O&M cost, depreciation and PSI contract cost.

On the other hand, affordability of households in the same period is estimated as presented in Table 9.1-1, and the all year average is 212 Kshs/month. Analysis of household income and affordability is also discussed in detail in Subsection 4.2.2 of the Main Report - Master Plan Study.

Table 9.1-1 Estimated Affordability of Households

Income Level	2000	2001	2002	2003	Unit: Kshs/month
Top 45% Level	155	160	164	169	163
Top 30% Level	202	207	213	219	212
Top 15% Level	248	255	262	269	260
Three Level Average	202	207	213	219	212

Theoretically, it is possible to operate the projects at 60% collection by charging 211 Kshs/month in all year average from the viewpoint of households' affordability during 2000-2003.

On the other hand, the total Gross Regional Domestic Product (GRDP) of Nairobi in 2000-2003 is estimated at Kshs 316 billion. The total of O&M, depreciation and contract-out cost in this case is about Kshs 2,881 million and it is about 0.9% of GRDP. It is safely assumed that the project is feasible from the viewpoint of macro-economy as well as financing since the required burden on Nairobi is less than 1% of GRDP. (This litmus paper is used in other SWM studies, such as Bucharest, Romania).

Finally, if the average charge for households is set at 211 Kshs/month, which is decided in proportion to their waste production and deemed as affordable, the charge for commercial establishments set at 437 Kshs/month and tipping fees set at 89 Kshs/ton, which are also calculated in proportion to their waste production/dumping, would be appropriate from the viewpoints of macro-economy and the Polluter Pay Principle (PPP).

### **9.1.3 Consideration of Service Level and Initial Investment Reduction**

In case that the revenue necessary to achieve 60% waste collection ratio in the First Implementation Stage is not attained, the reduction of service level and the initial investment may be taken into consideration.

Waste collection rate would be maintained at 40% in the 2000-2003 period in this case. Initial investment cost including engineering amounts to Kshs. 2,059 million (US\$35.0 million), which is also assumed to be financed by grant aid. Average charge for households should be collected at 135 Kshs/month covering O&M, depreciation and PSI contract cost. As above, the average affordability in the same period is over 212 Kshs/month. This indicates that the project could be operated by charging 135 Kshs/month in all year average during 2000-2003.

The total of O&M, depreciation and contract-out cost in this case is about Kshs. 1,979 million and it is about 0.6% of GRDP. The proposed project is thus feasible from the viewpoint of macro-economy as well as financing.

In addition, if the average charge for households is set at 135 Kshs/month, the charge for commercial establishments set at 279 Kshs/month and tipping fee set at 88 Kshs/ton would also be appropriate from the viewpoints of macro-economy and the Polluter Pay Principle (PPP).

## **9.2 Technical Evaluation**

### **9.2.1 Operation and Maintenance**

#### **(1) Final Disposal**

The proposed final disposal site is assumed to be managed under a sanitary landfill system. Although this system has never been used in Kenya, it basically requires daily application of cover soil but there would be no technical difficulties if heavy equipment like bulldozers and/or excavators are employed. It should be noted that proper organisational arrangements are essential to sustain the sanitary landfill system.

#### **(2) Collection and Transportation**

Daily operation and maintenance of collection vehicles is an integral part of the sanitary landfill system. The container system has already been introduced by the Nairobi City Council (NCC) and it is still workable. In this sense, operation and maintenance of the container truck and container itself would not bring any technical constraint. Major failures resulting in vehicles being

stuck on roads are caused by inadequate repair or replacement of parts. Construction of a new workshop under the Department of Environment (DoE) with a sufficient stock of spare parts for repair and maintenance will solve this problem.

### **9.2.2 Requirement of Expertise**

#### **(1) Final Disposal**

In the Experimental Sanitary Landfill and Closure Work implemented as one of the pilot projects in this Study, NCC operators learned what the sanitary landfill system is and how it operates on the site. The landfill operation is also described in **Section 8.5, Operation and Management Manual of Landfill Site, Data Book (1)**. With this experience of NCC operators, expertise on the system may not be necessary.

#### **(2) Collection and Transportation**

The mechanical system of the container truck is the same as that of the dump truck in terms of hydraulic system. This system could be well maintained and fully repaired by local staff.

As for the transfer station, there is no complicated mechanical system and therefore, no expertise is required on a daily basis except in the introductory stage of the facility which will be covered by technical assistance and/or grant aid.

### **9.3 Environmental Evaluation**

#### **9.3.1 Priority Projects Subject to Environmental Evaluation**

The priority projects chosen for the Feasibility Study and subject to environmental evaluation are: (1) Construction of the Final Disposal Site, and (2) Improvement of the Collection and Transportation System. For the purpose of environmental evaluation, the Improvement of the Collection and Transportation System is divided into three aspects, namely, (a) solid waste storage through communal containers; (b) collection and transportation; and (c) transfer station.

#### **9.3.2 Evaluation of Priority Projects**

The EIA conducted during the Feasibility Study had focused on the construction of disposal site at either the Ruai Area or the Ngong Road Forest Area. Also focused are the impacts involved due to collection and transportation.

Since the Ngong Road Forest Area is not suitable as a solid waste disposal site, the Ruai Area is selected in which case a transfer station is needed. For this transfer station whose location is still to be decided by the Kenyan authorities concerned, an initial environmental examination and an environmental impact assessment are necessary which could be carried out during the detailed design stage of the overall project.

The components of the priority projects and their environmental implications are summarised in the Table 9.3-1 below.

**Table 9.3-1 Potential Negative Impacts of Priority Projects on the Environment**

Priority Project Components	Final Disposal	Collection & Transportation System		
		Storage	Collection & Transportation	Transfer Station
<b>Potential impacts</b>				
Groundwater pollution	2	4	4	*
Offensive odour	1	1	3	*
Harmful insects generation	1	1	4	*
Surface water pollution	3	4	4	*
Smoke from garbage	3	4	4	4
Dust, Exhaust fumes	2	4	2	*
Soil pollution	3	4	4	*
Noise	2	4	2	*
Gas migration	3	4	4	4
Traffic	1 (access road)	4	2 (main road)	*
Landscape	3	1	4	*
Scavengers	1	2	4	*

Legend: 1: impact of high significance; 2: impact of moderate significance; 3: impact of low significance; 4: impact of no significance; \*: to be evaluated by EIA during the detailed design

### 9.3.3 Mitigation Measures

The potential impacts to be generated by each component of the projects and their mitigation measures are as described below.

#### (1) Final Disposal

Offensive odour and insect procreation, dust, noise, leachate and traffic on access roads are the major items that can impact the environment. However, the disposal site shall be designed and constructed to receive domestic solid waste with the provision of adequate environmental control facilities and implementation of operational procedures to mitigate these possible adverse impacts. In addition, the upgrading of the access road to Class C shall be executed to mitigate the high impact on the traffic.

Scavenging activities into the disposal site is considered as impact of high significance because they can negatively influence the smooth operation of the site. If NCC will allow them to work at the site, then the enactment of specific working rules is necessary to control their activities.

#### (2) Collection and Transportation

Dust, noise, traffic and smell are potential negative impacts on storage of solid waste. These impacts could be minimised by using adequate equipment and selecting the appropriate routing and time for the collection and transportation. Besides, it is assumed that the collection from solid waste collection points will be conducted on an efficient and reliable manner, avoiding in this way undesirable odours.

Scattering of waste, smell and insect procreation, on the other hand, are the major constraints in the component of collection and transportation. To minimise these impacts, the solid waste collection points and communal containers should be decided and designed, taking into consideration the protection of the environment and public health as well as convenience to the users.

#### **9.3.4 Conclusion**

Some potential negative impacts are predicted to appear with the proposed projects; however, the implementation of mitigation measures will minimise these impacts.

Since currently the waste collection in the city is very poor and in some places is null, the proposed projects are expected to make a clean city with less disease caused by the poor management of solid waste.

The existing disposal site currently have serious impacts on the surrounding environment. The newly proposed disposal site will be of sanitary landfill type, diminishing in this way possible adverse effects on the surrounding environment.

In conclusion, the proposed projects are considered to be beneficial as a whole from the point of view of their contribution to a better environmental quality of Nairobi City as well as to the improvement of public health.

### **9.4 Social Evaluation**

#### **9.4.1 Public Awareness**

The new collection and transportation system depends mainly on a container system. In other words, communal containers will be installed all over the city as much as possible and NCC will collect the waste discharged in the containers. Since the installation of new containers would be conspicuous, the introduction of the container system will result in arousing people's awareness toward the importance of solid waste management. It will accordingly enhance people's cooperation with the new system.

#### **9.4.2 Scavenging**

A large number of scavengers is operating in the city and especially sustained by the Dandora dumpsite. Proper collection services will gradually reduce the number of scavengers. The closure of the Dandora site will eliminate scavenging problems such as health and safety. Although the construction of the new final disposal site at Ruai area will create a new venue for scavenging activities, a proper level of management and control in the new site will minimise the scavenging problems and contribute more or less to reuse and recycling of the waste by scavengers.

The construction of a transfer station may bring social tension in the surrounding area because the transfer station is proposed near the residential area. In this respect environmental impact assessment (EIA) as well as social survey should be carried out

before the implementation, and construction schedule will be fixed based on the result of EIA.

### **9.5 Institutional and Organisational Evaluation**

The proposed Institutional Restructuring Plan (IRP) and the Capacity Building Assistance Program (CBAP) will end in the year 2000. The new collection and transportation system will start in the middle of 2000, and the new final disposal site will receive collected solid waste from the year 2001. Therefore, these technical approaches could be carried out smoothly and properly under the restructured organisations including the financial system by IRP and CBAP.

### **9.6 Consideration on Project Implementation**

It is recommendable that the Government of the Republic of Kenya and the Nairobi City Council (NCC) should carry out all the priority projects in the First Implementation Stage, i.e., from 1999 to 2003. However, in case that the revenue necessary to implement the projects is not enough because of financial constraints, some of the projects may have to be deferred to the next implementation stage.

In consideration of the possibility of securing special funds from the central government and/or grant aid from other governments, the priority projects as considered in this Study may be divided into smaller project units which can be executed as independent projects. The following table shows the prioritisation of project implementation, prerequisites and required project costs.



Table 9.6-1 Prioritisation of Project Implementation, Prerequisites and Project Costs

Priority	Project	Prerequisite	Capital Cost Required (million Kshs)
1	Institutional Restructuring and Financial Reform under the Capacity Building Assistance Program (CBAP)	Implementation of Preparatory Actions by NCC	47.8
2	Construction of a new small workshop at Kaloleni* <sup>1</sup>	-ditto-	88.2
3	Introduction of container system with side loaders, dump trucks, etc.* <sup>2</sup>	Implementation of Preparatory Actions by NCC; and After start-up or in parallel with the above CBAP	447.2
4	Construction of a new sanitary landfill site at Ruai (First Stage)* <sup>3</sup>	Implementation of Preparatory Actions by NCC and the Urgent Improvement Plan; and After start-up or in parallel with the above CBAP	455.4
5	Procurement of heavy equipment for the new landfill site* <sup>4</sup>	-ditto-	89.1
6	Closure work of the existing dumpsite at Dandora	-ditto-	227.0
7	Implementation of the Community Waste Management Project (CWMP)	Implementation of Preparatory Actions by NCC	12.0 (for 5 years)
8	Construction of a transfer station	Implementation of Preparatory Actions by NCC and the Urgent Improvement Plan; and After start-up or in parallel with the above CBAP	945.0

Note: \*<sup>1</sup> Including rehabilitation of the existing depots.

\*<sup>2</sup> Vehicles and others required are 27 container trucks, 507 containers, 14 side loaders, 6 dump trucks, 6 wheel loaders, 1 water sprinkler, 22 inspection cars and 1 recovery truck.

\*<sup>3</sup> The first stage construction excludes excavation, embankment and installation of leachate collection and drain piping and gas exhaust equipment work for the following stage of construction.

\*<sup>4</sup> Heavy machinery required are 5 bulldozers, 1 excavator, 2 dump trucks and 1 jeep.

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**CHAPTER 10**

**CONCLUSION**

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## CHAPTER 10

### CONCLUSION

To improve public cleanliness and public health and protect the environment, the Government of the Republic of Kenya and the Nairobi City Council (NCC) should carry out the priority projects in the First Implementation Stage, i.e., from 1999 to 2003. The priority projects are composed of: (1) Institutional Restructuring and Financial Reform; (2) Promotion of Private Sector Involvement; (3) Construction of the Final Disposal Site; and (4) Improvement of the Collection and Transportation System.

The total cost of the four projects is estimated at Kshs. 6,743 million including Kshs. 3,854 million (US\$65.5 million) for initial investment and engineering cost. If waste charges only cover the operation and maintenance (O&M) cost and depreciation of the projects, NCC should collect 211 Kshs/month from each household, 437 Kshs/month from commercial establishments and 89 Kshs/ton for tipping in the period 2000-2003.

The first project, i.e., Institutional Restructuring and Financial Reform will be conducted under the Capacity Building Assistance Program (CBAP) which costs Kshs. 47,773,000 (US\$812,500) under technical assistance. The CBAP is scheduled to start in 1999 and end in 2000.

The second project, i.e., Promotion of Private Sector Involvement will be implemented after establishing a new Contract Management Section (CDS) under the CBAP. The total cost for contract-out is estimated at Kshs. 521,500,000.

The third project, i.e., Construction of the Final Disposal Site will be completed fully by the end of 2002. The total project cost amounts to Kshs. 1,962,600,000, including Kshs. 1,821,800,000 (US\$30,983,000) for initial investment and engineering cost under grant aid.

The last project, i.e., Improvement of the Collection and Transportation System will be carried out based on the project cost of Kshs. 4,203,300,000. The initial investment and engineering cost will be Kshs. 1,984,200,000 (US\$33,745,000).

Alternatively, if the revenue necessary to achieve 60% waste collection rate could not be attained, the reduction of service level and initial investment may be taken into consideration, assuming that the transfer station is constructed in the next implementation stage and the sanitary level of landfill system for the new disposal site is reduced to Level 2+. The total cost of the four projects will be Kshs. 4,038 million including the Kshs. 2,059 million (US\$35.0 million) for initial investment and engineering cost. Required waste charges will be 135 Kshs/month for each household, 279 Kshs/month for commercial establishments and 88 Kshs/ton for tipping fee.

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***CHAPTER 11***  
***RECOMMENDATION***

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## CHAPTER 11

### RECOMMENDATION

The JICA Study Team recommends that the Government of the Republic of Kenya and the Nairobi City Council (NCC) should carry out the priority projects (see **Chapter 10**) in the First Implementation Stage, i.e., the years 1999 to 2003. The priority projects should be followed by the Preparatory Actions and Urgent Improvement Plan, as described in detail in **Sections 4.11 and 4.12 of Volume 2, Main Report - Master Plan Study.**

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

- (1) Drafting of a new SWM By-laws.
- (2) Restructuring the organisation and financial system of the Department of Environment, Nairobi City Council.
- (3) Making arrangements with the central government and donor countries or agencies in order to secure financing for the implementation of the projects.

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