社会開発調査部報告書

No. 62

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

MAIN REPORT II (FEASIBILITY STUDY)

MARCH 1999

PACIFIC CONSULTANTS INTERNATIONAL
KOKUSAI KOGYO CO.,LTD.

JICA THE STUDY ON SOLID WASTE MANAGEMENT FOR METRO MANILA IN THE REPUBLIC OF THE PHILIPPINES FINAL REPORT MAIN REPORT II (FEASIBILITY STUDY) MARCH 19

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

MAIN REPORT II
(FEASIBILITY STUDY)

MARCH 1999

PACIFIC CONSULTANTS INTERNATIONAL
KOKUSAI KOGYO CO.,LTD.

The exchange rate applied in this report is

Master Plan &
The Environmental Improvement of SAN MATEO SLF

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).

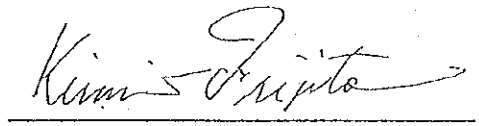
JICA selected and dispatched a study team headed by Dr. KATSUHIDE NAGAYAMA of Pacific Consultants International and consist of Pacific Consultants International and Kokusai Kogyo Co., Ltd. to Philippines, 5 times between February 1997 and February 1999. In addition, JICA set up an advisory committee 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".

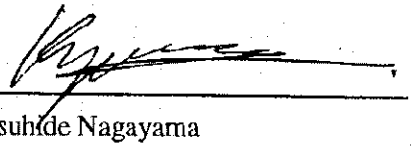
This report compiles the results of the study which was undertaken in the Republic of the Philippines, from February 1997 to February 1999 by the Study Team, jointly organized by Pacific Consultants International and Kokusai Kogyo Co., Ltd.

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.

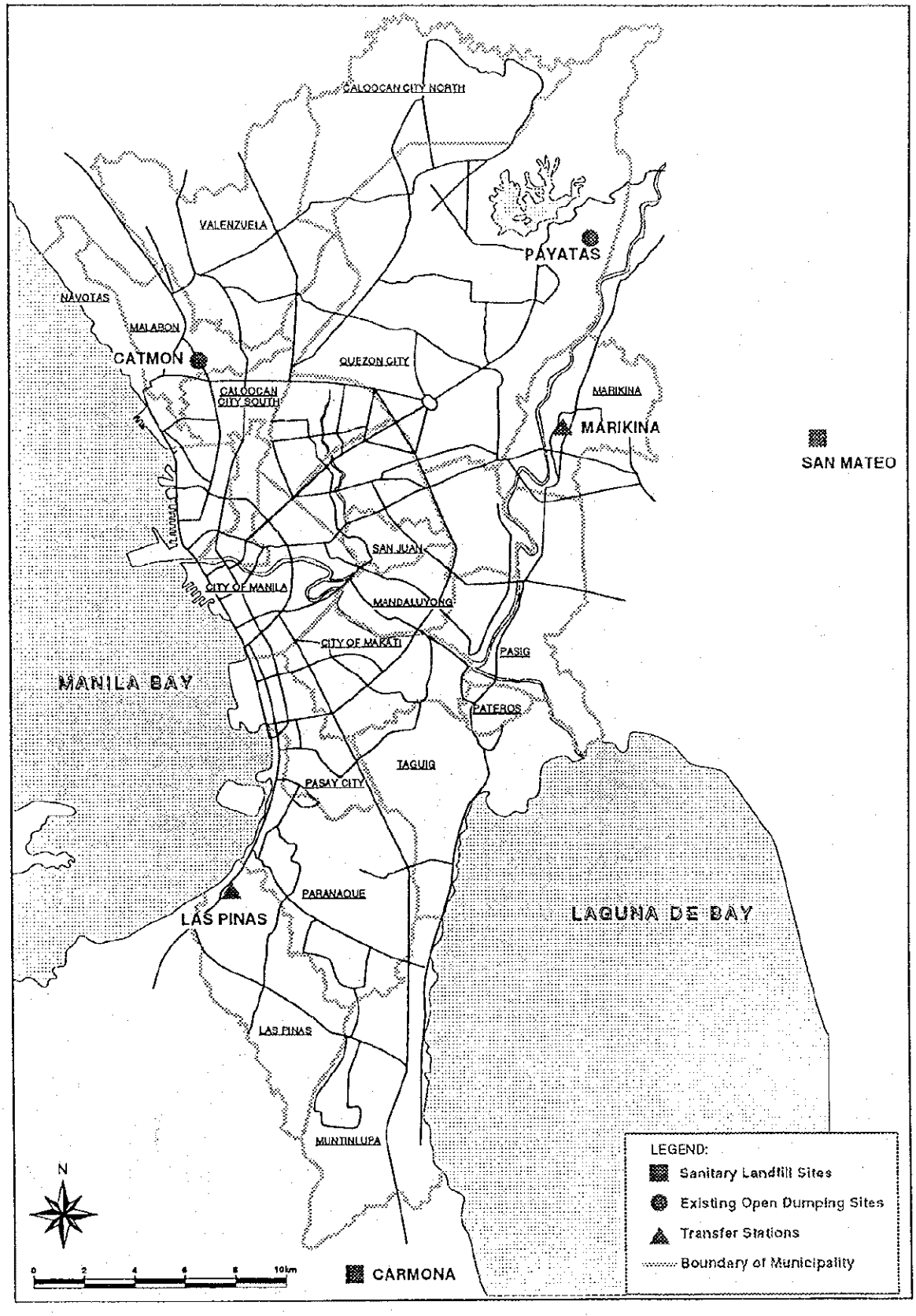
We also acknowledge and appreciate greatly the excellent support given by your agency, the JICA Advisory Committee and the Embassy of Japan in the Republic of the Philippines.

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.

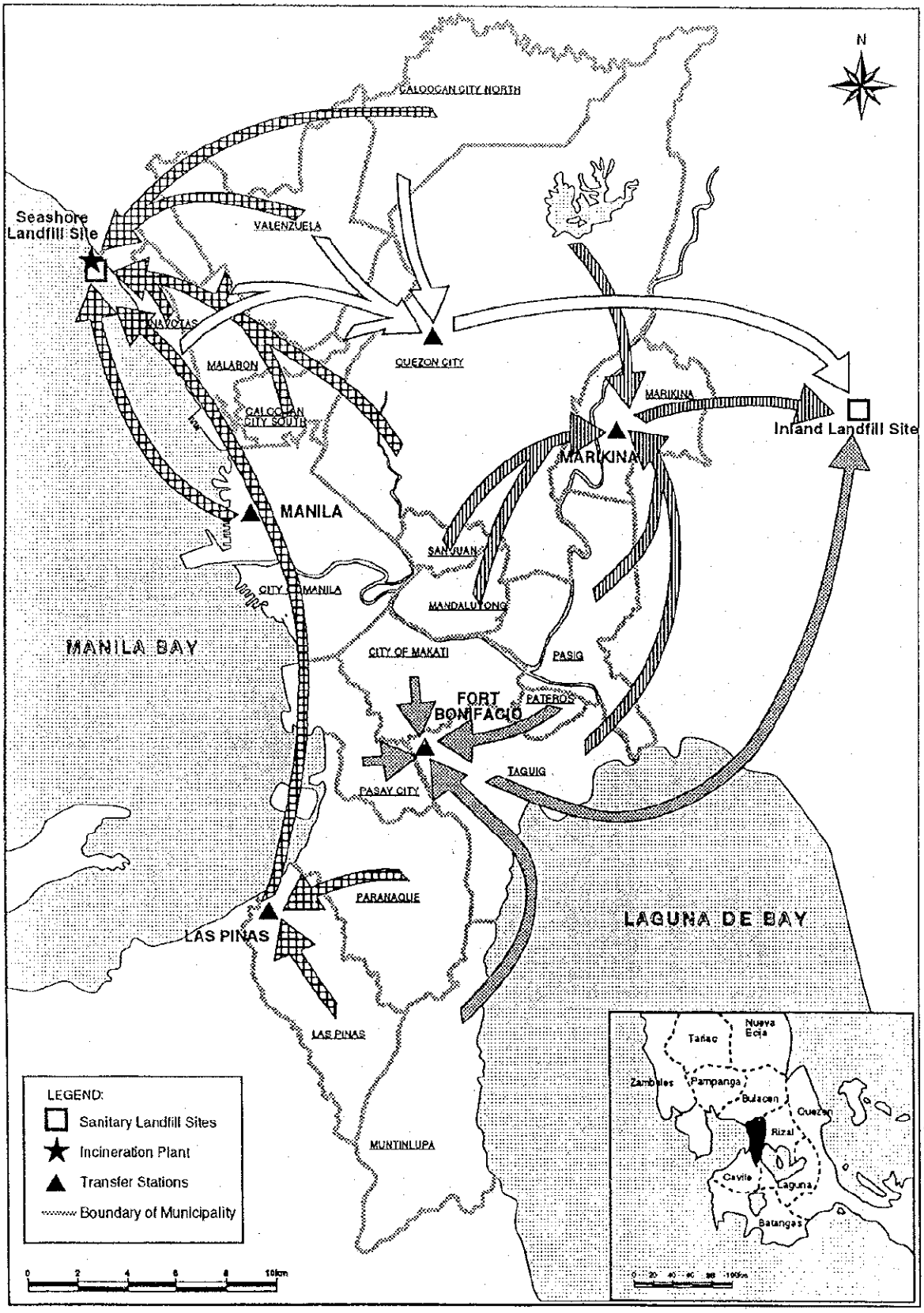
Very truly yours,



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



Study Area and Existing Facilities for Solid Waste Management



Proposed Waste Flow in Metro Manila in the year 2010

The Study on Solid Waste Management for Metro Manila
Feasibility Study Report

TABLE OF CONTENTS

C: PILOT PROJECTS

C1. IMPROVEMENT OF COLLECTION SYSTEM

C2. COMMUNITY BASED RECYCLING C2-1

C3. ENVIRONMENTAL EDUCATION C3-1

D: ENVIRONMENTAL SURVEY

LIST OF TABLES

C. PILOT PROJECTS

C1:Collection System

C2:Community-based Recycling

C3:Environmental Education

D. Environmental Survey

LIST OF FIGURES

LIST OF ABBREVIATIONS/ACRONYMS

As	Arsenic
BOD	Bio-chemical oxygen demand
Cd	Cadmium
CO	Carbon monoxide
DAO	DENR Administrative Order
dB	Decibel
DECS	Department of Education, Culture and Sports
DENR	Department of Environment and Natural Resources
DO	Dissolved oxygen
DPWH	Department of Public Works and Highways
ECC	Environmental Compliance Certificate
EGF	Environmental Guarantee Fund
EIA-RC	Environmental Impact Assessment-Review Committee
EIRR	Economic Internal Rate of Return
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMF	Environmental Monitoring Fund
F/S	Feasibility Study
Hg	Mercury
ICB	International Competitive Bid
ICC	Investment Coordinating Council
IPDG-SWMO	Infrastructure Planning and Development Group – Solid Waste Management Office
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
LGU	Local government unit
MEFCON	Marikina Environment and Forest Conservation
mg/l	Milligram per liter
MOA	Memorandum of Agreement
MMDA	Metropolitan Manila Development Authority
MMT	Multi-partite Monitoring Team
NCR	National Capital Region
NO2	Nitrogen dioxide
NPV	Net Present Value
Pb	Lead

PD	Presidential Decree
PQ	Pre-qualification
PTFWM	Presidential Task Force on Waste Management
RPMG	Recycling Project Management Group
SLF	Sanitary landfill
SS	Suspended solids
SO2	Sulfur dioxide
SWM	Solid waste management
TOR	Terms of Reference
TS	Transfer station
TDS	Total dissolved solids
TSP	Total suspended particulates
TSS	Total suspended solids
ug/Ncm	Microgram/Normal cubic meter
WGR	Waste generation rate
ZWMG	Zero Waste Management Group

A. FEASIBILITY STUDY
on the
ENVIRONMENTAL IMPROVEMENT OF SAN MATEO SANITARY LANDFILL

A: F/S on THE ENVIRONMENTAL IMPROVEMENT OF SAN MATEO SANITARY LANDFILL

1. Introduction

1.1 Background of the Project

The present solid waste flow in Metro Manila – as examined in the Master Plan prepared by the JICA Study Team in March 1998 – is summarized as shown in Figure 1.1 below.

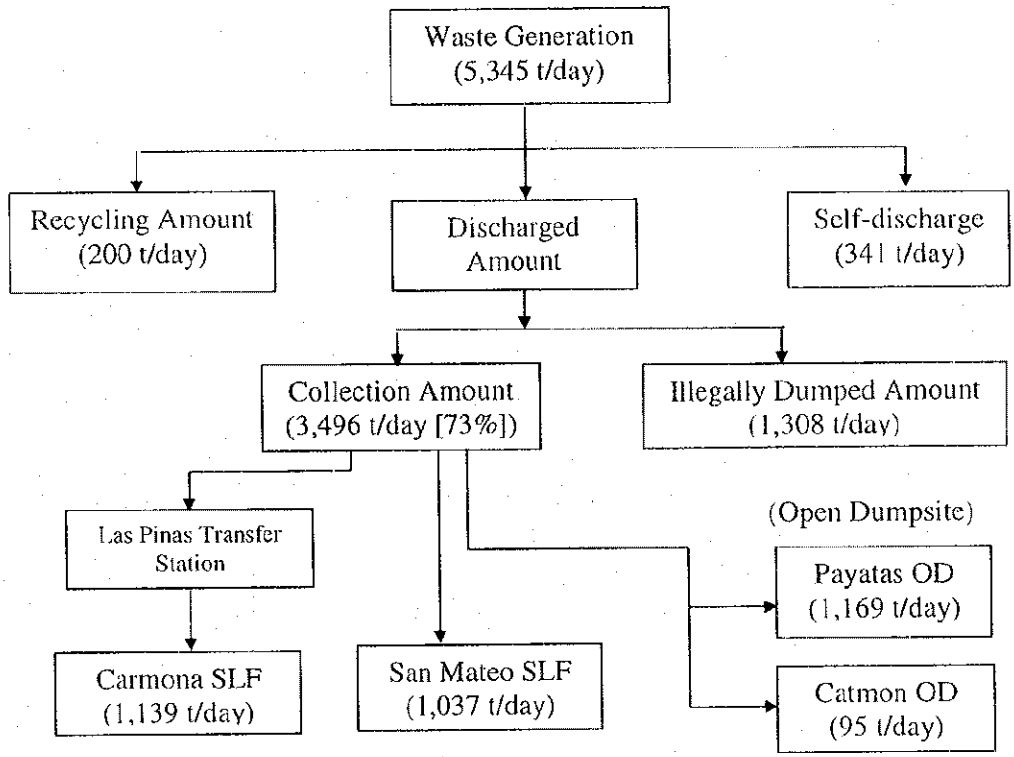


Figure 1.1 Waste Flow in Metro Manila (1997)

Securing a disposal site is a pressing matter for the management of solid waste in Metro Manila. At present, MMDA operates two sanitary landfill sites, one in Carmona and the other in San Mateo. There are also two open dumpsites being operated by local government units in the metropolis, one in Payatas and the other in Catmon, which are located close to residential areas and endanger the environmental conditions therein. Therefore, these open dumpsites are expected to close soon, however, the difficulty in acquiring alternative substitute disposal sites emerges, since one third of the waste in the metropolis is disposed of in these dumpsites.

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.

To effectively secure landfill sites for long-term waste disposal management, 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.

This project will not commence without reaching public consensus. Being the first landfill to be conserved in the MEFCON project, however, improvement of the present environmental condition of the San Mateo SLF is substantially vital. Otherwise, the residents in the neighboring areas will find it difficult to accept the concept of MEFCON. Based on the significance of safe landfill operations with environmental conservation, the project for Environmental Improvement of San Mateo SLF (referred to as "the Project" hereafter) should be given top priority as one of urgent actions.

1. 2 San Mateo Sanitary Landfill

The amount of waste disposed of in the San Mateo SLF, as of 1997, is approximately 1,037 tons/day, 32% of the total amount of waste collected in Metro Manila. This is equivalent to the amount of waste generated by 2.5 million people. If the San Mateo SLF were to accommodate the amount of waste being handled in the Payatas and Catmon open dumpsites (due to their closure), San Mateo SLF would then dispose of 2,300 tons of waste per day; which is equivalent to the amount of waste generated by 5.5 million people. In spite of this imminent problem, there are no other alternatives at present but the MEFCON project.

The San Mateo SLF has faced neighboring residents' opposition to its operation because of serious environmental problems and the poor management. In practice, the problems include generation of bad odor, proliferation of vermin and traffic accidents caused by haulage vehicles. It is foreseen that if no urgent countermeasures against these problems were implemented, it would lead to the non-acceptance by the residents of the MEFCON development, thereby resulting in a waste crisis in the near future.

Table 1.1 summarizes the environmental problems that need to be urgently solved.

Table 1.1 Current Environmental Problems in San Mateo SLF

Problems	Countermeasures
a) Waste scattering, odor, 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.)

The following are noted:

1) Problems stipulated in item a) can be overcome by operating the SLF strictly according to the manual prepared in October 1992.

2) The existing leachate treatment facility in the San Mateo SLF is unsuitably located, being close to Barangay San Juan which is populated with 300 families (4,500 residents) and has an elementary school (Sapinit Elementary School) attended by 369 students. Neighboring residents complain about the odor emanating from the facility.

   The existence of the leachate treatment facility will also hinder a more effective utilization of the land after closure of the landfill site, as it will have to be operated for 15 to 20 years, as long as leachate is flowing out.

3) Improvement of the access road to the San Mateo SLF is proposed to mitigate traffic accidents, noise, and illegal dumping. Since this road will function as a part of the internal road system for the MEFCON Project, the improvement of the access road should be designed in consideration of the entire MEFCON Project.

1.3 Proposed Components of the Environmental Improvement Project

Based on the aforementioned issues, the environmental improvement project of the San Mateo SLF is proposed with 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. Leachate Treatment System Development

Among the above-listed components, the leachate treatment facility is key to the current serious environmental problem in the San Mateo SLF. Since the adequate development of the facility requires a sizable amount of public investment, the JICA Study Team focuses on the examination of its technical and economic feasibility.

2.1 Alternative Plans for Leachate Treatment in San Mateo SLF

Three alternatives are 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.

2.2 Design Conditions

1) Basic Requirements for Landfill Operation

The leachate treatment plant design should be based on the premise that the following landfill operations will be undertaken according to the operation manual:

(1) Full soil covering of filled area;

(2) Removal of rainwater from filled area;

(3) Prevention of rainwater from the next phase from flowing into the active area;

(4) Prevention of rainwater from the outside from flowing into the active area;

(5) Construction of the leachate treatment plant for the second phase; and

(6) Installation of the following leachate treatment facilities:

- Subaqueous rotor
- Leachate circulation system
- Settling tank

2) Disposal Design Amount

The disposal amount required to design the leachate treatment facility is assumed as shown in Table 2.1.

Table 2.1 Disposal Design Amount

Period	Disposal Amount	Remarks
1991 - 1997	2,260,000m^2	Recorded amount
1998	7,422,000m^2	
Total	9,682,000m^2	

3) Scale of Treatment Plant and Regulation Reservoir

The treatment capacity indicated in the "Computation of the Treatment Plant" prepared by MMDA is 1,060m^3/day (530m^3/day x 2 lines).

4) Design Influent Quality

Table 2.2 shows the design influent quality, based on the sampling surveys and analyses carried out by the JICA Study Team in March 1998.

Table 2.2 Leachate Quality

Parameters	Unit	Recorded Value
1. Color (PCU)	PCU	>5,000
2. pH (range)		8.2
3. BOD_5	mg/λ	1,270
4. COD	mg/λ	6,827
5. Total suspended solids (TSS)	mg/λ	5,742
6. T-Hg	Ppb	2.85
7. Cd	mg/λ	0.015
8. As	mg/λ	< 0.001
9. Cr6+	mg/λ	< 0.01
10. Pb	mg/λ	0.882
11. PCB	mg/λ	< 0.001
12. Phenols	mg/λ	0.520
13. Oil/grease (petroleum ether extract)	mg/λ	85.0
14. Total Coliform Bacteria	MPN/100ml	500

Source: JICA Report, March 1998

5) Design Effluent Quality

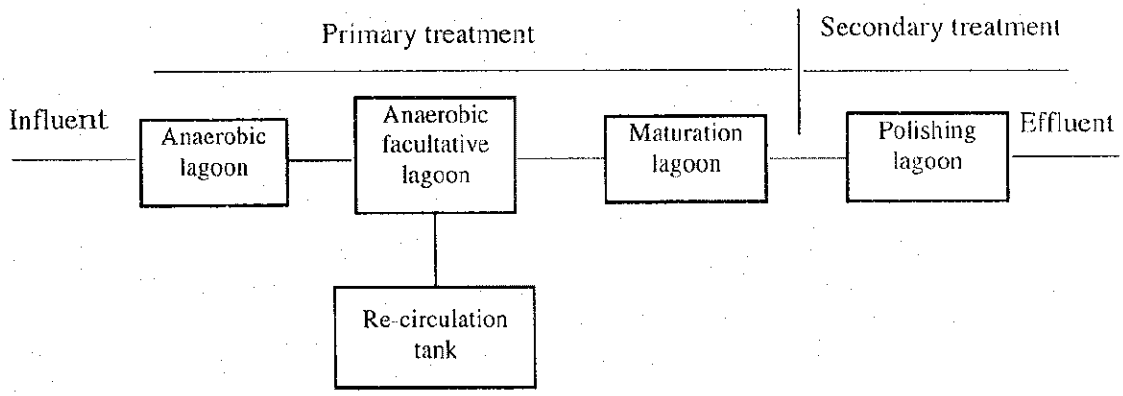
The design effluent quality should be less than the standard value established in the Philippines as shown in Table 2.3.

Table 2.3 Effluent Standards: Conventional and Other Pollutants in Protected Inland Water Supply

Parameters	Units	Category II	
		Standard A	Standard B & SB
1. Color	PCU	150	100
2. Temperature	°C	3	3
3. pH (range)		6.0 – 9.0	6.0 – 9.0
4. COD		100	60
5. Settlement of solids	mg/λ	0.3	0.3
6. BOD5 (20?)	mg/λ	50	30
7. Total suspended solids (TSS)	mg/λ	70	50
8. Total dissolved solids (TDS)	mg/λ	1,200	1,000
9. Surfactants (MBAS)	mg/λ	5.0	2.0
10. Oil/grease (petroleum ether extract)	mg/λ	5.0	5.0
11. Phenolic substances (phenols)	mg/λ	0.1	0.05
12. Total coliforms	MPN/100mλ	5,000	3,000

6) Treatment Method

The division of leachate flow into two equal streams of 530m^3/d was proposed, and each stream is planned as shown below.



2.3 Preliminary Design of Leachate Treatment Facilities

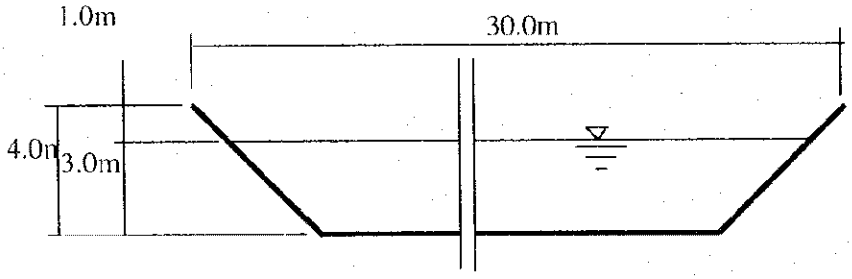
1) Examination of Facility Scale

(1) Anaerobic Lagoon

Design leachate flow rate = 530 m^3/d
Design retention time = 4 days
Required volume = 530 m^3/d x 4 days = 2,120 m^3

Proposed scale of the lagoon:

Top width =	30 m
Top length =	30 m
Depth =	3.0 m
Freeboard =	1.0 m
Slope =	1:1



Effective volume = $1/3 \times 3.0 \times (30 \times 30 + 24 \times 24 + \sqrt{30 \times 30 \times 24 \times 24})$
= 2,196 m^3

Actual retention time = 2,196 / 530 = 4.1 days

Influent BOD = 5,000mg/λ

Assuming a 60 % BOD reduction, the effluent BOD is estimated at 2,000mg/λ

(2) Four (4) aerated lagoons

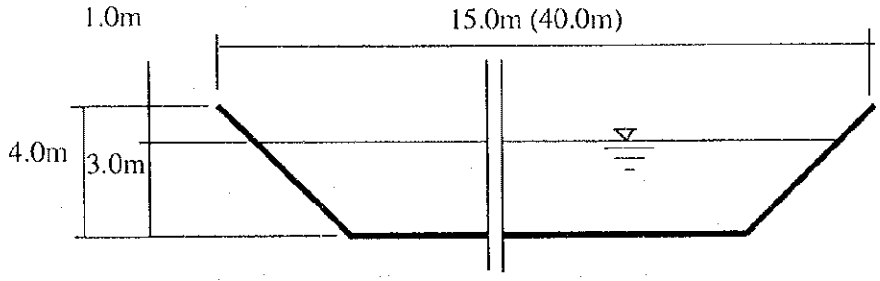
Four (4) lagoons will be designed. Two of these lagoons will be operated either in parallel to each other or in series. Each lagoon will have an 80% BOD removal capacity and BOD removal rate coefficient.

Ke = 0.5 day
T = (% BOD removal)/((100 - %BOD removal) x Ke)
= 80 / ((100 – 80) x 0.5)
= 8.0 days

Volume required = 5330m^3/d x 8days = 4,240m^3

Proposed scale of the lagoon:

Top width	=	15 m
Top length	=	40m
Depth	=	3.0m
Freeboard	=	1.0m
Slope	=	1:1

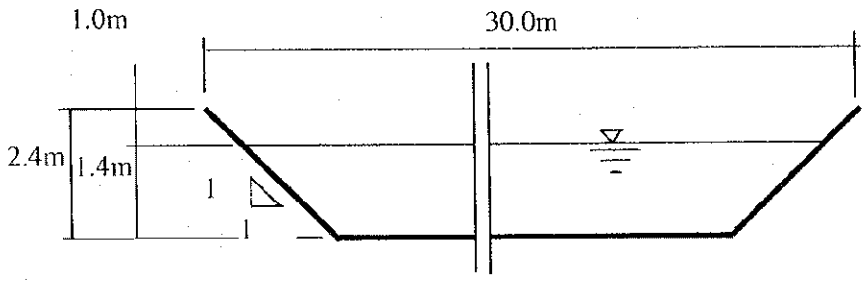


Effective volume = 1/3 x 3.0 x (40 x 15 +34 x 9 + $\sqrt{40 \times 15 \times 34 \times 9}$)
= 1,334 m^3
Actual retention time = (1,334 x 4) / 530 = 10.1 days

(3) Maturation pond

Design retention time for lagoon = 2 days
Required volume = 530 m^3/d x 2 days = 1,060 m^3
Proposed scale of pond

Top width	=	30 m
Top length	=	30 m
Depth	=	1.4 m
Freeboard	=	1.0 m
Slope	=	1:1

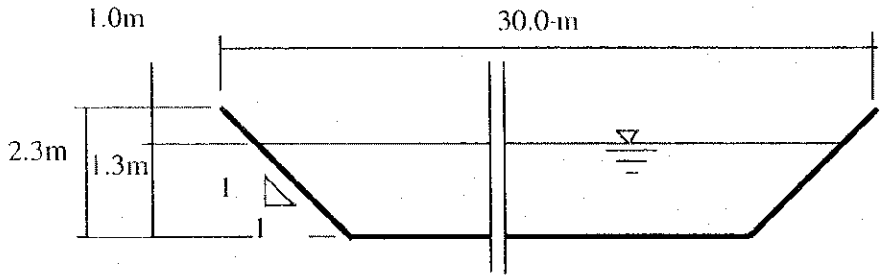


Effective volume =1/3 x 1.4 x (30 x 30 +27.2 x 27.2 + $\sqrt{30 \times 30 \times 27.2 \times 27.2}$)
=1,146m^3
Actual retention time = 1,146 / 530 = 2.2 days

(4) Polishing Lagoon

Proposed scale of pond

Top width	=	30m
Top length	=	30m
Depth	=	1.3m
Freeboard	=	1.0m
Slope	=	1:1



Effective volume = 1/3 x 1.3 x (30 x 30 +27.4 x 27.4 + $\sqrt{30 \times 30 \times 27.4 \times 27.4}$)

= 1,072m^3

Actual retention time = 1,072 / 530 = 2.0 days

2.4 Quantity of Construction Works

The results of the above study were used to estimate the quantity of work for the construction of the facilities. Table 2.4 shows the quantity of construction work in case that the leachate treatment plant is relocated downstream.

Table 2.4 Quantity of Construction Works (Relocation)

Work Items	Specifications	Unit	Quantity
1. Earthworks			
Clearance		m^2	84,000
Excavation	soil (haulage l = 500m)	m^3	86,700
Waste soil-A	soil	m^3	8,800
Waste soil-B	soft rock	m^3	63,600
Filling stabilization	concrete pile (mean l = 10.0m)	Nos.	54
2. Slope protection			
Cutting slope	turfing	m^2	28,410
Filling slope	turfing	m^2	18,700
3. Masonry			
Retaining wall		m^2	1,890
4. Pavement			
Surface course (G)	t = 10cm	m^2	11,841
Subgrade (G)	t = 20cm	m^2	19,641
5. Drainage			
Side ditch (A)	1,000 x 500 pitching stone	M	2,215
Side ditch (B)	1,000 x 500 pitching stone	M	990
Concrete pipe 600	d = 600mm	M	73
Concrete pipe 1000	d = 1,000mm	M	232
Concrete basin (A)	0.8 x 0.8 x 0.8	Nos	15
Concrete basin (B)	1.2 x 1.2 x 1.2	Nos.	15
6. Miscellaneous			
Guard fence		M	890
Guard rail		M	905
Lighting		Ls	1
7. Environmental measures			
Buffer zone	Planting	Ls	1
Leachate pipe	Polyethylene pipe d = 300	M	2,500

2.5 Cost Estimate

1) General

The total costs of each of the three alternatives are 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.
-

2) Investment Cost

Table 2.5 Carbon Deodorization System (Alternative 1)

(Unit: Million Peso)

	Total			1999			2000		
	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C
1 Leachate treatment facilities	175.00	131.28	43.72	9.61	7.37	2.23	165.39	123.90	41.49
(1) Supplemental work in Phase I	9.61	7.37	2.23	9.61	7.37	2.23			
(2) Active carbon deodorization equipment	165.39	123.90	41.49				165.39	123.90	41.49
2 Earth work	90.00	30.27	59.73	47.40	14.22	33.18	42.60	16.04	26.56
(1) Earth work	47.40	14.22	33.18	47.40	14.22	33.18			
(2) Construction in Phase 2	42.60	16.04	26.56				42.60	16.04	26.56
3 Engineering services	30.00	30.00		18.00	18.00	0.00	12.00	12.00	0.00
(1) Planning & Operational Support	30.00	30.00		18.00	18.00	0.00	12.00	12.00	0.00
Total	**295.00**	**191.54**	**103.46**	**75.01**	**39.60**	**35.41**	**219.99**	**151.95**	**68.05**
	100%	65%	35%	100%	53%	47%	100%	69%	31%

Notes: F/C: Foreign currency; L/C: Local currency

Table 2.6 Combustion Deodorization System (Alternative 2)

(Unit: Million Peso)

	Total			1999			2000		
	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C
1 Leachate treatment facilities	225.90	175.89	49.98	9.61	7.37	2.23	216.29	168.52	47.75
(1) Supplemental work in Phase I	9.61	7.37	2.23	9.61	7.37	2.23	0.00	0.00	0.00
(2) Active carbon deodorization equipment	216.29	168.52	47.75				216.29	168.52	47.75
2 Earth work	90.00	30.27	59.73	47.40	14.22	33.18	42.60	16.04	26.56
(1) Earth work	47.40	14.22	33.18	47.40	14.22	33.18			
(2) Construction in Phase 2	42.60	16.04	26.56				42.60	16.04	26.56
3 Engineering services	36.92	36.92		22.15	22.15	0.00	14.77	14.77	0.00
(1) Planning & Operational Support	36.92	36.92		22.15	22.15	0.00	14.77	14.77	0.00
Total	**352.82**	**243.08**	**109.72**	**79.16**	**43.75**	**35.41**	**273.66**	**199.33**	**74.31**
	100%	69%	31%	100%	55%	45%	100%	73%	27%

Notes: F/C: Foreign currency; L/C: Local currency

Table 2.7 Relocation of Leachate Treatment Facilities (Alternative 3)

(Unit: Million Peso)

	Total			1999			2000		
	Total	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C
1 Leachate treatment facilities	146.74	57.32	89.42	44.02	17.19	32.78	102.72	49.03	76.49
2 Earth work	90.38	27.11	63.27	90.38	27.11	63.27			
3 Engineering services	24.00	24.00		14.40	14.40		9.60	9.60	
Total	**261.12**	**108.43**	**152.69**	**148.80**	**58.71**	**96.05**	**112.32**	**58.63**	**76.49**
	100%	42%	58%	100%	39%	65%	100%	52%	68%

Notes: F/C: Foreign currency; L/C: Local currency

3) Operation and Maintenance Cost

Operation and maintenance cost covers the following:

- Electrical bills;
- Fuel expenses;
- Expenses for the removal of sludge; and
- Expenses for changing the active carbon.

The estimated O & M costs from 2001 to 2010 are as shown in Table 2.8. The O&M costs of the following items will be calculated every year, from 2001 to 2010, for a period of ten years.

Table 2.8 Estimated O&M Costs 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

3. Project Evaluation

3.1 Social Evaluation

The operation of the sanitary landfill is not being carried out in accordance with the 1992 operation manual, and its facilities are very basic in design. Residents living in the area surrounding the San Mateo SLF believe that each and every day that San Mateo SLF operates, the danger to their living environment increases. To change this belief based on their apprehensions, the present environmental conditions should be improved. Because this project entails environmental improvement, it must be acceptable to the residents.

Public acceptance is a very significant process in the development of landfill sites for solid waste management in Metro Manila. The improvement of the environmental conditions of the San Mateo SLF would have a positive impact on public opinion regarding sanitary landfill sites. It would be an ideal way of making the public understand the importance of developing sanitary landfill sites left upstream of the Marikina River, under a comprehensive project of MEFCON.

3.2 Environmental Evaluation

The improvement of facilities and the adequate management and operation of these facilities will lead to the reduced generation of pathogenic insects, toxic gas, offensive odor, and occasional fires. It will also prevent health hazards for inhabitants, workers, and pupils who attend the school located near the site.

The installation of a well-functioning leachate treatment facility with adequate design will lead to reduced leakage and leachate penetration to groundwater. It will prevent the aggravation of the quality of groundwater used for drinking, and the quality of river water used for living water, fishery and agriculture.

3.3 Economic Evaluation

The improvement of the leachate treatment facility is indispensable to properly operate and maintain San Mateo SLF. One of the three alternatives should be implemented not only from the environmental aspect but also from the social aspect of obtaining a positive consensus to the development of MEFCON.

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

- Both investment and operation and maintenance costs of Alternative 3 are the least among the three alternatives.
- 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.

- Assuming that Alternative 1 is the "without project" case in evaluating Alternative 3, the cost of Alternative 1 can be considered to be the "saved costs or benefits" accruing from the implementation of Alternative 3. Based on this concept, annual benefits and costs for Alternative 3 can be computed from 1999 through 2010 as shown in Table 3.1. The result indicates a Net Present Value (NPV) during the 11-year project life of 43.4 million Pesos and a B/C ratio of 1.15. Hence, the Economic Internal Rate of Return (EIRR) is calculated to be as high as 56 %, as shown in Table 3.2. These figures point out that the Project of Alternative 3 will be viable enough to be implemented.

Table 3.1 Economic Benefits and Costs for Alternative 3

Alteranative 3 (Unit: Mill. Peso)

	Total	1 1999	2 2000	3 2001	4 2002	5 2003	6 2004	7 2005	8 2006	9 2007	10 2008	11 2009	12 2010
Benefit	422.7	75.0	220.0	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Cost	347.0	148.8	112.3	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
Net Benefit	75.7	-73.8	107.7	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Dsct'd Benefit	335.9	75.0	196.4	10.2	9.1	8.1	7.2	6.5	5.8	5.2	4.6	4.1	3.7
Dsct'd Cost	292.4	148.8	100.3	6.8	6.1	5.5	4.9	4.4	3.9	3.5	3.1	2.8	2.5
NPV	43.4	-73.8	96.1	3.3	3.0	2.7	2.4	2.1	1.9	1.7	1.5	1.3	1.2

Table 3.2 NPV, B/C and IRR of Alternative 3

NPV (r=12%)	43.4 million Pesos
B/C (r=12%)	1.15
IRR	56 %

3.4 Overall Evaluation

As discussed above, the implementation of the Project will lead to positive social and environmental impacts, and the project implementation will be feasible from the viewpoints of economic and financial evaluation. Therefore, the Project is assessed to be worth being implemented.

4. Implementation Plan

The remaining capacity of the San Mateo SLF is estimated at 7 million m^3. It is projected to reach its full capacity by early 2003, or much earlier if the Carnoma SLF remains closed.

The capacity of the presently 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 enough to cope with the increasing leachate amount. Therefore, the leachate treatment plant should be immediately expanded as well as improved, employing deliberate environmental technologies.

The desirable schedule for the improvement of the leachate treatment facility is proposed as illustrated in Figure 4.1.

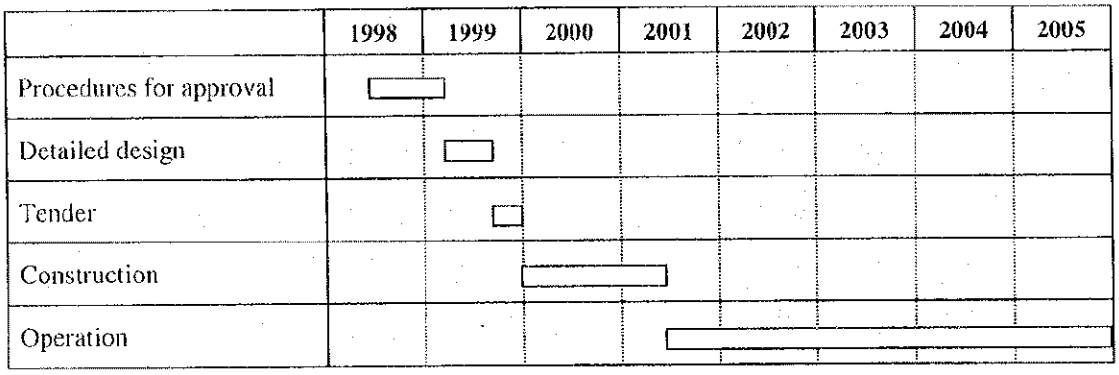


Figure 4.1 Implementation Schedule

5. Conclusions and Recommendations

5.1 Conclusions

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. The main technical reasons are as follows:

- The present leachate treatment facilities adversely affect the environment of nearby areas;
- As leachate treatment facilities will be used over an extended period even after the closure of the landfill, leachate will continue to affect the surrounding areas;
- The present facilities are located beside the landfill area. The continued operation of these facilities will restrict the use of the finished landfill area for various purposes. Therefore, the leachate treatment facilities should be relocated to raise the value of the finished landfill area; and
- The implementation of this Project is expected to help gain public acceptance not only for the continuation of the present landfill operation but also for the development of new disposal sites in the region.

Nevertheless, this option of Alternative 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 be subject to a series of additional ECC procedures which will take a 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 from the existing San Mateo SLF to the leachate treatment facility site, which will be used as maintenance road, will cause some soil erosion problems, even if the slope protection work is well done, because of its steep configuration.

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

5.2 Recommendations

The JICA Study Team has come up with the following recommendations for the implementation of the Project:

1) Sanitary Landfill Operations

The San Mateo SLF has been observed to be operated under "controlled tipping," that is, the lowest sanitary landfill level although the site was originally designed to

have a higher sanitary level. Sanitary landfill operations should be done according to the manual prepared in 1992. The adequate operation of the sanitary landfill site with proper soil covering can greatly reduce the leachate generation amount.

2) Present Facility and Its Expansion

The capacity scale of the presently existing leachate treatment facilities is only half of the scale that was proposed in the final plan. Considering the remaining life of the San Mateo SLF, the use of the present facilities should be continued until such time that 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

It must be a basic policy that the project costs for the initial investment, as well as operation and maintenance, should be internally financed by MMDA in a self-sustainable manner, by improving the current budgetary system. In this sense, introduction of a cost-sharing system by user charge should be considered as one of sustainable financial sources. However, materialization of such a policy will take a long time.

Since the Project is very urgent environmentally, the funds required for the construction of the facilities should be sought from possible international cooperation funds. While, the costs for adequate operation and maintenance should be financed by MMDA. To this end, the current tipping fee scale should be restructured in consideration of budgetary affordability of LGUs as well as financial needs for adequate and efficient operation and management.

4) Technologies

The development of the present leachate treatment facilities was the first experience in the Philippines. Due to lack of appropriate engineering technologies, the treatment system is not properly functioning. Therefore, the proposed facilities should be constructed using technologies of advanced countries that may contribute to technology transfer.

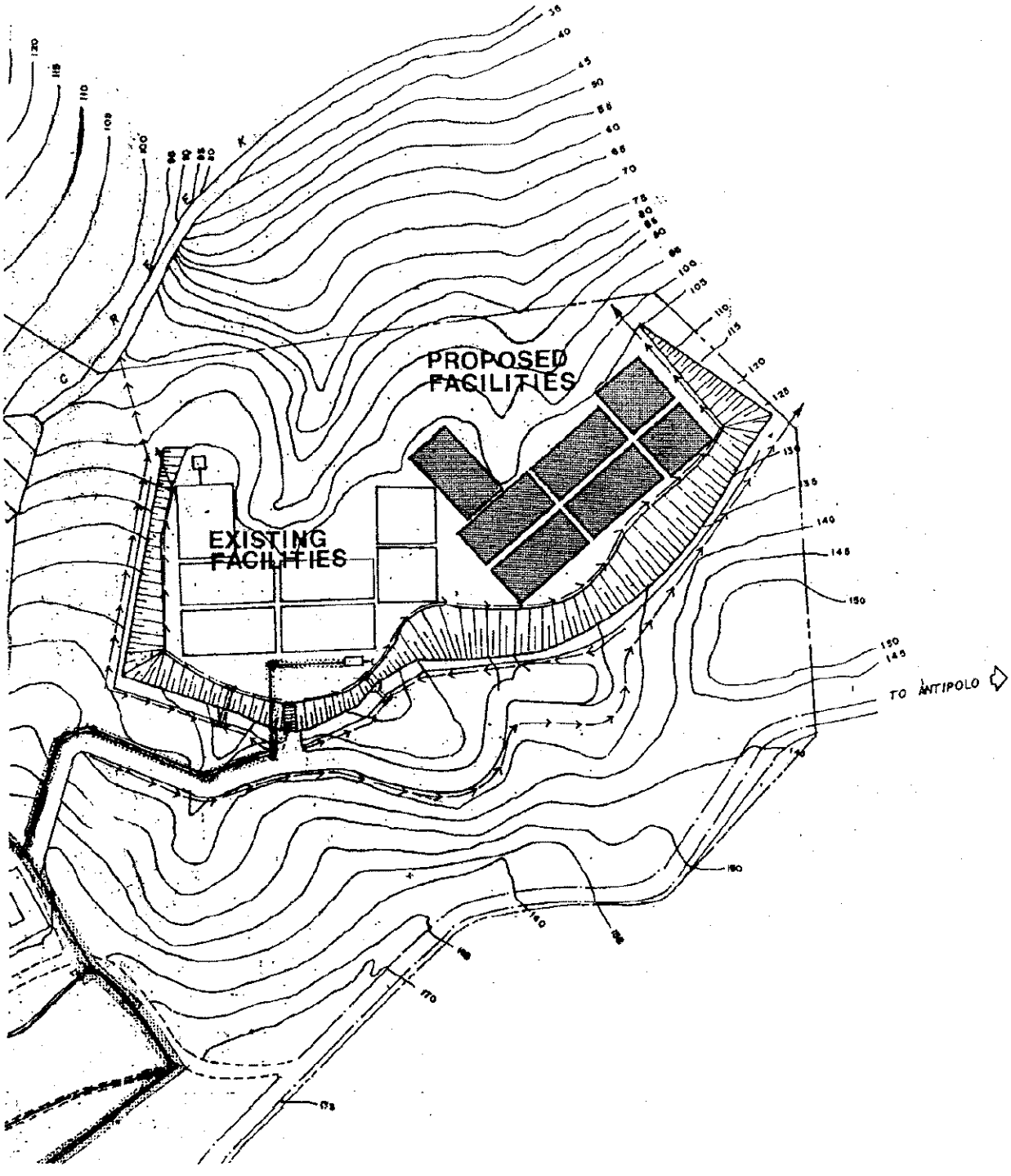


Figure 5.1 Proposed Site for Relocated Leachate Treatment Plant

B. FEASIBILITY STUDY
on the
DEVELOPMENT OF A
NEW SANITARY LANDFILL

B: F/S on THE DEVELOPMENT OF A NEW SANITARY LANDFILL

1. Introduction

1.1 Background of the Project

In 1998, Metro Manila generated a total of 5,700 tons of waste per day, of which 4,200 tons (73%) were disposed of daily. Four waste disposal sites were used, namely, San Mateo and Carmona landfills, which are operated by MMDA, and Payatas and Catmon open dumpsites, which are located in Quezon City and Malabon, respectively. However, as of September 1998, only San Mateo, Payatas and Catmon have been in operation. Payatas and Catmon, being open dumpsites, significantly affect the surrounding environment because of odor, dust, noise and vermin that they generate. These open dumpsites are considered sources of pollution that affect the urban environment. President Estrada has recently ordered the closure of the Payatas open dumpsite by the end of December 1998.

According to the Master Plan for the Solid Waste Management in Metro Manila prepared by the JICA study team on March 1998, the three existing disposal sites only have 3 to 4 years of life left, assuming that the Payatas and Catmon open dumpsites would be closed by the end of 2000. If Payatas will be closed this year, the life span of the remaining disposal sites will be comparatively shorter.

The capacity of the San Mateo and Carmona disposal site is so limited that the development of a new sanitary landfill site would be indispensable to keep solid waste management in Metro Manila sustainable. The JICA Study Team recommends, however, that the two sanitary landfill sites be operated as long as possible to buy time until a new sanitary landfill site is developed and becomes operational.

The development of an inland and offshore landfill site is proposed in the Master Plan. The Presidential Task Force (PTF) has approved the development of an off-shore landfill site under the BOT scheme. A private company is currently conducting the feasibility study for the development of an off-shore landfill site in the northern part of Manila bay. The areas proposed in the master plan for the development of inland landfill sites are the four valleys on the left bank of Wawa River located upstream of Marikina River. This landfill development plan is a component of the Marikina Environmental Forest Conservation Project (MEFCON), an integrated development project that includes forest conservation and the planning of recreational, sports and educational areas after the closure of the landfill. MEFCON aims to later develop this area for the recreation and relaxation of the citizens of Metro Manila.

The DENR and EMB have secured a land, "Parcel B", to develop as the next landfill site. This 32.4338 ha of land has been excluded from the Marikina watershed in accordance with 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 270,000m^3 and a life span of only a month.

Accordingly, the MMDA decided to abandon the development of Parcel B and selected New Parcel B (referred to as Pintong Bocaue 2 in MEFCON). New Parcel B measures 130.2 ha and is adjacent to Parcel B. It is the landfill site proposed in the master plan prepared by JICA to be developed following San Mateo SLF. A study conducted on the site and those in the provinces of Bulacan, Rizal, Cavite and Laguna shows that in terms of transportation, the site is most suitable for the development of a landfill. No major difficulties are also foreseen to arise in the use of the site after San Mateo SLF.

MMDA has given first priority to the development of another landfill site in consideration of the closure of the Payatas open dumpsite and the remaining life of San Mateo SLF. To realize this, the MMDA requested JICA to conduct a feasibility study on this project.

2 Planning Concept

2.1 Review of the Master Plan

2.1.1 Planning Target

The final objective of the basic plan is to develop an environment-friendly SWM system for Metro Manila by promoting public participation, establishing a self-sufficient SWM operation, and encouraging resource recovery/recycling. Target years set to accomplish this objective are as follows:

- Master Plan : 1999 – 2010
- Medium Term Improvement Plan : 2005 – 2010
- Short Term Improvement Plan : 1999 – 2004

The timetable of specific targets to be attained by these plans is as follows:

- Close existing open dumpsites by the end of 2000
- Commence partial separate collection by 2005
- Achieve an 80 % collection coverage ratio by 2005, and 90 % by 2010
- Subject 10 % of total waste volume to composting and recycling through government guidance by 2010
- Commence 500 ton/day incineration for waste reduction from 2005
- Convert all final disposal sites to sanitary landfills by 2005

2.1.2 Planning Framework

(1) Population

Population growth and urbanization in the Philippines is rapid. The population projection in view of the development until the target year of the Master Plan, 2010, is given in Table 2.1.1.

Table 2.1.1 Population of Metro Manila in 1995 and Projections for 2005

Year	Area (km^2)	Population (,000)	Population density (persons/ha)
1995	638.2	9,452	148
2000		11,063	173
2005		12,826	201
2010		14,583	229

(2) Waste Generation Rate

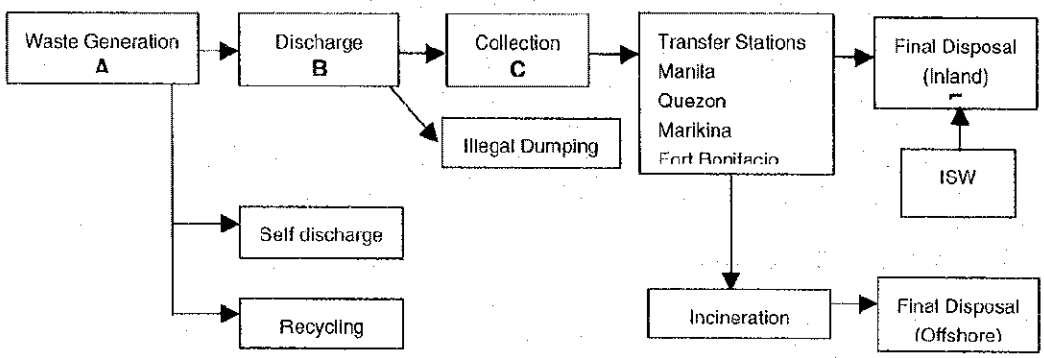
The future waste generation rate (WGR) forecast was based on the results of the study conducted by the JICA Study Team. Household waste generation rate has been estimated in the following table according to a 2% annual growth in WGR.

Table 2.1.2 Unit Waste Generation

Category		Unit	1997	2000	2005	2010
Household waste		g/person/day	419	445	491	542
Commercial waste	Restaurant	g/shop/day	21,318	22,623	24,978	27,579
	Other shops	g/shop/day	1,818	1,929	2,130	2,351
Institutional waste		g/person/day	72	75	85	95
Market waste		g/shop/day	7,261	7,705	8,507	9,393
Street sweeping waste		g/km/day	10,702	11,357	12,539	13,844
River cleansing waste		g/km/day	18,062	19,167	21,163	23,364

(3) Waste Stream

According to the timetable for specific targets, waste flows in 2005 and 2010 are forecast as shown in Figure 2.1.1.



Year	A	B	C	D	E
1998	5,745	5,169	3,760	493	4,191
1999	6,145	5,534	4,024	525	4,482
2000	6,545	5,898	4,288	558	4,774
2001	6,894	6,178	4,600	586	4,944
2002	7,242	6,459	4,911	615	5,114
2003	7,590	6,739	5,222	643	5,285
2004	7,938	7,019	5,533	671	5,455
2005	8,286	7,299	5,844	699	6,029
2006	8,692	7,695	6,342	733	6,466
2007	9,097	8,091	6,839	765	6,903
2008	9,502	8,487	7,337	798	7,340
2009	9,907	8,882	7,834	831	7,778
2010	10,312	9,278	8,332	864	5,715

Figure 2.1.1 Forecast Waste Stream up to Year 2010

2.1.3 Waste Collection System

The waste collection coverage rate in Metro Manila was 73% in 1997. Since a 2% natural increase in the waste generation rate is anticipated, the total waste generation amounts are forecast at 8,300 and 10,000 ton/day in 2005 and 2010, respectively, in consideration of population growth.

Because of these staggering increases, an 80% and 90% collection rate for 2005 and 2010, respectively, are the proposed targets in the Master Plan. When these targets are achieved, 4,000 ton/day of the present final disposal amount will become 5,800 ton/day in 2005, and 8,300 ton/day in 2010, which is almost double the present amount.

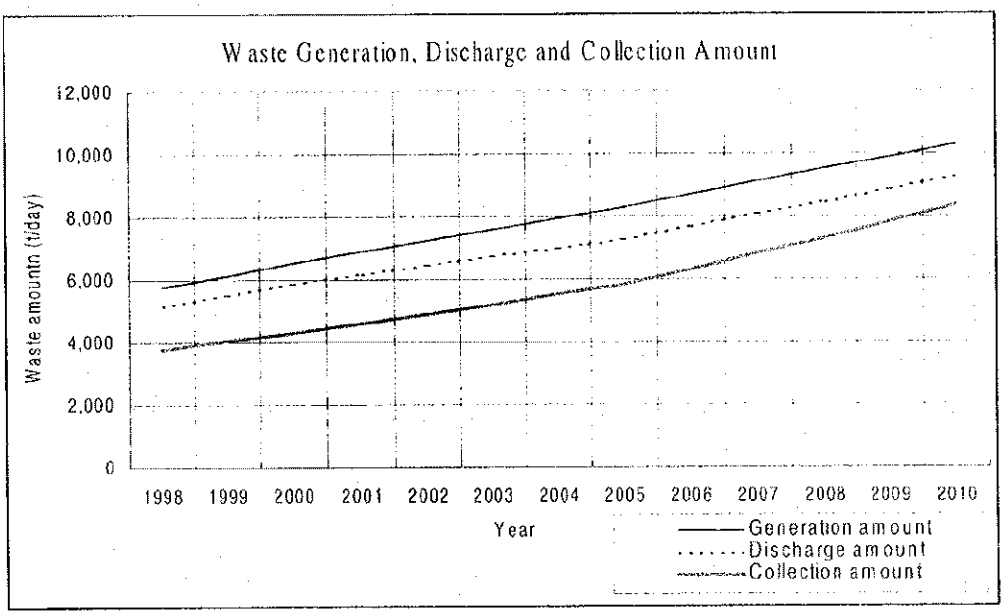


Figure 2.1.2 Forecast Waste Amount

The waste collection activities in Metro Manila are conducted under the supervision of the LGUs. The average collection rate in the entire Metro Manila has been estimated as 73%. In spite of the fact that the collection rate in the high and middle income areas is almost 100%, that in the low income area, i.e., squatters area, which comprises 30% to 40% of the total population of the metropolis, is so low that the average is pulled down.

The improvement of the collection services in such areas is indispensable to achieve the target proposed in the Master Plan. Accordingly, the JICA Study Team conducted the pilot project to improve the waste collection system in areas that are inaccessible to collection vehicles, and not only proved that the collection rate could be increased but also that a collection improvement method could be established. Each LGU is expected to propagate this method based on a manual to be prepared by the study team and the MMDA.

2.1.4 Waste Haulage System

In the master plan, the construction of five transfer stations by 2005, including the existing Las Pinas TS, is proposed not only to reinforce waste haulage services but also to reduce traffic load. A new landfill site is expected to be opened in 2003 or 2004 under the assumption that all the transfer stations will be operated by 2005.

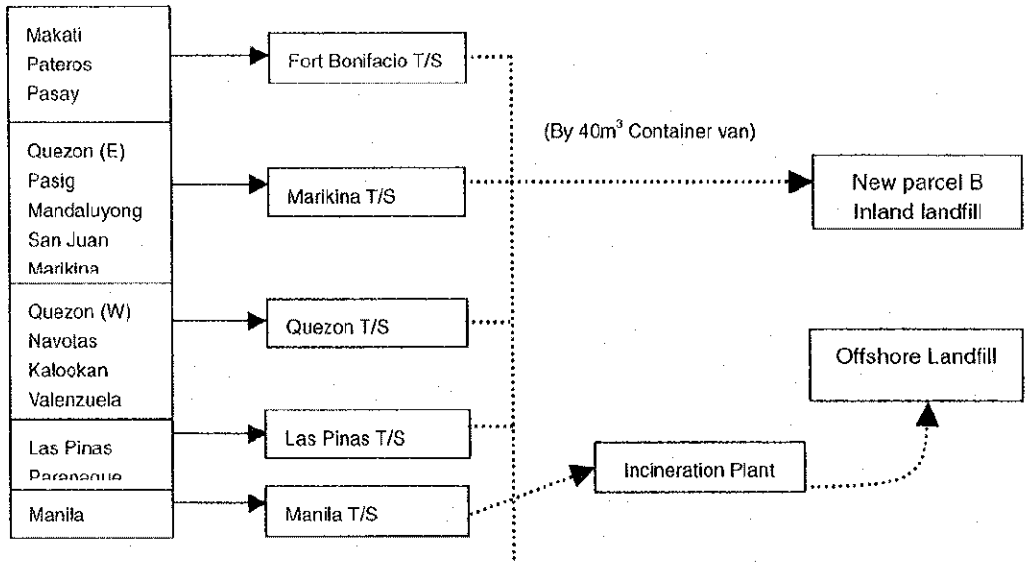


Figure 2.1.3 Proposed Transfer System in 2010

2.1.5 Intermediate Treatment

The following intermediate facilities were proposed in the Master Plan.

(1) Incineration Plant

Taking into account the difficulty of acquiring land for the landfill site and the enormous amount of waste to be disposed, incineration -- the most effective intermediate treatment for waste reduction -- should be considered. The introduction of an incineration plant is proposed in the Master Plan to determine the offshore landfill construction costs, which is considered to be comparatively high. Owing to this reason and the high level of technical know-how that is required, the JICA Study Team proposed a phased introduction of the incineration plant: 500 ton/day capacity in 2005 and 3,000 ton/day in 2010. Through the operation of the first plant, 500 ton/day is not small; it is expected that a proper financial arrangement will be established and an operational technique will be achieved at a level adequate enough to operate the big plant.

(2) Recycling Center and Compost Plant

In addition to the introduction of incineration, recycling, one of the important subjects to be promoted for future waste management, is included in the Master Plan as a means of reducing the waste disposal amount as much as possible. Construction of

sorting plants at the transfer stations and compost plant in the final disposal site are proposed, adjusting the commencement of partial separate collection by 2005.

2.1.6 Final Disposal

(1) Forecast of Waste Disposal Amount

The waste disposal amount is forecasted as shown in the table below.

Table 2.1.3 Forecast Disposal Amount

(unit: ton/day)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Disposal Amount	3,900	4,191	4,482	4,774	4,944	5,114	5,285	5,455	6,529	6,966	7,403	7,840	8,278	8,715
Inland DA	3,900	4,191	4,482	4,774	4,944	5,114	5,285	5,455	6,029	6,466	6,903	7,340	7,778	5,715
Incinerated WA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	500	500	500	500	500	3,000
Sea DWA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75	75	75	75	75	450

The waste disposal amount in 1998 is estimated at 4,191 ton/day. The JICA study team conducted a waste incoming survey at the Payatas open dumpsite and San Mateo SLF from 8 to 14 September 1998 to verify the appropriateness of the above forecast.

The disposal waste amount was estimated at 4,113 ton/day based on the incoming survey. The 2% difference in the forecast amount and the surveyed amount verified the appropriateness of JICA's forecast. The forecast waste amount in the master plan was adopted for the planning work involved in this feasibility study.

Table 2.1.4 Comparison of Forecast Disposal Amount And Surveyed Incoming Amount

(unit: ton/day)

	Incoming amount in 1997	Forecast amount in 1998	Incoming amount in 1998
San Mateo SLF	1,262	1,356	1,752
Carmona SLF	1,374	1,476	-
Payatas	1,169	1,255	2,257
Catmon	95	104	104
Total	3,900	4,191	4,113

Note: Incoming waste amount in Catmon in 1998 is used as forecast amount.

(2) Development of Final Disposal Site

Self disposal is a principle of solid waste management. However, there is no possible site for an inland type of final disposal within Metro Manila with its area of 638.2km^2 and 9.5 million population (source: 1995 census).

Therefore, the development of two landfill sites is proposed in the Master Plan: an inland landfill site outside of Metro Manila and an offshore landfill site in Manila Bay.

2.2 Final Disposal Management Plan

2.2.1 Short Term Final Disposal Management Plan

(1) Avoidance of Garbage Crisis

If the solid waste management in Metro Manila would be conducted according to the target proposed in the Master Plan, the disposal amount will increase at a rate of 6.9 %.

Unfortunately, Carmona SLF was closed in April 1998, and there are no new developments on this situation. In addition, a recent presidential order proclaimed the closure of the Payatas open dumpsite by the end of 1998 in order to eliminate the adverse impacts on the urban environment.

The JICA study team warns that a garbage crisis will break out in early 2002 under the assumption that Payatas is closed by the end of 1998 and Carmona SLF will not be reopened.

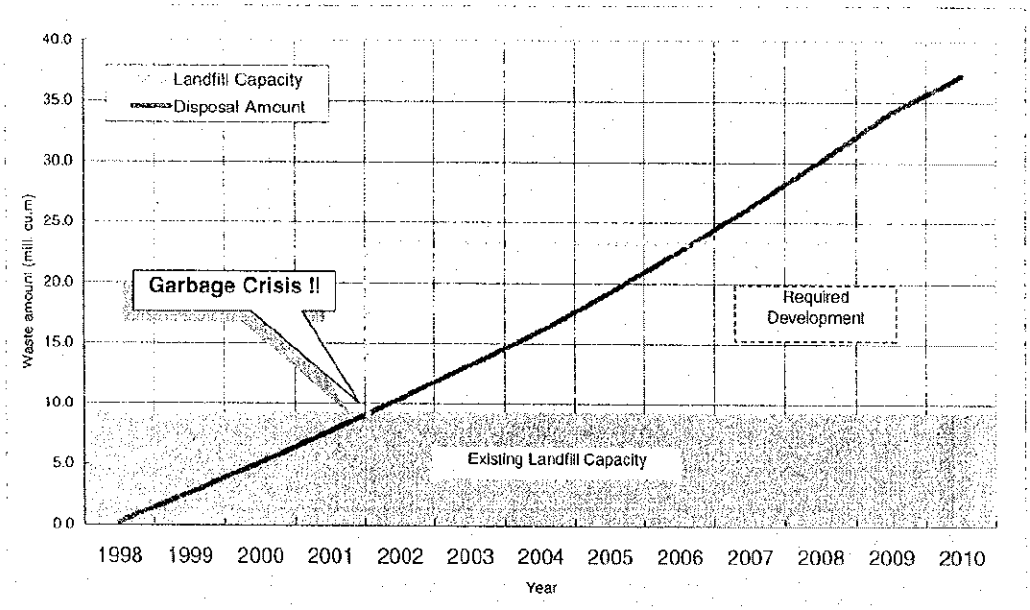


Figure 2.2.1 Balance Between Landfill Capacity and Disposal Amount

Since a period of at least 4 to 5 years is necessary to secure the financial source and the land, conduct the design, bidding, and construction of a new sanitary landfill site, it is practically impossible to prepare the next disposal site by the end of 2001.

The JICA study team recommends the extended use of the existing landfill sites to secure the required disposal capacity until 2003 when the operation of the new sanitary landfill site is expected to start. The JICA study team proposes to reopen Carmona SLF soon and establish a proper operation system to prolong the life of San Mateo and Carmona SLF. In the case of Payatas, its sudden closure will cause social problems. There are many people, such as scavengers and junk shop workers, depending on Payatas for their daily needs. Therefore, a detailed closure plan should be prepared using as reference the experience with Smokey Mountain.

(3) Development of New Landfill Site

An inland type of sanitary landfill is proposed in the MEFCON area in the Master Plan. According to this plan, it will be able to manage Metro Manila's waste by 2015 (refer to Figure 2.2.2).

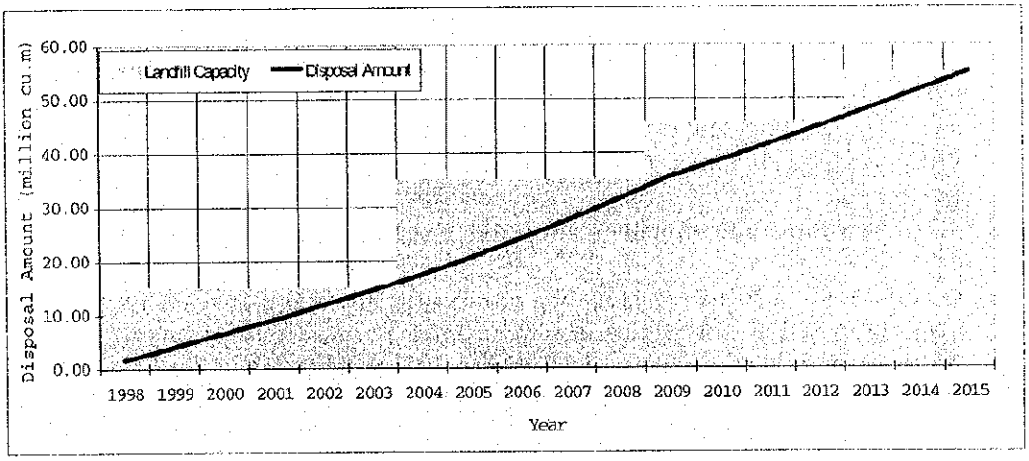


Figure 2.2.2 New Landfill Site Development and Disposal Amount

Table 2.2.1 Landfill Capacity and Disposal Amount

(unit: million m^3)

	Landfill Capacity	Disposal Amount	Note
1998	15.04	1.65	
1999	15.04	4.00	
2000	15.04	6.51	
2001	15.04	9.10	
2002	15.04	11.78	
2003	15.04	14.56	
2004	35.04	17.42	New Parcel B: +20 million m^3
2005	35.04	20.58	
2006	35.04	23.98	
2007	35.04	27.60	
2008	35.04	31.45	
2009	45.84	35.53	Pintong Bocaue 1 : + 10.8 million m^3
2010	45.84	38.53	
2011	45.84	41.62	
2012	45.84	44.80	
2013	54.94	48.08	Pintong Bocaue 3 : + 9.1 million m^3
2014	54.94	51.46	
2015	54.94	54.93	

As previously mentioned, the development of an offshore sanitary landfill site is also proposed in the Master Plan. This development will be conducted under the BOT scheme. The development of inland and offshore landfill sites is expected to result in the effective management of a final disposal system.

2.2.2 Environmental Improvement of the Existing SLF

To effectively secure landfill sites for long term waste disposal management, the JICA Study team proposed the Marikina Environmental 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.

This project will not commence without the consensus of the public. To realize this, the improvement of the present environmental conditions of the San Mateo SLF -- being the first landfill to be developed in the MEFCON project – would be vital. Based on the significance of safe landfill operations with environmental considerations, the Environmental Improvement of the San Mateo SLF should be given top priority.
Through the investigation of the San Mateo landfill site, the JICA study team established that the following environmental issues need to be solved.

- Differences between the implementation plan and actual site operation;
- Proximity of the landfill site to residential areas;
- Illegal settlers living inside the landfill site;
- Difficulty in the maintenance of installed facilities, e.g., drainage pipes, due to absence of drawings that would indicate where exactly these facilities are laid out;
- Unsatisfactory drainage of storm water from surrounding area;

- Absence of storm water drainage in the active landfill area;
- Inadequate landfill operations in the rainy season due to the absence of a plan for the construction of an access road to the active landfill area;
- Breeding of vermin due to absence of a soil covering plan;
- The treatment capacity of the present plant (530 m^3/day of waste from Stage 1) cannot cope with the disposed waste volume in Stage 2;
- Possible dangers of gas explosion in completed landfill sections;
- Odor generated by the present leachate treatment facility -- which is less than 500m north of the Sapinit Elementary School in Barangay San Juan -- greatly affects the school children and those living in the vicinity; and
- Involvement of waste haulage vehicles in many traffic accidents in the 4.7 km access road between Cogeo Road and the San Mateo SLF site, due to an imbalance in horizontal and vertical alignments.

On the other hand, the following environmental problems are clarified through interviews with residents in the vicinity.

(1) Problems caused by the landfill site

- Odor emanating from the site at night
- Harmful influence on the Sapinit Elementary School students
- Breeding of vermin

(2) Problems caused by waste haulage

- Frequent occurrence of traffic accidents
- Abandoned waste at points where the traffic accidents occurred
- Noise caused by waste haulage vehicles going uphill
- Leakage from open dump trucks loaded with waste during rainy season
- Wastes scattered by haulage vehicles

These landfill site problems are classified as internal and external problems. The internal problems may be solved by the proper operation or proper development of the site by the Philippine side. For example, the actual development of the site was not carried out according to the implementation plan prepared by the World Bank.

The external problems of the landfill site are mostly caused by waste haulage and obnoxious odor. Waste scattering and leakage accompanying waste haulage are caused by the drivers poor driving manners. These can be solved by the Philippine side carrying out an education/guidance program for the waste haulage drivers.

The site investigation results attribute the frequent occurrence of traffic accidents to the poor structure of the access road, e.g., narrowness, inadequate alignment. Traffic accidents can be eliminated therefore if the road is improved, e.g., widened.

The proximity of the landfill site to a residential area and a school in barangay San Juan is a problem in terms of the odor emanating from the site. The obvious solution here is either relocating the landfill site or the whole village. However, the closure of the San Mateo SLF would not prevent leachate seepage as the site has been used since 1991.

Soil covering of waste could reduce the odor emanating from the site to a considerable extent. The leachate treatment being adopted only involves aeration which cannot be fully used due to the pond's size. As a countermeasure, the study team proposes the installation of a deodorizing equipment in a fully enclosed treatment plant.

The improvement of the access road and the leachate treatment plant can be carried out independently from the operation of the San Mateo SLF. To gain public acceptance for the continuous operation of the San Mateo SLF and the development of the future landfill site in MEFCON area, these environmental improvement projects should be urgently implemented.

According to the results of the provisional study above mentioned, a feasibility study will be carried out on the two projects:

1) Improvement of access road
2) Leachate treatment improvement

The access road from Cogeo Road to San Mateo SLF is quite far from the one connected to the proposed new landfill site. Improvements, therefore, will be in the form of constructing an access road to the new landfill site.

At the moment, only half of the leachate treatment facilities is completed; the construction of the other half has not started yet. Moreover, some sections of the cutting slope, where the existing leachate treatment facilities were constructed on the excavated plane, are in danger of eroding or collapsing due to inadequate construction. Urgent measures are required.

The JICA study team conducted a feasibility study on the construction of the remaining half of the leachate treatment facilities and deodorizer. It reported the appropriateness and the necessity of urgent measures in the report: "Part II An F/S on the Project for Environmental Improvement of San Mateo SLF".

2.2.3 Final Disposal Management (from the present to 2004)

The timeframe for the opening the new landfill site is at least 4 to 5 years considering funding, design, bid and construction. The remaining disposal capacity of the San Mateo and Carmona SLF, being under MMDA control, is estimated at 8.5 and 4.2 million cubic meters, respectively. The JICA study team examined the following four scenarios.

Case 1	All disposal sites are available
Case 2	Carmona will remain closed from April 1998, Payatas and Catmon will be available.
Case 3	Carmona will be reopened, Payatas and Catmon will be closed by the end of 2000.
Case 4	Carmona will remain closed from April 1998, Payatas and Catmon will be closed by the end of 2000

In view of conserving the urban environment, Case 1 and Case 2 are unrealistic. From the planning point of view, Case 4 is also unrealistic as the new landfill is expected to

become operational in early 2004. Case 3 provides the best scenario for planning a new landfill site.

For Case 3, the reopening of Carmona SLF will add life to the existing San Mateo SLF. And although ideally, open dumpsites should be closed as soon as possible, the worst case scenario – which is the continued operation of both the Payatas and Catmon dumpsites until the end of 2000 – would give more time for the development of a new landfill site. Otherwise, MMDA should conduct educational programs on waste minimization and ensure that the operation of the San Mateo and Carmona disposal sites is properly carried out.

The early closure of Payatas and Catmon depends on when MMDA can determine the actual remaining capacity of the existing sanitary landfills, taking into consideration the amount of waste to be disposed and the expected date of operation of the new sanitary landfill. Therefore, when planning the new landfill site, careful consideration should also be given to a partial opening whereby disposal is allowed by early 2003.

Table 2.2.2 Landfill Scenario (1998 - 2004)

(Landfill capacity is estimated by JICA based on the Implementation Plan)

Case 1

unit : m^3

		1998	1,999	2,000	2,001	2,002	2,003	2,004
San Mateo	Capacity	7,375,756	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156
	Disposal	712,521	1,474,569	2,286,143	3,222,156	4,282,609	5,467,500	6,776,831
Carmona	Capacity	833,738	2,969,738	4,216,738	4,216,738	4,216,738	4,216,738	4,216,738
	Disposal	774,097	1,602,001	2,483,711	3,433,018	4,449,921	5,534,421	6,686,517
Payatas	Capacity	3,757,287	4,417,029	5,122,629	5,122,629	5,122,629	5,122,629	5,122,629
	Disposal	659,742	1,365,342	2,116,799	2,868,257	3,619,714	4,371,172	5,122,629
Catmon	Capacity	300,583	353,362	409,810	409,810	409,810	409,810	409,810
	Disposal	52,779	109,227	169,344	229,461	289,577	349,694	409,810
total	Capacity	12,267,364	16,275,286	18,284,333	18,284,333	18,284,333	18,284,333	18,284,333
	Disposal	2,199,140	4,551,139	7,055,998	9,752,891	12,641,821	15,722,786	18,995,787

Case 2

unit : m^3

		1998	1,999	2,000	2,001	2,002	2,003	2,004
San Mateo	Capacity	7,375,756	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156
	Disposal	1,293,094	2,883,046	4,576,330	6,461,650	8,539,006	10,808,397	13,269,824
Carmona	Capacity	193,524	-	-	-	-	-	-
	Disposal	193,524	-	-	-	-	-	-
Payatas	Capacity	3,757,287	4,417,029	5,122,629	5,122,629	5,122,629	5,122,629	5,122,629
	Disposal	659,742	1,365,342	2,116,799	2,868,257	3,619,714	4,371,172	5,122,629
Catmon	Capacity	300,583	353,362	409,810	409,810	409,810	409,810	409,810
	Disposal	52,779	109,227	169,344	229,461	289,577	349,694	409,810
total	Capacity	11,627,151	13,499,072	14,261,120	14,261,120	14,261,120	14,261,120	14,261,120
	Disposal	2,199,140	4,551,139	7,055,998	9,752,891	12,641,821	15,722,786	18,995,787

Case 3

unit : m^3

		1998	1,999	2,000	2,001	2,002	2,003	2,004
San Mateo	Capacity	7,375,756	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156
	Disposal	712,521	1,474,569	2,286,143	4,033,730	5,905,757	7,902,222	10,023,127
Carmona	Capacity	833,738	2,969,738	4,216,738	4,216,738	4,216,738	4,216,738	4,216,738
	Disposal	774,097	1,602,001	2,483,711	3,433,018	4,449,921	5,534,421	6,686,517
Payatas	Capacity	751,457	1,411,200	2,116,799	-	-	-	-
	Disposal	659,742	1,365,342	2,116,799	-	-	-	-
Catmon	Capacity	60,117	112,896	169,344	-	-	-	-
	Disposal	52,779	109,227	169,344	-	-	-	-
total	Capacity	9,021,068	13,028,989	15,038,037	15,038,037	15,038,037	15,038,037	15,038,037
	Disposal	2,199,140	4,551,139	7,055,998	9,752,891	12,641,821	15,722,786	18,995,787

Case 4

unit : m^3

		1998	1,999	2,000	2,001	2,002	2,003	2,004
San Mateo	Capacity	7,375,756	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156	8,535,156
	Disposal	1,293,094	2,883,046	4,576,330	7,273,224	10,162,153	13,243,118	16,516,120
Carmona	Capacity	193,524	-	-	-	-	-	-
	Disposal	193,524	-	-	-	-	-	-
Payatas	Capacity	751,457	1,411,200	2,116,799	-	-	-	-
	Disposal	659,742	1,365,342	2,116,799	-	-	-	-
Catmon	Capacity	60,117	112,896	169,344	-	-	-	-
	Disposal	52,779	109,227	169,344	-	-	-	-
total	Capacity	8,380,854	10,252,776	11,014,824	11,014,824	11,014,824	11,014,824	11,014,824
	Disposal	2,199,140	4,551,139	7,055,998	9,752,891	12,641,821	15,722,786	18,995,787

2.2.4 Identification of the Project Site

The 32.4338 ha of land identified as "Parcel B" has been excluded from the Marikina watershed in accordance with 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 270,000m^3 and a life span of only a month.

Accordingly, the MMDA decided to abandon the development of Parcel B and selected New Parcel B (referred to as Pintong Bocaue 2 in MEFCON). New Parcel B is adjacent to Parcel B. It is the landfill site proposed in the master plan prepared by JICA to be developed following San Mateo SLF. A study conducted on the site and those in the provinces of Bulacan, Rizal, Cavite and Laguna shows that in terms of transportation, the site is most suitable for the development of a landfill. No major difficulties are also foreseen to arise in the use of the site after San Mateo SLF.

MMDA has given first priority to the development of another landfill site in consideration of the closure of the Payatas open dumpsite and the remaining life of San Mateo SLF. To realize this, MMDA requested JICA to conduct a feasibility study on this project. Since it is necessary to secure New Parcel B before the commencement of the JICA study, MMDA intends to have the proposed site proclaimed as a non-NIPAS area (refer to Figures 2.2.3 and 2.2.4).

2.2.5 Project Component

This project is one of the components of the MEFCON Project, which does not only propose landfill development but also the utilization of the landfill site after closure. The MEFCON Project aims to create a recreational park, forest park, and educational and sports area for the Metro Manila residents along the left bank of Wawa River.

The proposed new landfill site is estimated to cover 130.2244 ha, with a capacity of almost 20,000,000m^3. Considering that the estimated waste disposal amount in 2005 is 6,000 ton/day, the life span of the landfill is 6 years and 4 months. The project also covers the extension and rehabilitation of the access road for safe and efficient waste haulage.

<Project Summary>

- Project Site:

  A valley along the tributary of Wawa River 3 km northeast of the existing San Mateo SLF.

- New landfill development:
  - Project area — 130.2244 ha.
  - Waste disposal space: — 20,000,000 m^3
  - 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

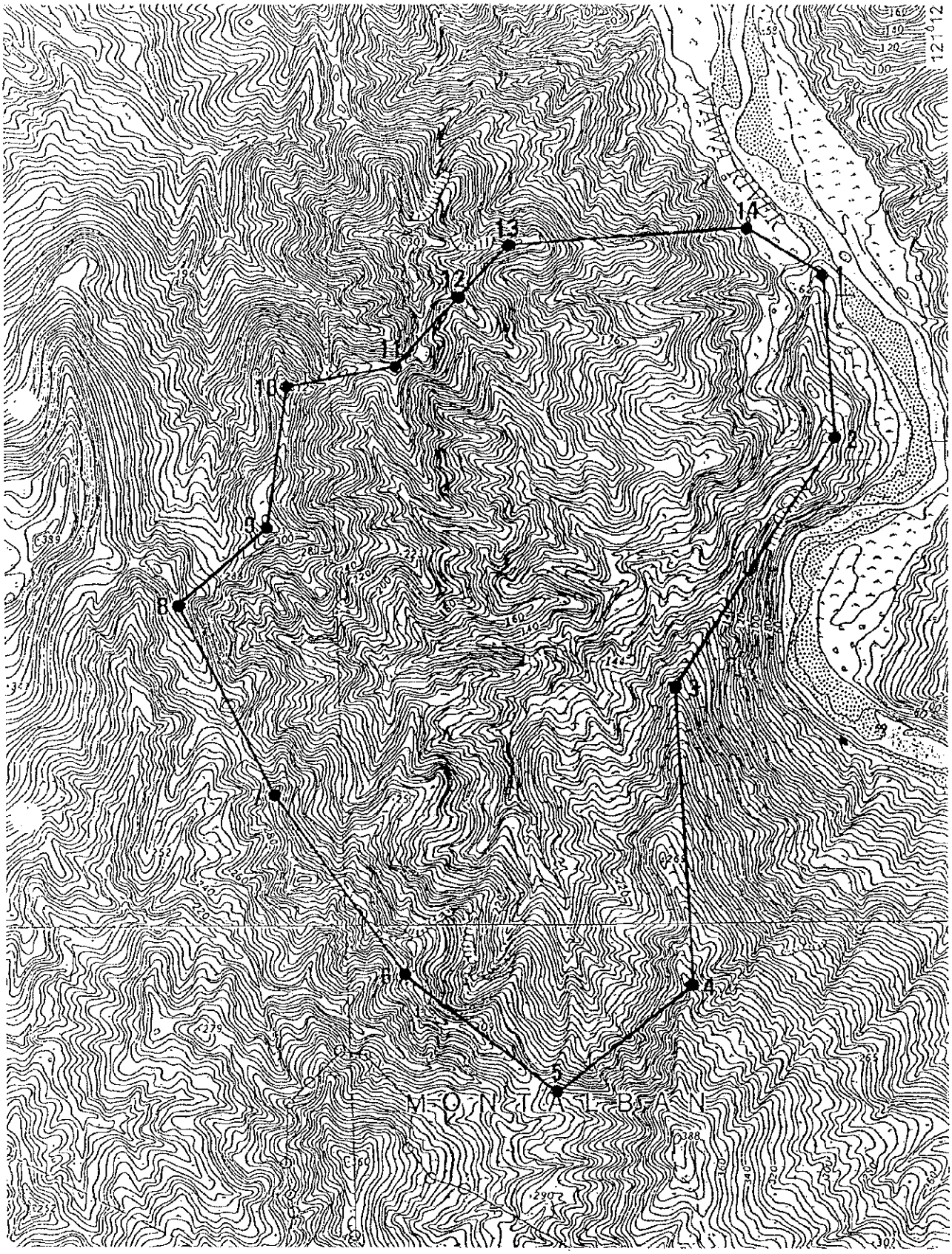


Figure 2.2.3 Location of the Project Site

Scale 1:10,000

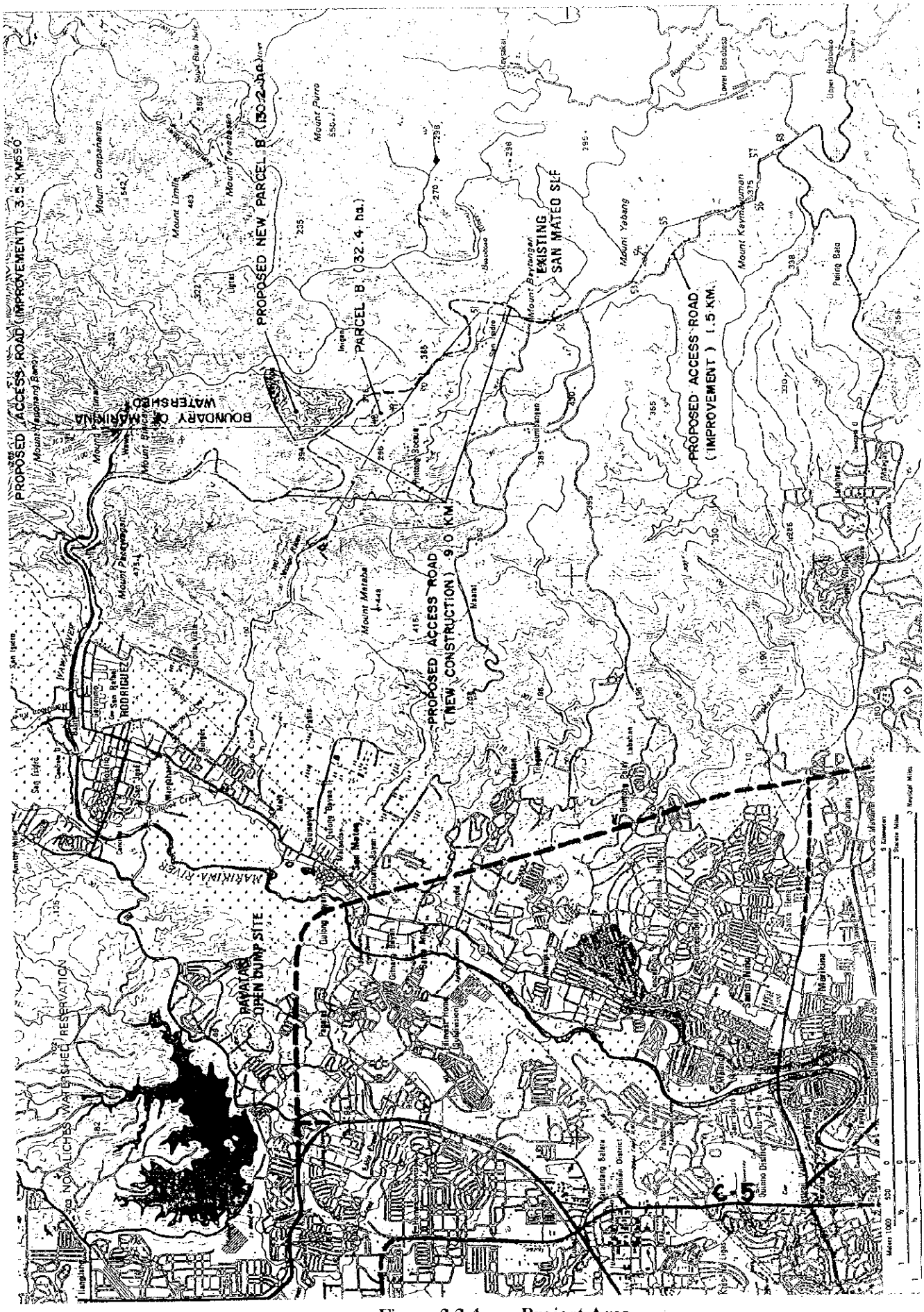


Figure 2.2.4 Project Area