

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

METROPOLITAN MANILA DEVELOPMENT AUTHORITY
THE REPUBLIC OF THE PHILIPPINES

**THE STUDY
ON
SOLID WASTE MANAGEMENT
FOR
METRO MANILA
IN
THE REPUBLIC OF THE PHILIPPINES**

FINAL REPORT

SUMMARY

MARCH 1999

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**PACIFIC CONSULTANTS INTERNATIONAL
KOKUSAI KOGYO CO.,LTD.**

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The exchange rate applied in this report is

**Master Plan &
The Environmental Improvement of SAN MATEO SLE**

US\$ 1.00 = Peso 40.06 = Yen 128.49
(as of end of February 1998)

The Development of a NEW SANITARY LANDFILL

US\$ 1.00 = Peso 40.35 = Yen 116.50
(as of end of October 1998)

PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct the Study on Solid Waste Management for Metro Manila and entrusted to study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Dr. KATSUHIDE NAGAYAMA of Pacific Consultants International and consist of Pacific Consultants International and Kokusai Kogyo Co., Ltd. to Philippines, 5 times between February 1997 and February 1999. In addition, JICA set up an advisory committee headed by Dr. KUNITOSHI SAKURAI, President of Tokyo International Environmental Planning Institute, between February 1997 and February 1999, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Philippines and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

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

March 1999



Kimio Fujita
President
Japan International Cooperation Agency

Mr. Kimio Fujita

President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Sir:

We are pleased to officially submit herewith the final report of "The Study on Solid Waste management for Metro Manila in the Republic of the Philippines".

This report compiles the results of the study which was undertaken in the Republic of the Philippines, from February 1997 to February 1999 by the Study Team, jointly organized by Pacific Consultants International and Kokusai Kogyo Co., Ltd.

We would like to express our deep appreciation and sincere gratitude to all those who extended their kind assistance and cooperation to the Study Team, particularly the officials concerned of Metropolitan Manila Development Authority, and other members of the Philippine Counterpart Team.

We also acknowledge and appreciate greatly the excellent support given by your agency, the JICA Advisory Committee and the Embassy of Japan in the Republic of the Philippines.

We sincerely hope that this report will be of help for the socio-economic development of the country as a whole. This report would be able to contribute really to Philippine people and socio-economic development in the future.

Very truly yours,



Katsuhide Nagayama

Team Leader

The Study Team for the Study on Solid
Waste management for Metro Manila in
the Republic of the Philippines

INTRODUCTION

The fast economic growth, rapid urbanization, and associated escalating generation of solid waste, is causing problems in the Philippines in general, and in particular in the capital region Metro Manila. In recognition of this situation the Government of the Philippines requested the Government of Japan to assist in improvement of solid waste management in Metro Manila. The Government of Japan, in response to the request, decided to dispatch a study team under the scheme of JICA's development study.

The study, which commenced on February 26, 1997, was conducted by the Japan International Cooperation Agency (JICA) and a team of consultants from Pacific Consultants International and Kokusai Kogyo Co., Ltd. The Metropolitan Manila Development Authority (MMDA) acts as the counterpart agency to the JICA Study Team and also as a coordinating body in relation with the other governmental and non-governmental organizations to ensure a smooth implementation of the study. An outline of the framework for the study is given below.

Study Area:	17 cities and municipalities in Metropolitan Manila, and those areas concerning the final disposal sites outside Metro Manila.
Target Year:	The target year of the Master Plan is 2010.
Time schedule:	Master Plan : 1998-2010 Short Term Improvement Plan : 1998-2004 Long Term Improvement Plan : 2005-2010

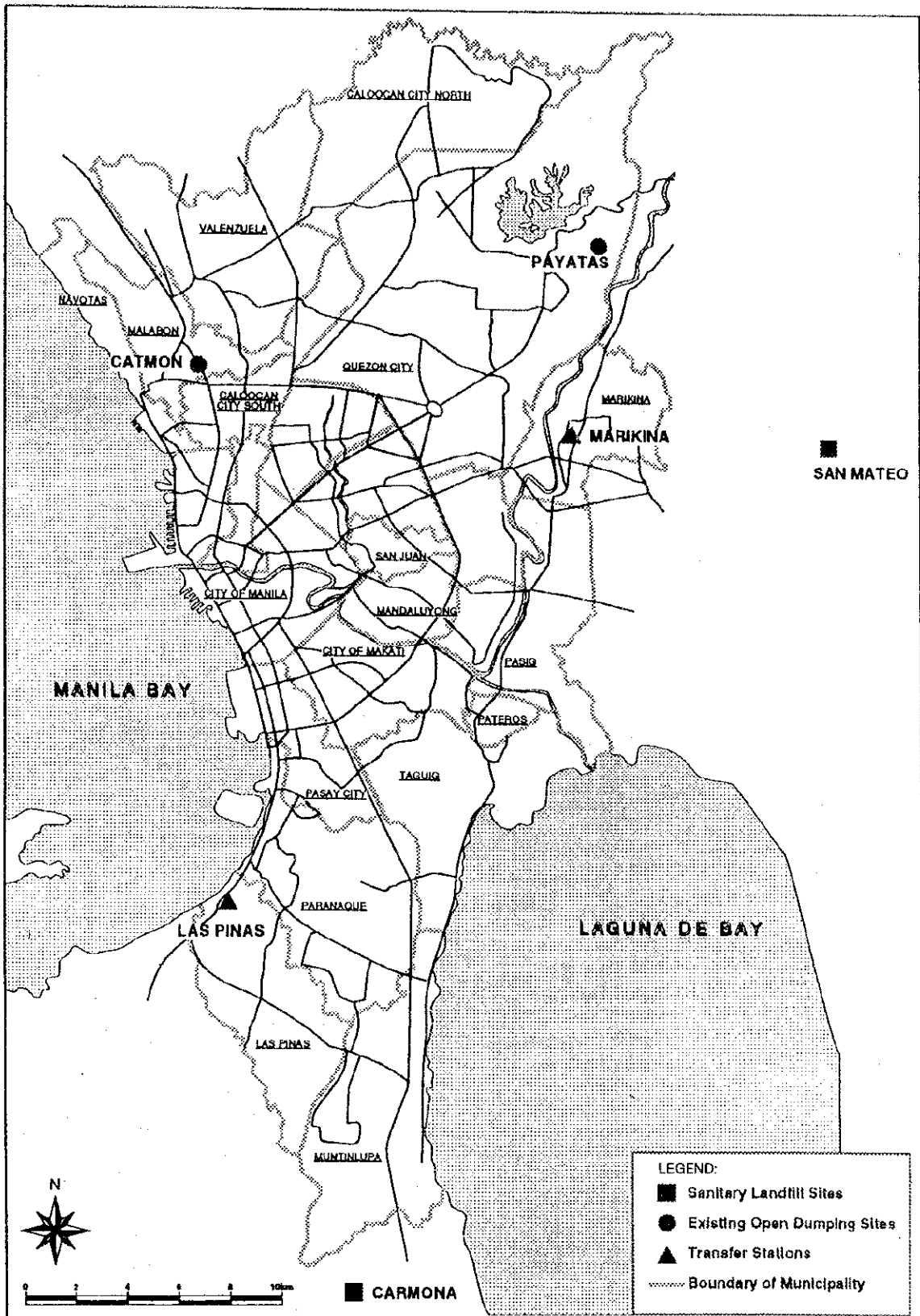
The Master Plan aimed to identify prompt and appropriate measures for improvement of the present solid waste management systems, with emphasis on upgrading the service level, expansion of service coverage and improvement of the institutional and financial status of organizations concerned.

The Feasibility Study was conducted for those projects selected by the Government of the Philippines out of the priority projects proposed in the Master Plan. The target projects selected are:

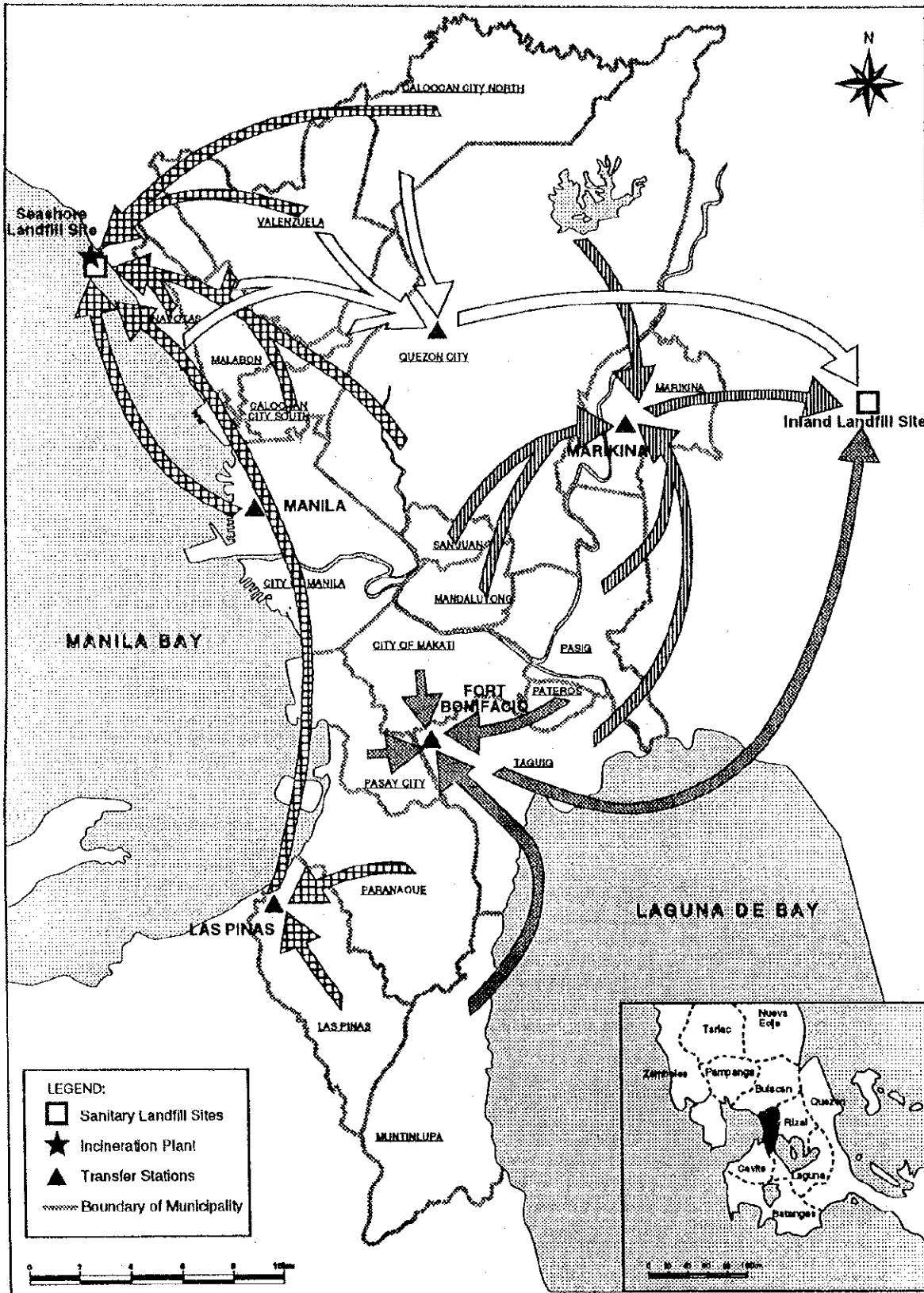
- 1) Environmental Improvement of San Mateo sanitary landfill
- 2) New sanitary landfill in "new Parcel B" in Marikina River Basin

The study was also extended to conduct a few categories of pilot project to confirm the effectivity of the improvement measures proposed in the Master Plan. Therefore this report contains a summary of the following outputs produced in the study:

- Part 1 - Master Plan
- Part 2 - Feasibility Studies
- Part 3 - Pilot Projects



Study Area and Existing Facilities for Solid Waste Management



Proposed Waste Flow in Metro Manila in the year 2010

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PART 1 - MASTER PLAN

1. FINDINGS AND PLANNING ISSUES

1.1 General

The data collection and analysis and field surveys carried out in the first part of the pstudy have yielded a number of findings and planning issues, which have been considered in making the Master Plan. The most important findings and planning issues are summarized below.

1.2 Solid Waste Stream

A Waste Amount and Composition Survey (WACS) was conducted in April and June 1997, in order to analyze the solid waste stream during dry and rainy seasons. A total of 3,402 samples were collected from 9 categories of generation sources in three sample areas believed to represent Metro Manila, namely Quezon City, Makati, and Parañaque.

A summary of the results from the WACS is given below:

- a) The total waste generation in Metro Manila has been estimated at 5,350 t/day, characterized by the following:
- b) Out of the total generation, household waste constitutes around 74% or 4,000 t/day.
- c) The unit generation amounts by income levels appeared: 500 g/person/day for the high income group; 451 for the middle income group and 344 for the low income group. Utilizing statistics on distribution of income level in the study area from the National Statistics Office, a weighted average of household waste generation in the study area was calculated at 419 g/person/day.
- d) The apparent specific gravity (ASG) of municipal solid waste (MSW) was measured at an average of 0.20 kg/l.
- e) The percentages of paper and plastics are very high compared to the other developing countries.
- f) The moisture content ranged between 30% - 55%.
- g) For 1997, the calorific value was estimated at 1,570 kcal/kg.
- h) The coverage of waste collection services is approximately 73% in Metro Manila.

The present solid waste flow in Metro Manila diagrammed in Figure 1.1.is based on the survey conducted by the JICA Study Team.

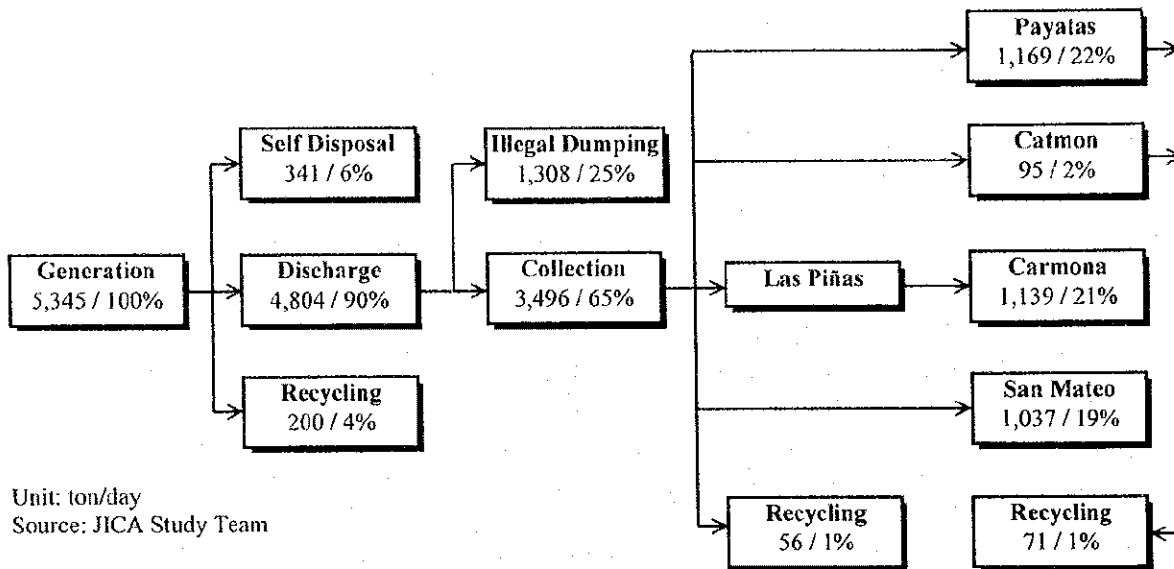


Figure 1.1 Synoptic Waste Stream in Metro Manila

1.3 Waste Collection System

As can be seen in Figure 1.1 above, the waste generated in Metro Manila totals around 5,350t/day, of which about 4,800 tons are discharged. Of the total amount of discharged waste in Metro Manila, around 73% or 3,500t/day are collected. The rest are either illegally dumped on nearby spaces or thrown into rivers. Based on the findings on waste collection activities and system, the following main issues have been identified.

(1) Expansion of Waste Collection Area Coverage

The present collection coverage is not sufficient, especially in squatter areas and other inaccessible areas. Hence, ways to expand waste collection coverage should be considered.

(2) Improvement and Standardization of Waste Collection Services

To properly conduct collection and haulage in the entire Metro Manila area, a manual should be prepared with the cooperation of MMDA.

(3) Dissemination of Environmental Education and Encouragement of Public Participation

The existing problems in waste collection are caused not only by technical reasons, but also by limited public perception and participation in waste collection services.

(4) Use of Containers

To efficiently collect wastes from large generation sources and in consideration of the effects of storage and discharge on environmental sanitation, the use of containers is recommended.

1.4 Waste Transport and Haulage

Collected wastes are generally either hauled directly to the final disposal site, or brought to a transfer station. Most wastes taken to the Carmona landfill site are first brought to the Las Piñas transfer station and loaded onto trailer trucks. Issues relevant to the planning of waste transport and haulage systems are summarized below.

(1) Expansion of Transfer Station

Transfer stations of local government units should be expanded, and the appropriate grouping of LGUs to share the transfer stations must be taken into account.

(2) Installation of Truck Scale

The installation of a truck scale in the San Mateo and Carmona disposal sites, and the Las Piñas transfer station would provide local government units with uniform information for the assessment of waste volume collected and transported.

1.5 Intermediate Treatment

There are at present no substantial intermediate treatment facilities in Metro Manila, but some facilities are identified as necessary measures the Master Plan as discussed below.

(1) Reduction of Waste to Increase the Life Span of Disposal Sites

The findings of the Study Team pointed that around 6% of total solid waste generated is being recycled. To further reduce the volume of waste, the setting up of recycling centers is recommended, but after a separate collection system is established.

(2) Feasibility of Compost Derived from Solid Waste

To assess the feasibility of waste derived compost, the present market, as well as the ways to increase demand, must be evaluated. This will also determine scale of composting plants to be constructed at final disposal sites.

(3) Introduction of Incinerator

Metro Manila is currently faced with problems concerning final disposal sites. Even the acquisition of a site outside of the metropolis is expected to encounter many difficulties. Accordingly, the introduction of an incinerator should be fully examined from the technical, economical, environmental and social points of view.

1.6 Final Disposal

There are four final disposal sites for the waste from Metro Manila; the two open dumpsites Payatas and Catmon, and the two landfills San Mateo and Carmona. The present distribution of waste volume among the sites is displayed in Figure 1.2.

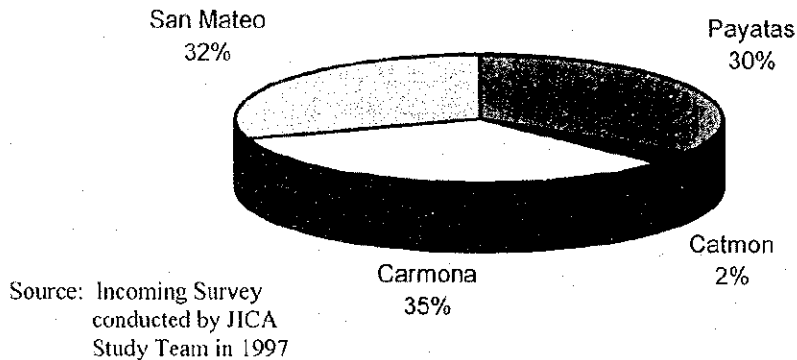


Figure 1.2 Distribution of Waste Coming to Final Disposal Sites in 1997

In the formulation of the Master Plan, the following findings on final disposal have been identified.

(1) *Improvement of Environmental Condition*

To improve the situation of the final disposal, it is recommended to improve the operational procedures and to innovate the structure at the San Mateo and Carmona disposal sites in order to minimize negative environmental impacts.

(2) *Identification of New Landfill Sites*

To get ready for the closure of existing final disposal sites, new sites for landfill need to be identified, and the preparatory work for development of the sites should be commenced as soon as possible.

1.7 Recycling Activities

In the formulation of the Master Plan, it is believed that the following issues must be addressed to encourage and promote recycling activities:

- 1) Definition of roles and responsibilities of both the central and local governments for recycling activities towards a Zero-Waste Society.
- 2) Provision of incentives for recycling projects/programs by the private sector.
- 3) Development of appropriate collection and segregation systems, taking into account the recycling market.

- 4) Promotion of public awareness of "Recycling Society" for sustainable growth.
- 5) Diversification of value-added "recycled products" by the private sector
- 6) Formation of an industrial policy to encourage investment in recycling industry, installation of the recycling process at factories and stabilization of the market for recycling materials.

1.8 Social Issues

The matters regarding social consideration found to be of most importance in the formulation of the Master Plan are summarized below.

- 1) Leadership and political will towards solid waste management improvements, especially from the LGU mayors, is fundamental for the promotion of the community participation in solid waste management;
- 2) Establishment/improvement of refuse recycling systems contributes to the waste minimization and the enhancement of public awareness;
- 3) Extension of collection services to squatter areas is indispensable to ensure the impartial delivery of public services;
- 4) Provision of better working conditions to the workers engaged in the solid waste management (formal or informal ones) should be addressed;
- 5) Coordination among several on-going efforts of solid waste management improvement should be sought.

1.9 Environmental Issues

Based on the findings on environmental problems in the present solid waste management system, the following issues have been considered of most importance in the Master Plan.

- 1) Expansion of collection coverage especially in squatter areas and inaccessible areas;
- 2) Improvement of roads around final disposal sites, including installation of turnouts and traffic safety facilities;
- 3) Closure of the open dump sites and suitable remedial measures to minimize the adverse environmental and health impacts from these sites;
- 4) Improvement of existing environmental protection system at San Mateo and Carmona landfills;
- 5) Monitoring of environment and health of inhabitants living in the areas surrounding the four final disposal sites and countermeasures to combat the adverse effects.

1.10 Institutional Issues

MMDA and the LGUs are currently facing institutional problems as shown below:

- 1) Formation of well-functioning institutional linkages of relevant organizations;
- 2) Improvement of MMDA's institutional and mandatory capability for solid waste management;
- 3) Facilitation of coordination with DENR, MMDA, LGUs and all stakeholders;
- 4) Capability building of human resources in relevant organizations;
- 5) Assurance of transparency of decision-making process; and
- 6) Study on the best option for institutional restructuring to meet financial and managerial requirements for project implementation for SWM in Metro Manila.

1.11 Financial Issues

Recently, the economy of Metro Manila seems to shift to an acute upward curve. Its current GRDP increased at 2.8 times from 1988 to 1996, while the total revenues of MMDA and the 17 LGUs increased at 5.6 times during the same period. That increased the share of revenue in the GRDP to 2.5% in 1996, from 1.3% in 1988, as shown in Figure 1.3. Thus, MMDA and the LGUs have attained a higher revenue growth rate than the GRDP growth rate of Metro Manila.

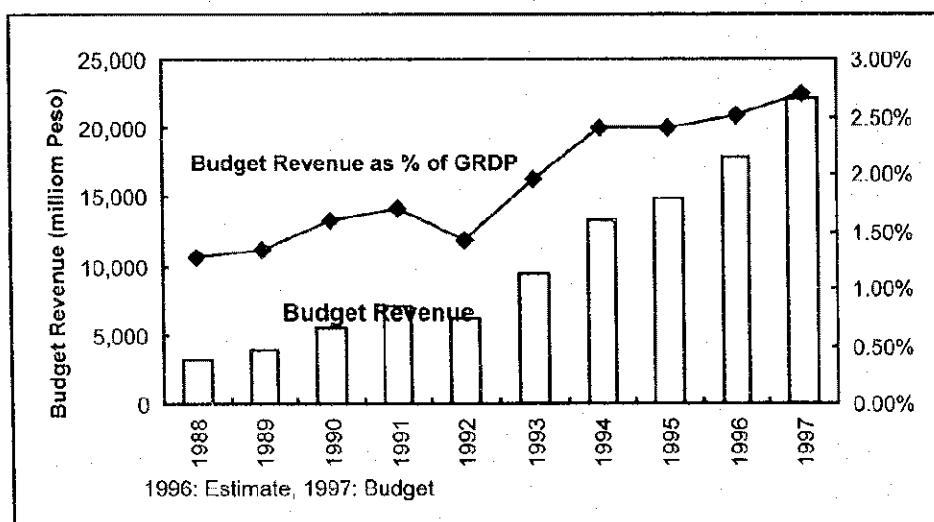


Figure 1.3 Revenues of MMDA and LGUs as Percentage of GRDP of Metro Manila

During the last five years from 1992 to 1996, after the implementation of the Local Government Code, the revenue of every LGU has increased more than twice or at an average annual growth rate higher than 20%. Some LGUs, such as Makati, Muntinlupa, Pateros and Taguig, increased their revenues at more than five times during the same period.

With regards to the revenue sources of the 17 LGUs, the autonomous income from tax revenue (local tax and real estate tax) shares 40-80% (or 67% on average), while IRA shares 22% on average. This means that the LGUs in NCR have abundant revenue sources at their disposal compared with MMDA and other LGUs outside Metro Manila.

It should be pointed out however that the sizes of budget remarkably vary among the 17 LGUs. In 1996, the cities of Makati and Manila gained more than 3 billion pesos of revenue, while the municipality of Pateros received only 80 million in the same year:

Since the Local Government Code took effect in 1991, the revenue structure of MMDA has undergone a drastic change. MMDA lost its revenue from local tax and real estate tax, which were entirely transferred to LGU revenues, and extremely increased their dependency to the grants coming from the national government to almost half of their total revenue. Furthermore, the grants are not regularly allocated to MMDA, and the remittance of mandatory contribution by LGUs is irregular. This irregularity of financial sources makes MMDA financially unstable and dependent.

Another financial issue is the large weight of recurrent costs. The total expenditure of MMDA increased by 1.6 times between 1991 and 1997. Particularly, personnel expenses are continuously increasing even after the Local Government Code took effect.

It is estimated that the expenditure for SWM amounts to 751 million pesos or 42 % of total expenditure of MMDA in 1997. The 17 LGUs on the other hand appropriated approximately 1,650 million pesos in total, 11% of their expenditure, to SWM in 1996.

Assuming that 40% of MMDA revenue and 10% of the 17 LGUs' revenues for 1997 are allocated for SWM, the total SWM cost is estimated at 2,800 million pesos.

Based on the findings on current financial and budgetary situation, the following issues have been identified as having importance in the formulation of the Master Plan:

- 1) Improvement of financial status and strengthening of budgetary capability of LGUs;
- 2) Promotion of cost efficient budgetary system for Solid Waste Management by LGUs; and
- 3) Establishment of a sustainable financial and budgetary scheme to meet the demand for capital outlay for investments and recurrent costs.

2. MAJOR COMPONENTS OF THE MASTER PLAN

2.1 Goal and Objectives of the Master Plan

The goal of the Master Plan is to develop a well functioning, environmentally sound and financially sustainable solid waste management system, and thereby provide a hygienic and healthy living environment in Metro Manila. The Master Plan is formulated considering the planning issues mentioned in Chapter 2, and the following three major objectives.

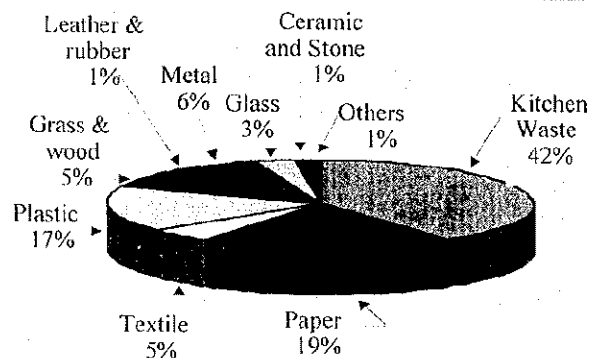
- a) To promote public participation in SWM;
- b) To build self-supporting and sustainable operation of SWM in every LGU; and
- c) To increase recycling and resource recovery

The timetable of specific targets assumed in the Master Plan is described below.

- Close existing open dumpsites by the end of 2000
- Commence partial separate collection by 2005
- Achieve an 80% collection ratio by 2005, and 90% by 2010
- Subject 10% of total waste volume to composting and recycling by 2010
- Commence incineration for volume reduction from 2005
- Convert all final disposal sites to sanitary landfills by 2005

2.2 Planning Framework

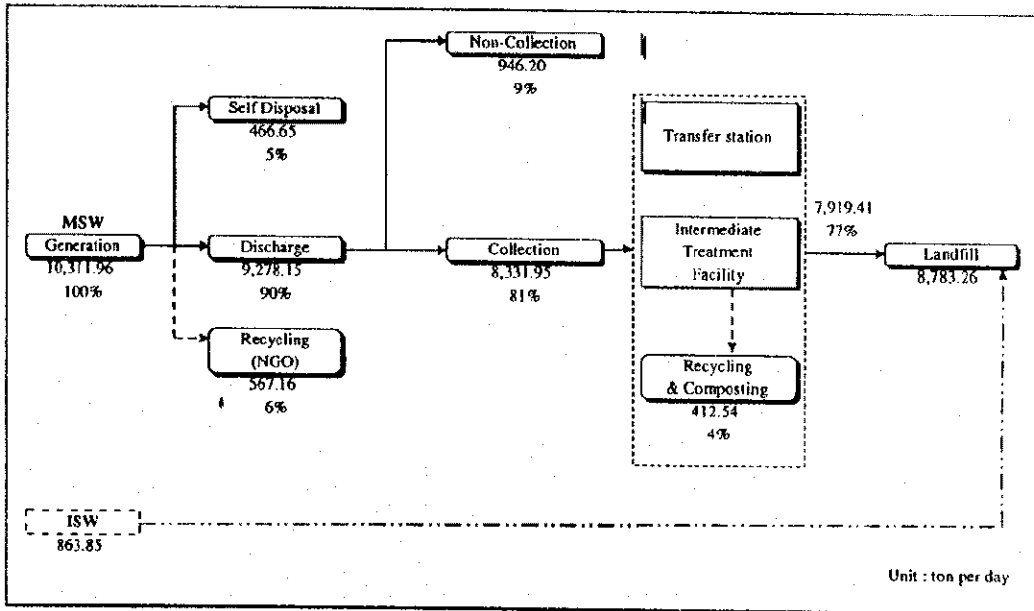
The future growth rate of waste generation predicted by this study is 2% per annum. Based on this, household waste generation rate by 2010 was estimated at 542 g/capita/day. Future waste composition was forecast based on the results of the study conducted by the JICA Study Team as shown in Figure 1.4.



Source: worked out by the JICA Study Team

Figure 1.4 Waste Composition in 2010

Waste amount was estimated according to the increase in generation source units, the forecast growth ration of waste generation, as well as increased collection ratio from the present 73% to 90% in 2010. As a result, the waste generation amount of Metro Manila in 2010 is forecast to be 10,000 tons/day, twice as much as at present. Figure 1.5 shows the predicted waste flow in Metro Manila in 2010.



Source: worked out by the JICA Study Team

Figure 1.5 Waste Stream Forecast in 2010

2.3 Acquisition of Final Disposal Sites

The accumulated disposal amount is estimated at 30 million tons from 1997 to 2010 and 66 million tons to 2020 assuming that a volume reduction of waste by incineration is not introduced. These amounts are equivalent to 21.5 million cum and 47 million cum. A large tract of land is required to dispose of such a huge amount of wastes. Assuming that the landfill height is 20 m, the disposal area needed is 135 ha by 2010, and 300 ha by 2020.

According to the "Criteria for the Selection of a Potential Sanitary Landfill", a potential site must meet anticipated needs for a period of 10 to 20 years. Therefore, the candidate disposal sites should be more than 100 ha.

Seashore landfill is one of the best-conceived options for final disposal because it proved very difficult to acquire a suitable land in inland areas. However, a seashore landfill site is, in general, of low-cost performance, or hardly feasible, because of the huge investment

cost for the embankment, which requires sufficient environmental measures to protect marine ecology.

The costly nature of seashore landfill forces MMDA to continuously seek inland landfill sites to escape the garbage crisis even though it is difficult to acquire them. Therefore inland landfill is still a practical option for the final disposal in terms of the Master Plan period.

A list of candidate disposal sites was drawn up according to the information provided by the MMDA, DENR-EMB, NEDA, etc., and is shown in Table 1.1.

Table 1.1 Candidate Disposal Sites

Candidate Sites	Area (ha)	Information Source
a. MEFCON*	365	DENR-EMB
b. Maragondon	100	MMDA, NEDA
c. Kalawakan, Bulacan	1000	DENR, Malolos
d. Bacolor, Pampanga	300 or more	DENR, Region III
e. Sea Landfill		PEA, etc.

* Marikina Environment Forest Conservation Project

These sites were assessed in terms of construction cost, transportation cost, necessary environmental protection measures and affected communities, and the result represents a ranking of suitability for the final disposal site, as shown in Table 1.2.

Table 1.2 Evaluation of Candidate Disposal Sites

Candidate Sites	Rank
a. MEFCON	1
b. Maragondon	3
c. Kalawakan, Bulacan	2
d. Bacolor, Pampanga	4
e. Sea Landfill	1

2.3.1 Inland Landfill in MEFCON

MEFCON is located within the Marikina watershed in Rizal Province, about 36km east of Manila City, and 3km north of the existing San Mateo disposal site. The DENR proposes the use of this site as part of the Marikina Environment Forest Conservation Project (MEFCON), an extensive land use plan which envisages the development of public space for the residents of the area and Metro Manila, by conserving the natural environment in the watershed of Marikina River. The proposed MEFCON landfill site on the left bank of the Marikina River is now under process of a presidential proclamation to release from the preservation area of forest and to authorize the use for solid waste

disposal. Furthermore, the adjacent three areas can be reclaimed successively. The proposed site is shown in Figure 1.6 as "Pintong Bocaue 2".

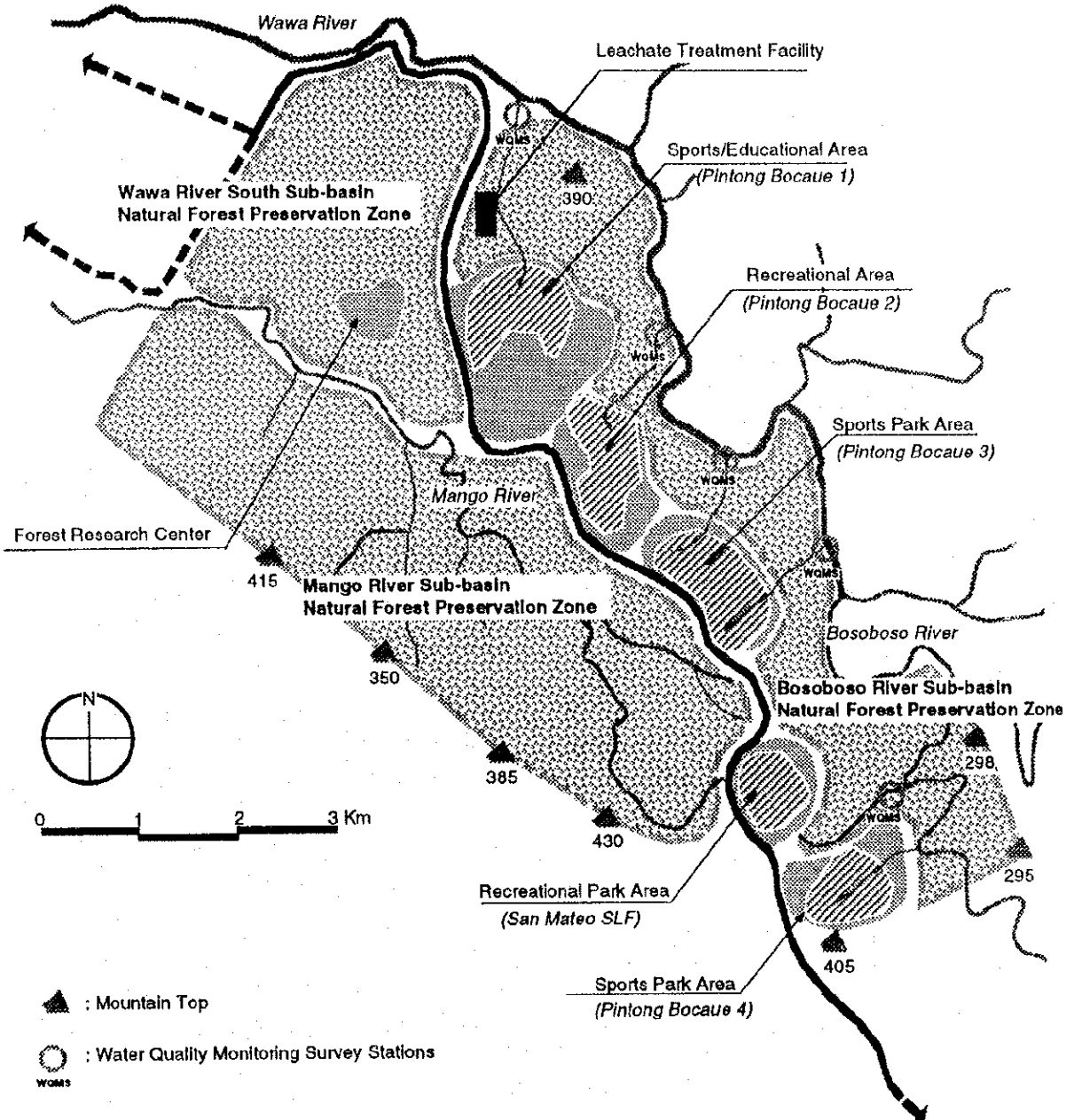


Figure 1.6 A Land Use Concept of Marikina Environmental Forest Conservation Projects (MEFCON PROJECT)

2.3.2 Seashore Landfill

Table 1.3 shows a model comparison in unit cost between the two types of landfill under the condition with and without incineration prior to final disposal. As indicated in the table, the most economical way is, of course, "inland landfill without any incinerating process," which has a unit cost of 590 pesos/ton. However, "with incineration" added to inland landfill, the unit cost goes up to be 1,300 pesos/ton.

On the other hand, the unit cost of seashore landfill goes down in case the incineration is adopted from 2,150 pesos/ton to approximately 2,000 pesos/ton. This is derived from an assumption that the seashore landfill only accepts the incinerated ash.

Table 1.3 Comparison of Waste Disposal Expenses

Landfill Type	W/o Incineration	W/ Incineration
Inland Landfill	590 pesos/ton	1,300 pesos/ton
Seashore Landfill	2,150 pesos/ton	2,000 pesos/ton

Note: The above values, including initial investment and O&M costs are estimated based on the following assumptions:

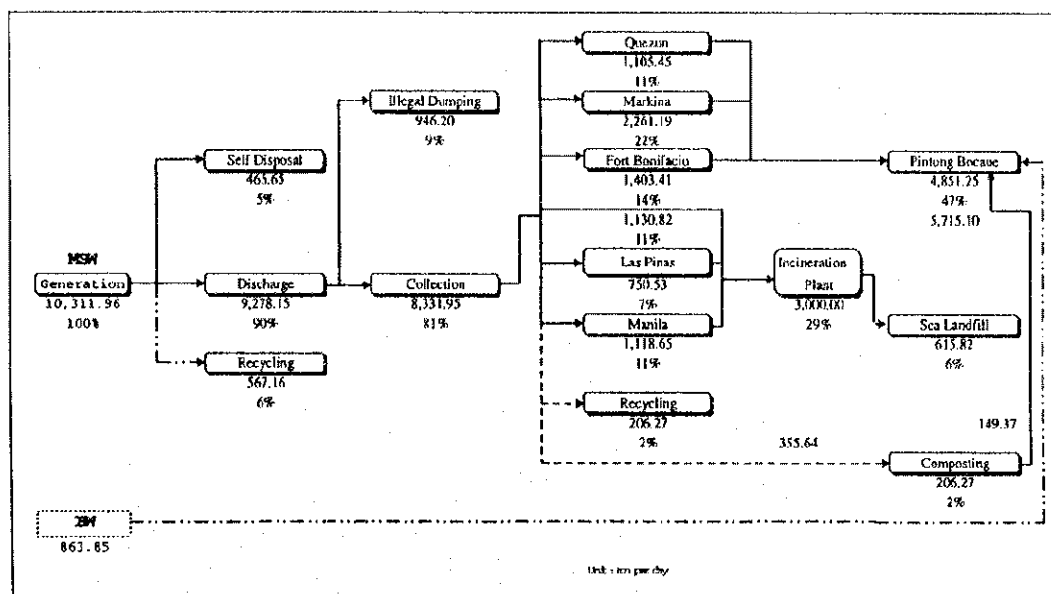
- Annual disposal amount: 1.0 million cum (raw waste)
- Project life: 15 years
- Volume reduction rate by incineration: 15%
- "Without incineration" means all the raw waste is disposed of via the landfill site.
- Unit costs are obtained using the following formula:
(Initial investment + O&M cost) / Accumulated waste amount given by raw waste amount)

As for the possible locations of a seashore landfill site, it has been tentatively identified in the northern sections of Manila Bay, taking into account existing navigation routes and a number of on-going/future reclamation projects.

In the northeastern section, there is a plan to develop the offshore area of the municipality of Navotas into the "North Bay Business Park. This area will be bounded by the Navotas fishport to the south and the Navotas and Tangos rivers to the north. It is possible to develop the northern part of the planned reclamation area or the offshore area into a seashore landfill site, however, further study is necessary to verify the possibility of the use as waste disposal.

2.4 Improvement of Technical System

Twelve different technical alternatives for future SWM system in Metro Manila have been evaluated from technical, economical, social and environmental point of view. The waste flow in 2010 of the proposed technical system is shown in Figure 1.7 below:



Source: worked out by the JICA Study Team

Figure 1.7 Waste Flow by Selected Technical System in 2010

2.4.1 Discharge and Storage

(I) Discharge and Storage Containers

A summary of the proposed discharge and storage containers are given in Table 1.4.

Table 1.4 Discharge and Storage Container

Type of Waste	Discharge and Storage Container	
	Present System	Proposed System
Household waste	plastic bags, rice sacks, plastic or metal dustbins, dustbins made from reusable tires, cartons, drum cans	various types of dustbins overlain with a plastic bag
Household waste in non-service areas (e.g. squatter areas)	-	installation of containers for communal use
Commercial waste	plastic bags, containers	plastic bags, containers
Institutional waste	plastic bags, containers	plastic bags, containers
Market waste	discharge yards (open heaping), containers	containers
Street sweeping waste	plastic bags	plastic bags
River cleansing waste	open heaping	open heaping

(2) At-Source Separation

The extension of guidance in the separate discharge of recyclable materials at discharge sources is recommended for waste volume reduction and environmental conservation.

(3) Proper Discharge

To maintain sanitary conditions and improve collection efficiency it is recommended to disseminate proper manner of waste discharge.

2.4.2 Collection and Haulage

The proposed future collection system is outlined in Table 1.5.

Table 1.5 Collection System

Type of Waste	Discharge Container	Collection System	Collection Equipment
Household waste	plastic bags	curbside or bell collection system	compactor trucks capacity 15.8 m ³
	containers (1 m ³)	container collection system	
Commercial waste	containers or plastic bags	container or curbside collection system	compactor trucks capacity 15 m ³
Institutional waste	containers or plastic bags	container or curbside collection system	compactor trucks capacity 15m ³
Market waste	containers (8 m ³)	container collection system	arm-roll truck
Street sweeping waste	plastic bags	station collection system	dump trucks capacity 10 m ³
River cleansing waste	open heaping	station collection system	dump trucks capacity 10 m ³

(1) Collection Method

As in the present, a part of segregated recyclable materials will be mainly collected by NGOs. Those left behind will be collected by the respective LGUs' collection fleet.

(2) Collection Time

When possible a fixed collection time, generally day collection for residential areas and night collection for main thoroughfares, is advisable.

(3) Collection Equipment and Number of Units

Table 1.6 shows the type and number of collection vehicles in 2010 by generation source.

Table 1.6 Collection Vehicles

Type of Waste	Type of Equipment	Quantity
Household Waste	15 m ³ compactor trucks	489
	8 m ³ compactor trucks	180
	1 m ³ containers	15,465
Commercial Waste	15 m ³ compactor trucks	131
Institutional Waste	15 m ³ compactor trucks	6
Market Waste	arm-roll trucks	85
	8 m ³ containers	271
Street Sweeping Waste	dump trucks	9
River Cleansing Waste	dump trucks	2

(4) *Truck Scale Management System*

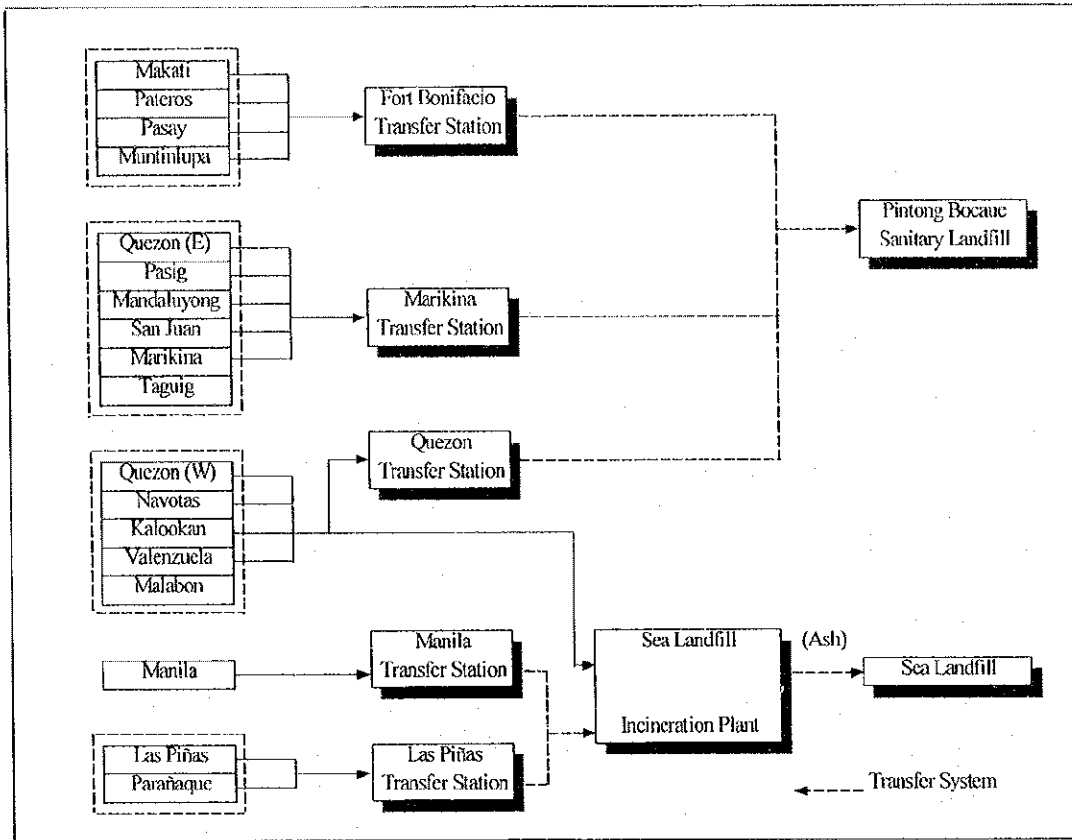
To improve the present monitoring of waste collection and haulage, the installation of a truck scale at transfer stations, incineration plants and sanitary landfill sites is proposed. Sharing the data obtained from this equipment would enable MMDA and the LGUs to systematically know the output of collection and haulage services.

(5) *Supervision of collection contractors*

Private companies collect and haul about 86% of the amount of waste generated in Metro Manila. To improve the present systems, the LGU supervision should be strengthened. Simultaneously, introduction of a manual for the selection of private companies and the supervision of their services, are proposed.

(6) *Haulage system*

The proposed transfer system is shown in Figure 1.8.



Source: Worked out by the JICA Study Team

Figure 1.8 Proposed Transfer System

2.4.3 Intermediate Treatment

The introduction of the following intermediate treatment systems for waste volume reduction are proposed.

- Composting
- Recycling
- Incineration

2.4.4 Final Disposal

The final disposal site proposed in this master plan will be constructed with the following facilities:

- Storage facility
- Leachate control facility
- Stormwater drains
- Leachate collection and discharge facilities
- Leachate treatment facility
- Gas control facilities

2.5 Promotion of Public Participation and Recycling

2.5.1 Social issues

An important aspect of the Master Plan is to address the social aspects of the solid waste management. The most important issues are discussed below.

(1) *Participation of the public in the solid waste management*

Public awareness to the problem should be heightened, specially in respect to the public health and environmental implications. To enhance the public's awareness and participation in SWM matters addressing the social issues it is proposed that MMDA sets up a new section, called the Community Mobilization and Environmental Education Section (CMEES).

(2) *Public acceptance of the facility siting*

It is very likely that the siting for facilities, mainly sanitary landfills, transfer stations and incinerators, is likely to raise strong opposition from the surrounding communities due to the problems associated to odor, noise, litter, air pollution and traffic congestion that they foresee or undergo at present. Protests against operation or construction immediately endanger the solid waste management. To cope with this problem, it is recommended to create a systematic mediation process called "Package compensation deal". A diagram showing the linkages and phases of decision in this process is shown in Figure 1.9.

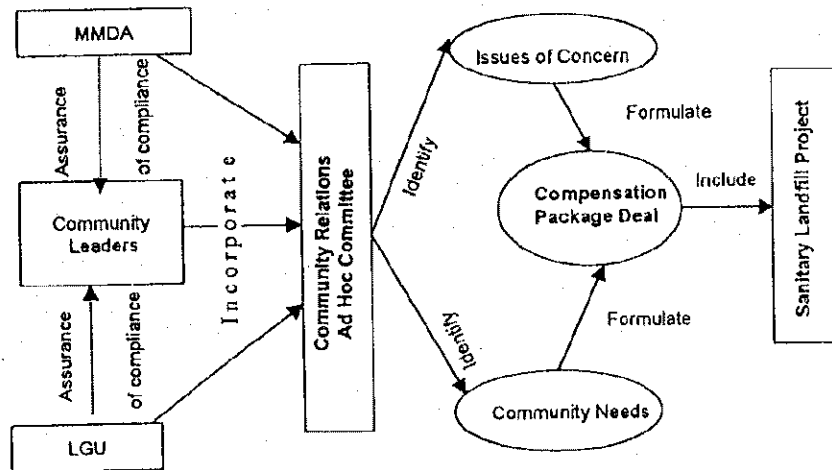


Figure 1.9 Public Involvement-for-Acceptance Process

(3) *User Charges*

Advanced system of solid waste management inevitably requires higher expenses than ever. To meet the expanded need of funds, it is recommended to introduce the user charge imposed on the waste generator.

(4) *Improvement of the recycling activities*

This is made by the waste pickers at present, however the promotion of separate collection and the development of recycling centers will provide them with a more efficient and hygienic way of earning their livelihoods.

(5) *Improvement of the performance of formal workers*

The enhancement of their working conditions and working capability is recommended.

2.5.2 Recycling

At present, 6% of generated waste, or 270 t/day, is being recycled in Metro Manila. The estimated present recycling volume and predicted future recycling volumes at different stages is shown in Figure 1.10.

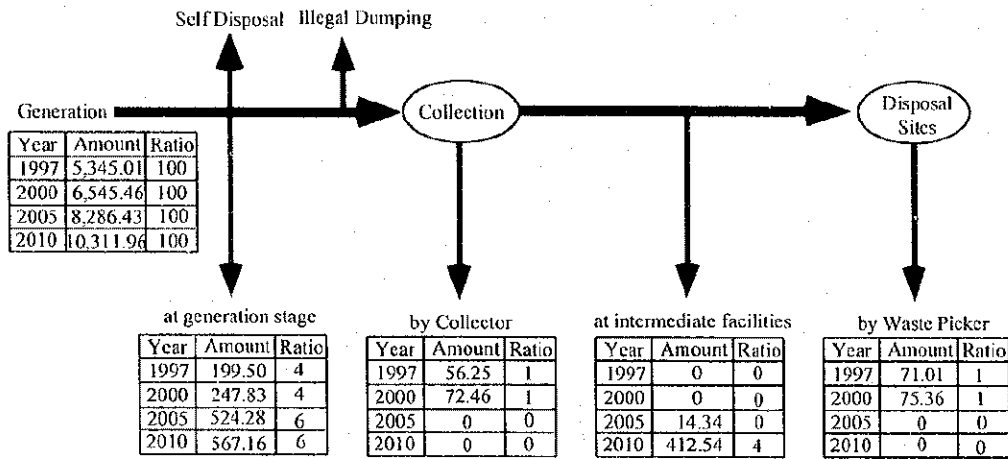


Figure 1.10 Flow of Recycling Waste Volume

2.6 Improvement of Institutional System

2.6.1 New Institutional Arrangements

The Master Plan contains the following proposals with regard to improvement of the institutional system:

(1) *New Demarcation Between MMDA and LGUs*

Delineation of tasks between LGUs and MMDA during the transition period for SWM is shown in Figure 1.11.

- a) Collection and Sweeping : LGU
- b) Transfer Station/Recycle Plant : LGU or LGU Cooperative
- c) Sanitary Landfill/Incineration/Compost : MMDA

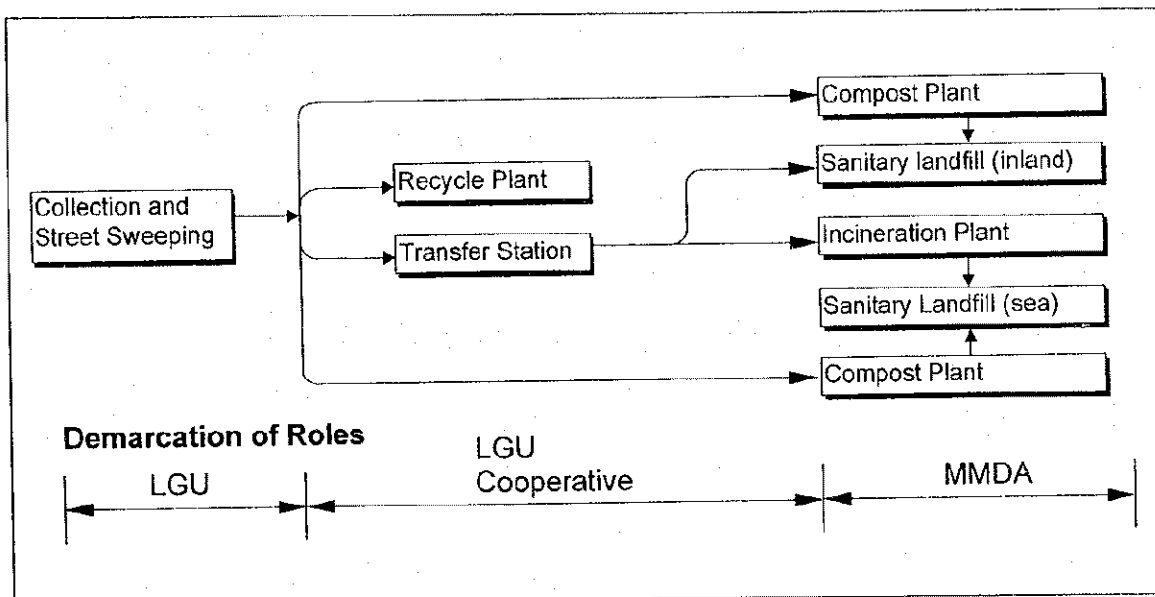


Figure 1. 11 Proposed Delineation of Management Body

(2) *Review of Local Resolutions Related to SWM*

It is proposed that MMDA Reg. 96-009 should be modified, and furthermore that LGUs take the initiative to adopt an ordinance related to SWM, following the more detailed stipulations by MMDA on SWM which are more suitable to LGUs.

(3) *Required Functions of Relevant Bodies*

The required function of the relevant bodies is outlined in Table 1.7 and 1.8.

Table 1. 7 Form of Execution of MMDA's Task in Master Plan

Task \ Field	Investor	Design	Construction	Operation & Maintenance	Note
Existing Sanitary Landfill	MMDA	DPWH	DPWH - MMDA - Contractor	MMDA - Contractor	
New Sanitary Landfill	MMDA - Soft Loan	MMDA - Contractor	MMDA - Contractor	MMDA - Contractor	Improvement
Compost Plant	Private	Private	Private	MMDA - Investor	BOT or BOO
Incineration Plant	MMDA - Soft Loan	MMDA - Contractor	MMDA - Contractor	MMDA - Contractor	

Table 1. 8 Supposed Form of Execution of LGU's Task in Master Plan

Task \ Field	Investor	Design	Construction	Operation & Maintenance
Collection & Sweeping	LGU / Private	---	---	LGU - Investor LGU
Transfer Station & Haulage	LGU - Soft Loan	DPWH - Contractor	DPWH - Contractor	LGU - Contractor
Recycle Plant	LGU - Soft Loan	DPWH - Contractor	DPWH - Contractor	LGU - Junk Shop

2.6.2 Strengthening of Institutional and Financial Capacity of MMDA

Considering the present poor operation of final disposal sites, MMDA should strengthen its institutional and financial power to a great extent in order to carry out its tasks effectively.

(1) Rationalization of SWM Section

MMDA has a huge number of permanent employees most of which were assigned to the SWM section in the era of MMC (Metro Manila Commission). While some SWM functions like waste collection and street sweeping have been devolved to LGUs together with the major budget for the service, those employees have remained in MMDA without proper alternative tasks. A possible solution to this problem is to shift the former metro-aids to other possible positions after giving necessary vocational training.

(2) Establishing a Solid Financial Base

To manage the financial requirements for the establishment, management and operation of sanitary landfills MMDA must be provided with a stable and sufficient source of income. The establishment of a separate and transparent accounting structure is the first step to improve MMDA's performance of SWM and to allow the recovery of all costs of services provided by the facilities.

(3) Introduction of Inter-Agency Mechanism in MMDA

The Master Plan proposes to establish an inter-agency mechanism in the MMDA to facilitate well organized cooperation among all stakeholders, including representatives from the private sector and the NGOs, in the form of advisory board or consultative committee in the decision making process. As the practical form of mechanism, it is proposed to set up a Community Relations Ad Hoc Committee to oversee and guide the process of community involvement and guarantee its transparency during the planning and construction phases of the disposal and transfer plants.

(4) Introduction of Effective Internal Monitoring System

To ensure responsible performance of management tasks it is proposed that an independent audit division is established under the Metro Manila Council.

(5) Decentralization of MMDA in SWM

The autonomy of the SWM section must be increased. This will involve expansion of the technical, managerial and financial capability by decentralizing authority.

(6) Introduction of New Incentive Systems for MMDA Staff

MMDA must acquire and keep capable engineers, managers, financial administrators, environmental specialists and researchers in order to implement its own projects effectively and in an environmentally sound way. One way to achieve this is to introduce an efficiency wages structure whereby employees can get a pay commensurate to their ability or contribution.

2.6.3 Capacity Building

(1) Utilization of External Human Resources

The recommended technical alternative requires MMDA and LGUs to make more ambitious efforts to introduce unprecedented and complicated technologies. To overcome lack of sufficient resources and manpower in MMDA and LGUs, it is proposed to provide technical assistance to strengthen MMDA and LGUs capacity building for the personnel in charge. Considering that necessary expertise are not adequately available locally, it is advisable that experienced international firms are invited to bid for the operation of the facilities.

(2) Review and Promotion of Use of the Private Sector

The operation of the proposed facilities can be privatized on a management contract basis. However, the present contract system including selection procedure should be reviewed to ensure the definite effect of privatization. The proposed compost plant can be privatized on a BOO scheme if acceptable private sectors are interested in the project.

2.6.4 Strengthening of Institutional and Financial Capacity of LGUs

(1) *Establishment of an Independent Budgetary and Accounting Structure for SWM*

Improvements in accounting procedures are the first line of reforms so that LGUs are able to ensure responsible performance of management tasks.

(2) *Formation of LGU Cooperative for SWM*

The arrangements for transfer stations proposed in the Master Plan require effective coordination among the LGUs that are grouped together for the management of their common facilities. To this end, the Team proposes that LGUs using a common transfer station form a LGU association.

The LGU association should be established under the following principles:

- It is established and managed by the consent of all participating LGUs.
- It has an administrative authority as a quasi-LGU.
- Human resources and revenue depend on the provision of member LGUs.
- Budgetary contribution of member is determined by 1) equal rate for fixed cost, and 2) proportional rate for investment and operation cost which is usually calculated by the share of population.

(3) *Participation of Barangays and Local Communities*

Community participation is paramount for improving the efficiency of the solid waste management system with respect to cleansing its community, garbage collection, resource recycling and waste reduction. The Study Team therefore proposes the establishment of a Community Mobilization and Environmental Education Section (CMEES) at MMDA in order to enhance public awareness in Metro Manila.

3. PRIORITY PROJECTS

3.1 Prioritization

A number of projects and/or programs have been identified to achieve the planning targets in the medium-term, as discussed in the preceding chapters. Their prioritization have been considered from the following five standpoints:

- View 1: First, efforts should be made to make use of the existing resources in improving the solid waste management.
- View 2: Special attention should be placed on vital and effective projects to avoid "garbage crisis," which would otherwise take place in the near future.
- View 3: Intermediate treatment facilities and technologies for waste reduction should be introduced in order to relieve the enormous pressure for the ceaseless need of final disposal sites.
- View 4: Urgent actions should also be taken for preparation of development of additional SLF sites, which can contribute to the medium- and long-term solution.
- View 5: Even small-scale projects/programs, if those are likely to strengthen LGUs' capability as well as uplift the people's awareness for solid waste management, should be launched at the earliest stage.

As a conclusion, 10 projects/programs are proposed as priority projects as shown in Table 1.9. In this table, the corresponding viewpoints, as discussed above, are indicated for each of the projects.

Table 1.9 Proposed Priority Projects for Solid Waste Management in Metro Manila

Proposed Priority Projects		Corresponding Views				
		1	2	3	4	5
Collection and Haulage						
1	Improvement of Collection and Haulage System	X				X
2	Development of Transfer Stations at 4 Locations (Marikina, Fort Bonifacio, Manila and Quezon), and Improvement of the Las Piñas Transfer Station	X		X		
3	Improvement of Collection System for Inaccessible Areas & Community Based Recycling	X				X
Intermediate Treatment						
4	Development of Compost Plants (at 2 locations of SLFs)	X		X		X
5	Development of Recycling Centers (as part of functions of Transfer Stations)	X		X		X
6	Development of Incineration Plant (with a 500 ton/day capacity in 2005 and 3,000 ton/day in 2010)			X		X
Final Disposal						
7	San Mateo SLF Improvement Project (Environmental Improvement)	X	X			
8	Development of New Inland SLF (Pintong Bocaue)				X	
9	Development of Offshore SLF (Navotas)				X	
Promotion of People's Awareness						
10	Education and Enlightenment Program					X

3.2 Implementation Schedule

The implementation schedule for priority projects is proposed as shown in Figure 1.12. The technical system has been designed to meet the demand in 2015, five (5) years from the target year of 2010.

		1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Existing Landfill Operation														
Improvement of San Mateo														
New Landfill Site (Inland)														
New Landfill Site (Sea)														
Transfer Stations														
Incineration Plants														
Composting Plants														
Recycling Centers														
Community-based Recycling and Composting														
Population	mill.persons	10.4	10.7	11.0	11.4	11.7	12.1	12.4	12.8	13.2	13.5	13.9	14.2	14.6
Collection Coverage Ratio	%	73	73	73	74	76	77	79	80	82	84	86	88	90
Waste Generation Amount	ton/day	6,745	6,145	6,545	6,893	7,241	7,590	7,938	8,286	8,691	9,096	9,502	9,907	10,312
Disposal Amount	ton/day	4,191	4,453	4,714	4,977	5,240	5,504	5,767	6,030	6,297	6,564	6,831	7,098	7,365


Legend:  Planning  Implementation

Figure 1.12 Implementation Schedule of Proposed Technical Alternative

3.3 Project Cost

The total cost for the selected technical system has been estimated at 77,500 million pesos in 1997 prices. The capital investment shares 77% of the total costs, while the remaining cost shall be allocated for operation and maintenance costs. Besides the costs for technical systems, the costs for the institutional arrangement and the compensation for land acquisition/utilization are estimated at 200 million pesos and 2,300 million pesos (3% of overall costs), respectively. The total costs of the Master Plan during the period from 1998 to the target year of 2010 amount to 80,000 million Pesos as shown in Tables 1.10 and 1.11.

The average SWM cost of the collected waste per ton is calculated at about 2,080 pesos in 1997 prices, which is smaller than the present value of 2,200 pesos by 10%.

**Table 1. 10 Overall Cost Estimates for Selected Technical Alternative
(1998 ~ 2010)**

Category	Priority Project/Program	Million Pesos	(%)
Technical System	Collection System Improvement	12,800	16.0
	Four (4) Transfer Stations	6,300	7.9
	Two (2) Composting Plants	3,500	4.4
	Two (2) Recycling Centers	600	0.8
	Incineration Plants	19,000	23.8
	Final Disposal Sites Development	35,300	44.1
	New Inland (Pintong Bocaue)	(15,900)	(19.9)
	Sea Landfill	(17,300)	(21.6)
	San Mateo	(2,100)	(2.6)
Institutional Arrangement	Capacity Building Program	200	0.3
Compensation	Cost for Compensation Program	2,300	2.9
	Total	80,000	100.0

Table 1. 11 Cost Allocation Schedule

	Total Cost	1998 ~ 2000	2001 ~ 2005	2006 ~ 2010
				million pesos
1) Technical System	77,500	4,200	42,100	31,200
2) Institutional Arrangement	200	100	50	50
3) Compensation	2,300	-	2,300	-
Total Cost	80,000	4,300	44,450	31,250

3.4 Formation of Project Implementation

The ideal implementing body of the proposed projects is an LGU or LGU group; however, it is not yet practical to shift the present demarcation in SWM to the ideal formation in the planning period until 2010. The practical formation of implementing body is proposed by project as shown in Table 1.12.

Table 1. 12 A Practical Formation of Implementing Bodies

Project	Design		Construction		Operation	
	Implementing Body	Supported By	Implementing Body	Supported By	Implementing Body	Supported By
Improvement of Existing SLF	MMDA	Private Firm	MMDA	Private Firm	MMDA	Private Firm
New SLF	MMDA	DPWH, Private Firm	MMDA	DPWH, Private Firm	MMDA	Private Firm
Incineration Plant	MMDA	Private Firm	MMDA	Private Firm	MMDA	Private Firm
Compost Plant	Private Firm	-	Private Firm	MMDA	Private Firm	-
Transfer Station	LGU, LGU Assoc.	DPWH, Private Firm	LGU, LGU Assoc.	DPWH, Private Firm	LGU, LGU Assoc.	Private Firm
Recycle Plant	LGU, LGU Assoc.	DPWH, Private Firm	LGU, LGU Assoc.	DPWH, Private Firm	Junk Shop	LGU, LGU Assoc.

3.5 Initial Allocation of Required Fund

3.5.1 Initial Investment

The initial allocation of required funds is summarized in Table 1.13. It combines the O&M cost with the investment fund by the implementing body. The table shows that MMDA needs to prepare about 56 billion pesos, 70% of the total cost. This amount corresponds to approximately 3 times as much as the annual projected revenue of 1997. On the other hand, LGUs are requested to prepare in total about 20 billion pesos, which is almost the same as the total targeted revenue of the eight cities in NCR. National government and the private sector are expected to contribute to the preparation of the remaining fund of about 4 billion pesos.

Table 1.13 Allocation of Cost to Implementing Bodies

million pesos

Use of Fund	Initial Allocation of Required Fund				
	Total	Central Gov't	MMDA	LGU	Private Sector
Collection & Haulage	12,800			12,800	
Transfer Station					
Las Piñas	800			800	
Marikina	2,200			2,200	
Fort Bonifacio	1,600			1,600	
Manila	1,700			1,700	
Compost Plant					
Pintong Bocaue	1,700				1,700
Sea landfill site	1,800				1,800
Recycle Centers	600			600	
Incineration Plant	19,000		19,000		
Final disposal					
Pintong Bocaue	15,900		15,900		
Sea landfill site	17,300		17,300		
San Mateo	2,100		2,100		
Institutional Measure	200	80	120		
Compensation	2,300		1,700	600	
Total	80,000	80	56,120	20,300	3,500

3.5.2 Amortization of Initial Investment

Investment fund would need amortizing from the regular budget of implementing bodies within the lifetime of the target facility. In case a loan is adopted as the source of investment fund, users of the facility are considered to be responsible for the amortization of the loan even if the implementing body should pay the installment according to the loan agreement. The recovery of investment fund is usually realized by payment of user charges to the implementing body. Therefore the cost allocation for the project is different from initial allocation. A certain part of investment cost will be transferred to the users, i.e, LGUs should bear the equivalent of installment cost in the form of user charges to MMDA for the use of incineration plant and final disposal sites. Assuming that the LGUs share half of the initial fund allocation, allocation of cost for the priority project is summarized in Table 1.14.

Table 1. 14 Cost Allocation for Priority Projects

Implementing Body	Initial Cost Allocation		Final Cost Allocation	
	MMDA & LGUs	MMDA	56,120 70 %	MMDA
LGUs		20,300 25 %	LGUs	47,450 59 %
Others		3,580 5 %		3,580 5 %
Total		80,000 100 %		80,000 100 %

The above table shows that MMDA is requested to pay about 29 billion pesos, or 36 % of the total cost, which is about 50 % higher than the annual estimated revenue of 1997. On the other hand, LGUs are requested to pay in total about 47 billion pesos, which is almost twice as much as the total revenues of the 17 LGUs in NCR.

3.5.3 Financial Capacity of MMDA and LGUs

The future revenues of MMDA and the LGUs were estimated under the assumption that their revenue will increase sharing the same rate to the GRDP of Metro Manila. The real growth rate of GRDP is estimated at 6.5% p.a. for the year 1997-2000 and 6.0% for the year 2001 - 2010. The future GRDP of Metro Manila and the revenue of MMDA and the 17 LGUs are estimated in Table 1.15.

Table 1. 15 Future GRDP and Revenues of MMDA and LGUs in Metro Manila (1998 ~ 2010)

	million pesos		
	1998 ~ 2000	200 ~ 2005	200 ~ 2010
1) Projected GRDP in Metro Manila (at constant 1997 prices)	2,789,500	5,909,300	7,908,000
2) Projected Revenue	75,300	159,500	213,500
- 17 LGUs	69,700	147,700	197,700
- MMDA	5,600	11,800	15,800

3.5.4 Potential Budget of MMDA and LGUs for SWM

The required expenditure for SWM amounts to 95,000 million pesos consisting of 80,000 million pesos for the year 1998 to 2010 and 15,000 million pesos for the O&M cost from 2011 to 2015. The potential budget for the proposed projects/programs is estimated at 66.500 million pesos based on the following assumptions:

Table 1.14 Cost Allocation for Priority Projects

Implementing Body	Initial Cost Allocation		Final Cost Allocation			
	MMDA & LGUs	MMDA	56,120	70 %	MMDA	28,970
LGUs		20,300	25 %	LGUs	47,450	59 %
Others		3,580	5 %		3,580	5 %
Total		80,000	100 %		80,000	100 %

The above table shows that MMDA is requested to pay about 29 billion pesos, or 36 % of the total cost, which is about 50 % higher than the annual estimated revenue of 1997. On the other hand, LGUs are requested to pay in total about 47 billion pesos, which is almost twice as much as the total revenues of the 17 LGUs in NCR.

3.5.3 Financial Capacity of MMDA and LGUs

The future revenues of MMDA and the LGUs were estimated under the assumption that their revenue will increase sharing the same rate to the GRDP of Metro Manila. The real growth rate of GRDP is estimated at 6.5% p.a. for the year 1997-2000 and 6.0% for the year 2001 - 2010. The future GRDP of Metro Manila and the revenue of MMDA and the 17 LGUs are estimated in Table 1.15.

Table 1.15 Future GRDP and Revenues of MMDA and LGUs in Metro Manila (1998 ~ 2010)

	million pesos		
	1998 ~ 2000	200 ~ 2005	200 ~ 2010
1) Projected GRDP in Metro Manila (at constant 1997 prices)	2,789,500	5,909,300	7,908,000
2) Projected Revenue	75,300	159,500	213,500
- 17 LGUs	69,700	147,700	197,700
- MMDA	5,600	11,800	15,800

3.5.4 Potential Budget of MMDA and LGUs for SWM

The required expenditure for SWM amounts to 95,000 million pesos consisting of 80,000 million pesos for the year 1998 to 2010 and 15,000 million pesos for the O&M cost from 2011 to 2015. The potential budget for the proposed projects/programs is estimated at 66.500 million pesos based on the following assumptions:

- LGUs and MMDA will appropriate to SWM at the same rate as present, which is 0.3 % of the GRDP of Metro Manila; and
- the selected alternatives serve from the middle of 2002 to 2015.

Under this assumption, the proposed projects / programs will result in an accumulated deficit of 28,500 million pesos. To dissolve the deficit, it is required to raise the budget from 0.3% to 0.42% of GRDP under the discount rate of 3% p.a.

3.5.5 Additional Sources of Budget

The following three alternative measures are proposed to attain the additional 0.12% of GRDP for the proposed projects/programs. The results of these measures are summarized in Table 1.16. LGUs are requested to choose either of these alternative measures to achieve the goals of the Master Plan:

- 1) LGUs appropriate, as a whole, an additional 5% (15% of total revenue for SWM)
- 2) LGUs pay tipping fee at the rate of 730 pesos per ton of garbage for final disposal and incineration
- 3) LGUs impose collection fee on households at the rate of 40 pesos per month per household

Table 1. 16 Alternative Revenue Sources for Additional Budget

Potential Financial Resources	Additional Budget Estimated (million pesos)				% to GRDP
	Total	1998-2000	2001-2005	2006-2010	
1) Additional 5% expenditure from LGU budget	19,900	3,300	7,100	9,500	0.12
2) Tipping fees for treatment at the rate of P730.00/ton	19,900	3,200	7,000	9,700	0.12
3) User charge from households at the rate of P40.00/month/family	19,000	3,200	6,800	9,000	0.11
4) Projected GRDP in constant 1997 prices	16,606,800	2,789,500	5,909,300	7,908,000	

4 RECOMMENDATIONS

4.1 Improvement of Present Landfills

In order to undertake the proposed actions necessary to fulfill the targets of the Master Plan, and avoid a garbage crisis, it is crucial to immediately redevelop and improve the present sanitary landfills.

4.1.1 Continuous Operation of Carmona Landfill Site

To avoid another garbage crisis until 2003, the continuous operation of Carmona landfill site is absolutely necessary. Otherwise the new landfill site proposed in Pintong Bocaue will not be in time to relay the final disposal without interruption.

4.1.2 Improvement of Present landfills

(1) *San Mateo Sanitary Landfill Site*

From the environmental point of view, there are several matters to be improved at the San Mateo landfill site. Especially, mitigation of odor from the leachate treatment facility and traffic accidents and/or noise caused by the waste haulage are urgently required.

(2) *Carmona Sanitary Landfill site*

The leachate treatment facilities at the site is not sufficient at present. Open air burning has sometimes happened due to improper dumping manner. Improvement of the present landfill facilities and operation should therefore be considered to get the social acceptance for continued operations at the site.

4.1.3 Existing Open Dump Sites

It is highly desirable that the two open dump sites in Metro Manila, which are located in the vicinity of residential areas, will be closed soon. However, these open dump sites have to be used until the new landfill site starts operation. To improve the present conditions, some measures should be carried out tentatively. A permanent measure to avoid negative influence even after closure is also required to be ready prior to completion of landfill operations.

4.2 Land Acquisition for Siting facilities

The weakest point of the solid waste management system in Metro Manila is that the responsible bodies presently do not have any prospective project sites for final disposal sites other than Pintong Bocaue or Parcel B. Furthermore, the effort to acquire land for this purpose is not conducted in a systematic manner. The respective actions required for each facility are stated below.

(1) *Inland Landfill Site*

Presently, MMDA has six (6) candidate sites other than "Parcel B" in San Mateo. However, all the sites still have some problems to be solved before they are identified as the target site for feasibility study. Although an inland landfill site (Parcel B) has already been identified as the target for feasibility study, its status has now come to question because of a lawsuit raised by the local government. Because the landfill site is a sort of consumables, this situation urges to identify other inland landfill sites to get ready for the stable final disposal.

(2) *Sea Landfill Site*

A sea landfill site is expected to form another pole of garbage disposal in cooperation with inland landfill sites. Its location suits the traffic condition of Metro Manila particularly for LGUs facing Manila Bay. Though the estimated cost is fairly high to develop a pollution-free sea landfill site, it will provide Metro Manila with an adjacent and long lasting final disposal site. It is therefore recommended that MMDA initiates an immediate action to create the space for a sea landfill site.

(3) *New Transfer Station*

The proposed responsible body for new transfer stations are LGUs or LGU cooperatives, which are obliged to establish new transfer stations on their account. Since land acquisition takes a long time, the process has to taken as soon as possible. The study team proposes four (4) new transfer stations to be constructed by 2005.

The LGUs who are supposed to share the facility are expected to make the effort to acquire a land for their common transfer stations in cooperation with the other member LGUs sharing the facility. The formation of a cooperative is recommended so that the member LGUs can mutually agree on the scope of the introduction of transfer stations somewhere in their jurisdictions.

4.3 Reinforcement of Performance of LGUs in SWM

It is proposed that LGUs become self-sufficient in the management of solid waste (as expected in the Local Government Code) just like other LGUs outside Metro Manila. This self-sufficiency is in terms of fiscal, technical and managerial performance so as to meet their expanded responsibility from conventional garbage collection and road sweeping to the establishment and operation of new transfer stations and recycle centers.

In addition, an inter-LGU basis restructuring, through formation of cooperatives, is also proposed in order to cope with the establishment and operation of new transfer stations and recycle centers and other management activity brought into LGU's coverage. The proposed implementation schedule of technical alternative indicates that the formation of LGU cooperatives should be completed by 2000 at the latest; design work for transfer station is expected to start in 2001.

4.4 Reinforcement of Performance of MMDA in SWM

R.A. No.7924 (MMDA Law) states that MMDA should take the role of virtual coordination body in solid waste management. To accomplish this, an urgent revision of institutional strengthening is required for both project-oriented tasks and regular coordination among LGUs in NCR.

(1) Reinforcement for Project Oriented Tasks

For the smooth and early commencement of proposed projects supposed to be undertaken by MMDA, the creation of a Project Management Unit (PMU) is expected. The proposed function of PMU is implementation of new projects such as improvement of existing sanitary landfill sites, construction of inland landfill site and sea landfill and incineration plant.

(2) Reinforcement for Routine Coordination

The Master Plan contains many fundamental changes of the legislative and organizational system and it is important that the changes are in place for the implementation of time-constrained projects. Therefore, the establishment of a core organization, called Program Steering Committee (PSC), is required as soon as possible in order to prompt and adjust the concerning bodies in their efforts to restructure

4.5 Institutional Arrangement Prior to Introduction of Incineration Plants

The introduction of incineration plants is proposed in the Master Plan. This proposal hinges on the following conditions. First, the readiness of the society to accept incineration plants, which is currently still immature. Second, thoughtful examination should be carried out for the incineration plant project to assure the following four conditions:

- 1) Economic/financial feasibility and operational sustainability need to be assured;
- 2) Minimal environmental impacts and health safety should be guaranteed;
- 3) Legislative/institutional guidelines regarding operation of incineration plants should be prepared; and
- 4) People's support and cooperation for separate waste discharge (into "combustible" and "not-combustible").

4.6 National Framework for Privatization of SWM

Presidential Memorandum Order (MO) No. 202 issued in April 1994 stipulates the privatization policy for SWM, not only the operation of final disposal sites but also of intermediate treatment such as incineration and compost plants. Based on this policy guideline, the Government is now seeking some BOT projects for development of large-scale incineration plants in the post Smokey Mountain area, San Mateo and/or some other areas. At the same time, some LGUs are also looking into the BOT projects for incineration plants, with proposals from private sector proponents.

As proven by the fact that none of the on-going BOT schemes for SWM have yielded any successful result or favorable progress so far, the privatization policy holds many difficulties in reaching an agreement with both parties of the government and the proponent, under the current social, administrative, budgetary and financial conditions. In other words, the society, as well as the economy, is not yet ready to afford such a commercialized operation for SWM. The Master Plan, of course, needs to be in line with such a national policy framework, however, at the same time, the Master Plan should look at the reality on the actual ground for the implementation.

PART 2 - FEASIBILITY STUDIES

1. SELECTION OF TARGET PROJECTS

Out of the priority projects proposed by the study team in the Master Plan, the Metro Manila Council selected the following for implementation in the Feasibility Study Stage:

- 1) Feasibility Study on the Environment Improvement of San Mateo landfill
- 2) Feasibility Study on Development of a New Sanitary Landfill
- 3) Pilot Project on Improvement of Collection System
- 4) Pilot Project on Community Based Recycling
- 5) Pilot Project on Environmental Education

The results from these studies are summarized in Part 2 and 3 of this report.

2. FEASIBILITY STUDY ON THE ENVIRONMENTAL IMPROVEMENT OF SAN MATEO SANITARY LANDFILL PROJECT

2.1 Outline of the Project

The San Mateo and Carmona sanitary landfill sites have remaining capacities of 7 million m³ and 4.5 million m³ respectively. Given the closure of the open dumpsites at the end of the year 2000, these two sanitary landfill sites will eventually reach their full capacity by early 2003. The DENR, EMB and the JICA Study Team proposed the Marikina Environment and Forest Conservation (MEFCON) Project in the Master Plan. This project entails the development of five landfill sites, including the present San Mateo SLF, and the conservation of the natural environment and forest resources in the watershed of Marikina River.

The San Mateo SLF has faced neighboring residents' opposition to its operation because of serious environmental problems and the poor management. It is foreseen that if no urgent countermeasures are taken against the problems, it would lead to the rejection of the residents against the MEFCON Project. The project for Environmental Improvement of San Mateo SLF (referred to as "the Project" hereafter) should therefore be given the top priority of urgent actions. Table 2.1 summarizes the environmental problems that need to be urgently solved.

Table 2.1 Current Environmental Problems in San Mateo SLF

Problems	Counter measures
a) Waste scattering, odor, fly, leachate leakage	• Adequate operation of the sanitary landfill with soil covering, drainage system installation, internal road construction, based on prepared manual.
b) Odor from the existing leachate treatment plant, leachate leakage	• Improvement of leachate treatment facilities (deodorization)
c) Frequent traffic accidents, noise, illegal waste dumping	• Improvement of access road (improvement of road alignment, etc.)

Based on the aforementioned issues, the environmental improvement project of the San Mateo SLF is proposed to have the following components:

Soft Components:

- Site plan with adequate buffer zones and land uses;
- Reclamation and soil cover operation plan;
- Drainage system plan;
- Leachate collection system plan;
- Waste incoming management and tipping charge system plan; and
- Closure plan.

Facilities Improvement Construction:

- Rehabilitation/improvement of the existing leachate treatment facility (the first phase facility);
- Construction of new leachate treatment facility (the second phase facility);
- Drainage system and maintenance road improvement; and
- Buffer zones improvement with tree planting;

2.2 Leachate Treatment System Development

(1) Alternative Improvement Method

Among the above-listed components, the leachate treatment facility is key to the current serious environmental problem in the San Mateo SLF.

Three alternative methods are identified as technically feasible for improvement of the leachate treatment system:

Alternative 1: Improvement of the existing facilities by installing an active carbon-type deodorizer – one of the cheapest odor preventing instruments.

Alternative 2: Improvement of the existing facilities by installing a combustion-type deodorizer – expensive but quite effective.

Alternative 3: Relocation of the existing facilities, constructing a new facility at a more suitable location.

(2) Preliminary Design

The treatment capacity indicated in the “Computation of the Treatment Plant” prepared by MMDA is 1,060m³/day (530m³/day x 2 lines). The design influent quality should be based on the sampling surveys and analyses carried out by the JICA Study Team in March 1998. The design effluent quality should be less than the effluent standards established in the Philippines.

The proposed treatment method is displayed in the Figure 2.1 below.

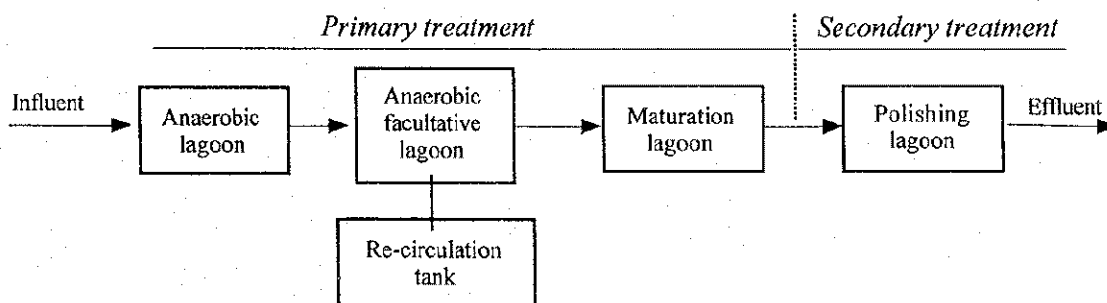


Figure 2.1 Proposed Treatment Method

(3) Cost Estimates

Based on the results from the preliminary design, the cost for the construction of the facilities was estimated. The costs were estimated under the following assumptions:

- Prices are based on the market price as of February 1998;
- The foreign exchange rate as of the end of February 1998 is used during the whole project period, i.e., US\$ 1.00 = Peso 40.06, Peso 1.00 = Japanese Yen 3.2074;
- The project period is assumed to be fifteen (15) years until negative impacts of leachate water on the environment may not be born; and
- Physical contingency is estimated at fifteen (15) % of the total construction cost, while inflation is not taken into account.

The total investment cost for the three systems are:

Alternative 1 (Carbon Deodorization System):

Total: 295.00 Million Pesos,
Foreign Currency: 191.54 Million Pesos
Local Currency: 103.46 Million Pesos

Alternative 2 (Combustion Deodorization System)

Total: 352.82 Million Pesos,
Foreign Currency: 243.08 Million Pesos
Local Currency: 109.72 Million Pesos

Alternative 3 (Relocation of Leachate Treatment Facility)

Total: 261.12 Million Pesos,
Foreign Currency: 108.43 Million Pesos
Local Currency: 152.69 Million Pesos

Estimated operation and maintenance cost from 2001 to 2010 are as shown in Table 2.2.

Table 2.2 Estimated O&M Cost from 2001 to 2010

Alternatives	Annual O&M Cost (mill. Pesos/year)
Alternative 1: Active carbon deodorization system	12.77
Alternative 2: Combustion deodorization system	16.32
Alternative 3: Relocation of leachate treatment facilities	8.59

2.3 Project Evaluation

Among the three alternatives, the relocation of the leachate treatment facilities (Alternative 3) is best recommended from the economic and financial points of view, because of the following reasons:

- Both investment and operation costs of Alternative 3 are the least among the alternatives, and
- The share of foreign currency of alternative 3 is small, which is almost one third of the total investment cost, while two thirds in Alternatives 1 and 2. Hence Alternative 3 will be expected to save more foreign exchange spending, contribute more to domestic products and create more employment opportunities than Alternatives 1 and 2.

The implementation of the Project will lead to positive social and environmental impacts. Therefore, the Project is assessed to be worth being implemented.

2.4 Implementation Plan

The capacity of the existing leachate treatment facilities of San Mateo SLF is only half of the required total capacity, which means that the present treatment plant is not sufficient to cope with the increasing leachate amount. Therefore, the leachate treatment plant should immediately be expanded as well as improved.

The desirable schedule for the improvement of the leachate treatment facility is illustrated in Figure 2.2.

	1998	1999	2000	2001	2002	2003	2004	2005
Procedures for approval	■							
Detailed design		■						
Tender			■					
Construction			■	■				
Operation				■	■	■	■	■

Figure 2.2 Implementation Schedule

2.5 Conclusion

It has been concluded that out of the three alternatives, the relocation of the leachate treatment facilities (Alternative 3) is the best option to mitigate adverse environmental impacts that leachate treatment can cause. On the other hand, this option 3 holds the following difficulties in the implementation:

- The new site of the leachate treatment facility is located outside the proclaimed San Mateo landfill area. This is likely to subject to a series of additional ECC procedures, which will take considerably long time and prevent the timely implementation of the project;
- The most suitable site for the new leachate treatment facility is located within the Presidential Proclamation Area for Resettlement; and
- It cannot be denied that the new 3-km access road is required from the existing San Mateo SLF to the relocation site of the leachate treatment facility.

If the above factors are thought to be negative, the second best alternative should be selected, that is Alternative 1.

2.5 Recommendations

The JICA Study Team makes the following recommendations for the implementation of the Project:

(1) Sanitary Landfill Operations

Sanitary landfill operation at San Mateo should be done according to the manual prepared in 1992.

(2) Present Facility and Its Expansion

The use of the present facilities should be continued until the new disposal site becomes operational. Should Alternative 1, the second best option, be selected, the new leachate treatment facility will need to be functionally linked with the existing one.

(3) Financial Source for the Project

The project costs for the initial investment, as well as operation and maintenance, should be internally financed by MMDA in principle. Since the Project is very urgent, the external fund sources should also be sought out of possible international cooperation schemes.

(4) Technologies

The proposed facilities should be constructed using technologies of advanced countries that may contribute to technology transfer.

3. FEASIBILITY STUDY ON THE NEW SANITARY LANDFILL DEVELOPMENT PROJECT

3.1 Outline of the Project

The EMB-DENR has secured a piece of land, once designated as "Parcel B," to be developed as the next landfill site. This 32.4 ha land has been excluded from the Marikina watershed in accordance with the Presidential Proclamation No. 635. According to the results of the JICA study, only 6.1 ha, equivalent to 20% of the whole area, can be utilized as a landfill site with an estimated capacity of only 270,000m³ and a life span of only a month. Accordingly, MMDA decided to abandon the development of Parcel B and selected New Parcel B (referred to as Pintong Bocaue 2 in MEFCON) adjacent to Parcel B, measuring 130.2 ha (Figure 2.3 and 2.4). It is the landfill site proposed in the master plan prepared by the JICA Study Team to be developed next to San Mateo SLF.

MMDA has given the first priority to the development of another landfill site in New Parcel B. To realize this, the MMDA requested JICA to conduct a feasibility study on this project. With a capacity of almost 20,000,000m³, the life span of the proposed landfill is about 6 years and 4 months. The project also covers the extension and rehabilitation of the access road for safe and efficient waste haulage. A tentative project summary is presented below:

New landfill development:

- Project area 130.2244 ha.
- Waste disposal space: 20,000,000 m³
- Expected operation period 6 years (2004 – 2009)
- Stormwater drainage system
- Leachate collection system
- Leachate treatment plant
- Administration facilities
- Internal road
- Buffer zone

Access road:

- New construction: 9.0 km
- Alignment improvement: 1.5 km
- Rehabilitation: 3.5 km

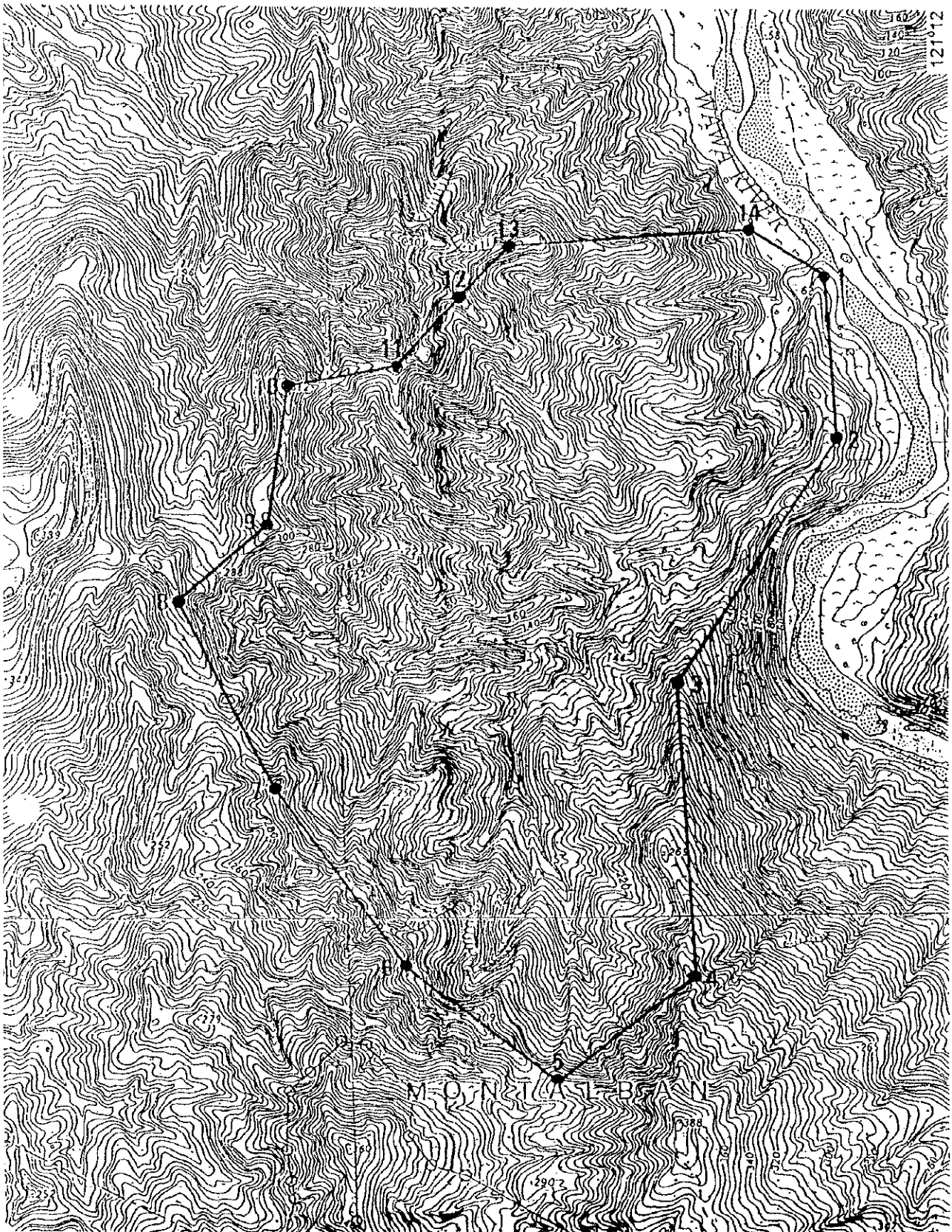


Figure 2.3 Location of the Project Site

Scale 1:10,000

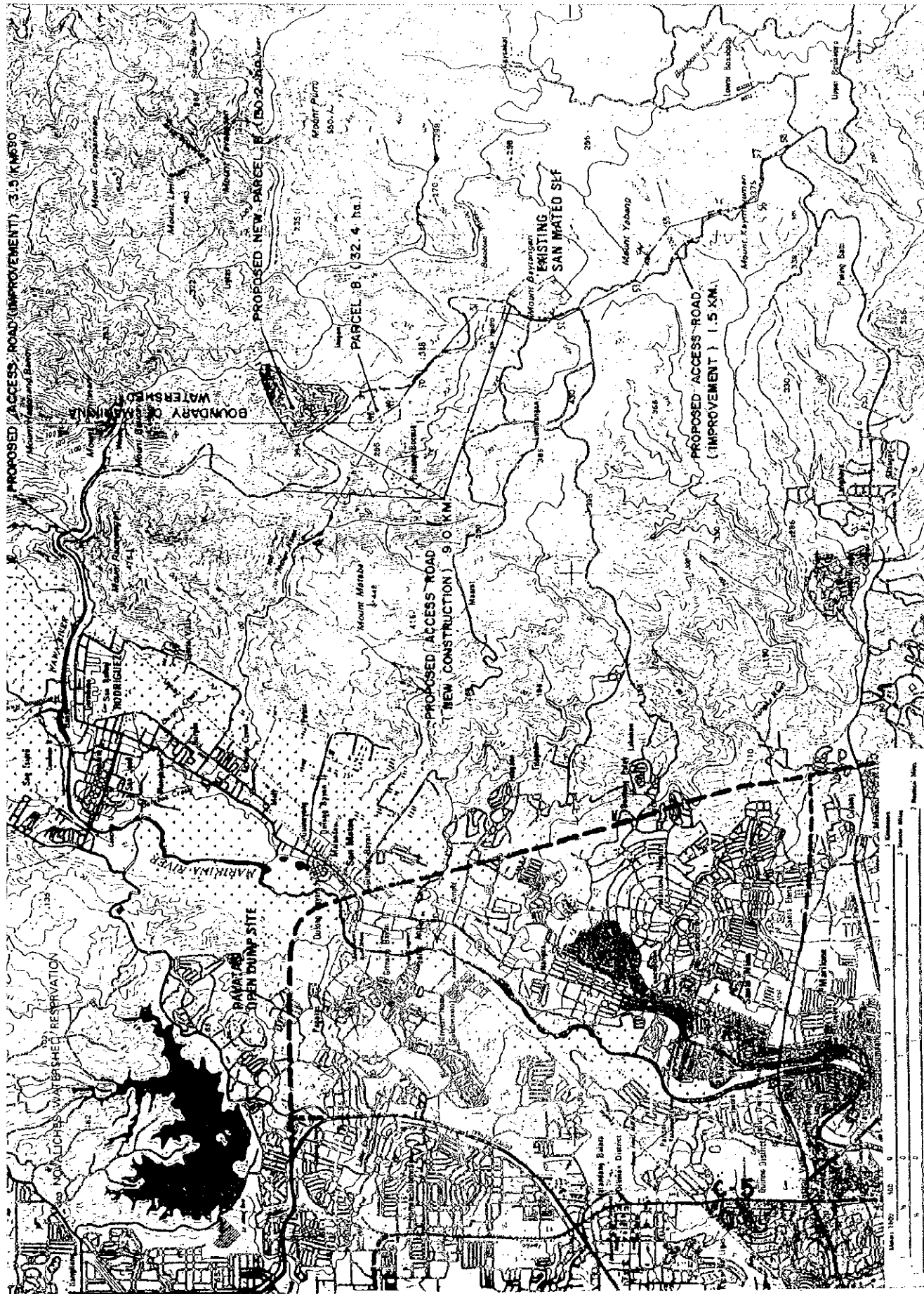


Figure 2.4 Project Area