NO.

JAPAN INTERNATIONAL COOPERATION AGENCY

MUNICIPALITY OF PANAMA
THE REPUBLIC OF PANAMA

MUNICIPIO DE PANAMA

THE STUDY ON SOLID WASTE MANAGEMENT PLAN FOR MUNICIPALITY OF PANAMA IN THE REPUBLIC OF PANAMA

Final Report
Volume I

SUMMARY

MARCH 2003

KOKUSAI KOGYO CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Panama, the Government of Japan decided to conduct a development study on Solid Waste Management Plan for Municipality of Panama in the Republic of Panama and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Hiroshi Kato, KOKUSAI KOGYO CO., LTD. to Panama three times between December 2001 and January 2003.

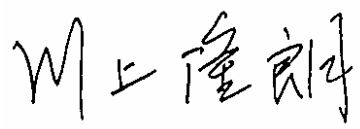
In addition, JICA set up an advisory committee headed by Dr. Hidetoshi Kitawaki, a professor of Toyo University, which examined the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Panama 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 the Republic of Panama for their close cooperation extended to the Team.

March, 2003



Takao KAWAKAMI
President
Japan International Cooperation Agency

March 2003

Mr. Takao KAWAKAMI
President
Japan International Cooperation Agency

Letter of Transmittal

Dear Mr. KAWAKAMI,

We are pleased to submit the report of the Study on Solid Waste Management Plan for Municipality of Panama in the Republic of Panama.

This report consists of three components: a study on the present practices of waste management in Municipality of Panama; the formulation of the solid waste management master plan until the year 2015; and a feasibility study on the priority projects drawn from the master plan.

In the study on the present practices, six types of field investigations were conducted and existing data and information of various sources were collected and examined. By doing so, the current status of solid waste management in Municipality of Panama was thoroughly understood and the issues to be considered were identified.

The master plan was formulated aiming at overcoming these issues, with ultimate goals of the establishment of a sound municipal solid waste management system by 2015. In concrete terms, to eliminate waste from living environment for protecting the health of the citizens, to establish an appropriate final disposal system for mitigating environmental impacts caused by collected waste, and to contribute resource conservation through waste minimization have been developed as policies of the master plan. On the basis of the policies, technical, legal, organization and financial systems have been formulated. It was one of distinguishing characteristics of the study that six pilot projects were selected out of various improvement measures of the master plan with taking into account their urgency and implemented.

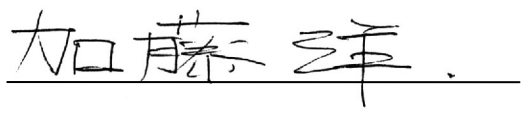
The feasibility study was carried out on two priority projects which are the construction of a new landfill that can receive waste until 2015 in the existing final disposal site, or Final Disposal Project, and a transfer and transport system that copes with the rapid urbanization in the east of Municipality of Panama, Transfer and Transport Project.

The Municipality of Panama has already implemented various measures for the goal of the master plan, such as enactment of a municipal ordinance on solid waste management that was jointly formulated by the Panamanian side and the Study Team, and invitation for bids on the Final Disposal Project for utilizing finance in the private sector. The study is actually yielding results.

We would like to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Economy, Trade and Industry, and the Ministry of Environment of Japan. We would also like to extend our deep appreciation to the Government of Panama, the Embassy of Japan and the JICA office in Panama for their vital cooperation during the implementation of our study in Panama.

Last but not least, we hope that the output of our study presented here will contribute to the improvement of solid waste management and citizens' welfare in the Municipality of Panama.

Respectfully,



Hiroshi KATO
Team Leader
The Study on Solid Waste Management Plan for Municipality of Panama in the Republic of Panama

1 Objectives of the Study

The Study has the following three objectives:

- Formulation of a Master Plan on solid waste management in the municipality of Panama targeting the year 2015
- Implementation of Feasibility Study for selected priority project(s)
- Technology transfer to the counterpart personnel in the course of the Study

2 Study Area

The study covers the area under the jurisdiction of the municipality of Panama, but not covers the municipality of San Miguelito and other municipal areas that avail themselves of Cerro Patacon Final Disposal Site. However, it was carried out to collect data and to estimate waste amount of those municipalities, in order to attain the objectives mentioned above.

3 Solid Waste to be Covered Under the Study

This study covers municipal solid waste, industrial waste and medical waste. However, the study on industrial and medical waste were carried out **NO** further than grasp of present condition and suggestion to find and handle problems in the master plan.

Municipal solid waste consists of:

- Household waste
- Commercial waste
- Institutional waste
- Market waste
- Road sweeping waste

4 Target Years

Target years set in the Study are as follows.

i) Master Plan 2015

ii) Selected Priority Projects

The Final Disposal Project

- Phase I 2006 to 2008(operation)
- Phase II 2008 to 2010(ditto)
- Phase III 2010 to 2011 (ditto)
- Phase IV 2012 to 2015 (ditto)

The Transfer and Transport Project

- Phase I 2005 to 2007
- Phase II from 2008

5 The Master Plan

5.1 Outline of the Master Plan

5.1.1 Goals

The principal goal of the Master Plan is to establish a sound Solid Waste Management System by the target year 2015 in Municipality of Panama, where the population and major economic activities of the country are centered.

The Master Plan aims to:

- **promote the citizens' well-being;**
- **implement sustainable SWM; and**
- **contribute to environmental conservation.**

5.1.2 Outline of the Master Plan

Table 1 shows contents of the master plan.

Table 1: Outline of the Master Plan

Item			Present (2002)	Phase 1(2005)	Phase 2 (2010)	Phase 3 (2015)
General information						
	Population (Panama)		744,448	807,868	944,574	1,132,726
	Service coverage (%)		92	98	100 (2006)	100
Waste generation amount (ton/day)						
	Total (ton/day)		1,025	1,102	1,263	1,444
	Household waste		439	476	557	669
	Commercial, institutions and industries		421	459	534	596
	Market waste		24	24	24	24
	Bulky waste		12	14	19	26
	Street sweeping waste		8	8	8	8
	Hospital waste		20	20	20	20
	Demolition waste		96	96	96	96
	Sewage		5	5	5	5
	Potential recyclable waste		293	328	385	444
	Non-recyclable waste		732	774	909	1,047
Discharge and storage						
	Discharge manner	Separate	0 %	0 %	16.5%	50%
		Mixed	0 %	0 %	83.5%	50%
	Discharge amount (ton/day)	Total	965	1,065	1,231	1,408
		Separate	0	0	63	222
		Mixed	965	1,065	1,168	1,186
	Recycling amount (ton/day)		0	0	27	94
Collection and transport						
	Collection system		Collection vehicle	Collection vehicle	Collection vehicle	Collection vehicle
	Transport system		Collection vehicle	Collection vehicle and transfer station	Collection vehicle and transfer station	Collection vehicle and transfer station
Facilities						
	Transfer station		-	Installation and operation	Operation	Operation
	Material Recovery Facility		-	-	Installation, operation, expansion	
Final disposal						
	Final disposal site		Cerro Patacon	Cerro Patacon	Cerro Patacon	Cerro Patacon
	Landfill		Sanitary landfill and control dumping	Sanitary landfill		
	Disposals amount (ton/day)	Panama	965.0	1,065.3	1,204.0	1,314.1
		San Miguelito	216.7	250.0	320.3	393.5
		Arraijan	27.4	39.0	70.5	122.8
		Total	1,209.1	1,354.3	1,594.8	1,830.4

5.2 Project Cost Estimation

Overall costs of the M/P are shown below.

Table 2 : Overall Cost (New Facilities)

unit : U$1,000

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Overall costs															
Investment															
Separate Collection	0	0	0	0	0	89	179	268	178	355	355	356	533	534	2,847
Transfer station	0	67	3,106	0	0	1,876	0	0	0	0	0	0	0	0	5,049
Tractor (300-350hp)	0	0	0	356	89	89	89	0	0	89	356	178	89	178	1,513
Trailer (85 yd3, 20 ton)	0	0	0	326	54	54	163	0	0	54	326	109	54	217	1,357
MRF (Cerro Patacon)	0	0	0	20	800	32	1,292	47	1,937	47	1,937	21	873	0	7,006
Landfill (Cerro Patacon)	0	0	141	9,541	306	20,706	341	23,041	8	508	0	0	0	0	54,592
Total	**0**	**67**	**3,247**	**10,243**	**1,249**	**22,846**	**2,064**	**23,356**	**2,123**	**1,053**	**2,974**	**664**	**1,549**	**929**	**72,364**
Operation and maintenance															
Separate Collection	0	0	0	0	0	206	418	625	418	831	831	831	1,242	1,249	6,651
Transfer station	0	0	0	211	211	211	270	270	270	270	270	270	270	270	2,793
Tractor (300-350hp)	0	0	0	122	152	183	213	213	213	244	244	274	274	305	2,437
Trailer (85 yd3, 20 ton)	0	0	0	7	8	9	12	12	12	13	13	14	14	16	130
MRF (Cerro Patacon)	0	0	0	0	0	40	40	105	105	202	204	301	301	345	1,643
Landfill (Cerro Patacon)	0	0	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
Total	**0**	**0**	**0**	3,286	3,317	3,595	3,899	4,171	3,964	4,506	5,166	5,294	5,705	5,789	48,692
Investment and O&M total															
Total	0	67	3,247	13,529	4,566	26,441	5,963	27,527	6,087	5,559	8,140	5,958	7,254	6,718	121,056

Table 3 : Total Overall Cost

Unit : U$1,000

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Investment															
New item	0	67	3,247	10,243	1,249	22,846	2,064	23,356	2,123	1,053	2,974	664	1,549	929	72,364
Current landfill	0	10,500	2,800	1,800	0	0	0	0	0	0	0	0	0	0	15,100
Investment total	**0**	**10,567**	**6,047**	**12,043**	**1,249**	**22,846**	**2,064**	**23,356**	**2,123**	**1,053**	**2,974**	**664**	**1,549**	**929**	**87,464**
O&M															
New item	0	0	0	3,286	3,317	3,595	3,899	4,171	3,964	4,506	5,166	5,294	5,705	5,789	48,692
Current landfill leachate treatment	0	2,742	2,848	3,146	1,711	180	180	180	180	180	180	180	180	180	12,067
O&M total	0	**2,742**	**2,848**	**6,432**	**5,028**	**3,775**	**4,079**	**4,351**	**4,144**	**4,686**	**5,346**	**5,474**	**5,885**	**5,969**	**60,759**
Total	**0**	**13,309**	**8,895**	**18,475**	**6,277**	**26,621**	**6,143**	**27,707**	**6,267**	**5,739**	**8,320**	**6,138**	**7,434**	**6,898**	**148,223**

5.3 Financial Evaluation

5.3.1 Financial Internal Rate of Return (FIRR)

Implementation of the Master Plan between 2003 and 2015 would give a positive financial balance of $61.5 million for the period, resulting in a financial internal rate of return (FIRR) of 47.5%. The high FIRR should be viewed with caution because it is extremely sensitive to variations in income. If government subsidy is eliminated as income source, the FIRR would go down to 17.8%. And if government subsidy plus income from landfill are eliminated, FIRR would go down to 7.4%.

Posing still greater problems, large cash flow deficits are expected in some years: around $3.9 million in 2003, $3.1 million in 2005, $10.6 million in 2007 and $10.9 million in 2009.

5.3.2 Sensitivity Analysis

Sensitivity analysis was conducted by assuming a 10% reduction in total income, a 10% increase in total cost, and a simultaneous 5% reduction in total income and 5% increase in total cost. Results are summarized in the following table.

Table 5-4: Sensitivity Analysis

Cases	FIRR
Base Case	47.5%
Income reduction: -10%	3.4%
Cost Increase: +10%	5.8%
Income reduction: -5% and Cost Increase: +5%	4.6%

5.4 Economic Evaluation

In this economic evaluation, three cases where the above cost reductions are considered or not considered are analyzed as presented in the following.

Table 5 : Study Case in Economic Evaluation

	Cost	Benefit
Case 1	Existing cost + incremental cost	Willingness to pay (U$ 77.02/ton)
Case 2	(Existing cost + incremental cost) – (saving cost by T/S system)	
Case 3	(Existing cost + incremental cost) – (save cost by T/S system + cost reduction of collection system)	

Table 6 : EIRR and B/C

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	EIRR	B/C
Case 1	-5,052	-683	-9,822	465	-17,234	2,282	-18,235	2,197	2,682	190	2,250	965	1,455	-26.32%	0.919
Case 2	-5,052	-683	-9,637	667	-17,017	2,513	-17,988	2,460	2,962	489	2,568	1,303	1,815	-23.18%	0.925
Case 3	**-2,679**	**1,771**	**-7,097**	**3,309**	**-14,306**	**5,279**	**-15,163**	**5,331**	**5,884**	**3,460**	**5,592**	**4,380**	**4,948**	**0.47%**	**1.002**

As the results show, the benefit-cost rate slightly exceeds 1.0 and EIRR barely becomes positive in the Case 3 where the Transfer and Transport System is introduced and the collection improvement is carried out as proposed in the M/P.

Consequently, it is evaluated that the M/P is economically feasible and upgrades the urban environment as well as improve the efficiency of MSWM carried out by DIMAUD.

6 Feasibility Study and Pre-feasibility Study for Priority Projects

6.1 Target

It is indispensable to secure a final disposal site for a sound Solid Waste Management. There is a plan to expand the existing landfill, or Etapa 2 in the Cerro Patacon Landfill. The part to be expanded is called Phase 4 of Etapa 2 and will have a capacity of 1,800,000 m^3. The Phase 4 will be full by the beginning of 2006. Then, another new landfill will be necessary. Therefore, a feasibility study is conducted under the scheme of the Study for a new landfill, or Cerro Patacon Etapa 3, to be operated between 2006 and 2015.

Waste collection works require a large amount of costs. At present, about 46% of the total SWM costs are spent for the collection works. Therefore, it is expected that improvement of collection efficiency will bring a considerably large cost reduction and will help the SWM stable. The collection works can be divided into two components, i.e., collection that picks up waste from generation sources in an area and transport that carries waste collected to a final disposal site.

In the Study, a pilot project to improve the collection efficiency was carried out. It brought a result of 21% reduction of the direct cost in the pilot project area. Meanwhile, it has also been sought to improve efficiency of transport in the eastern area (Tocumen, Pacora and San Martin) and northern area (Chilibre) where the distances to the Cerro Patacon Landfill exceed 40 km (a round trip). Therefore, aiming at improve the efficiency of the transport, a pre-feasibility study of transfer and transport systems in the areas were carried out.

6.2 Outline of Projects

Table 7 shows the outline of the final disposal project. Table 8 presents the transfer transport project.

Table 7: Outline of the Final Disposal Project (Feasibility Study)

Items	Facilities				
	Overall	Phase 1	Phase 2	Phase 3	Phase 4
Construction site	Cerro Patacon Area				
Construction period	-	2005 to early 2006	2007 to early 2008	2009 to early 2010	2011
Operation period	2006 to 2015	early 2006 to early 2008	early 2008 to early 2010	early 2010 to end of 2011	2012 to 2015
Area	Site area :28 ha Filling area : 20.4 ha	6.9 ha	6.5 ha	6.3 ha	20.4 ha
Landfill waste	Municipal waste				
Landfill capacity	6,400,000 m^3	1,300,000m^3	1,200,000m^3	1,100,000m^3	2,800,000m^3
Access	Existing road and internal road Length of internal road : 2,570 m	Length of internal road : 1,300 m	Length of internal road : 800m	Length of internal road : 470m	-
Waste transport control facilities	Gate : 2 (existing), Weighbridge : 2 (existing), Car washing : 1 (existing), Site office :1, Work shop :1				
Leachate management	**Seepage control works**: installation of 1.5 mm HDPE synthetic liner with 10 mm geotextile (under and upper of synthetic liner), installation of soil layer for protection of synthetic liner				
	Collection and treatment system				
	Collection pipe: 6,690m(dia. 200 to 900mm)	2,070 m	2,020m	1,830m	770m
	Treatment system Regulation pond : 24,000 m^3,Treatment capacity : 800 m^3/day (oxidation ditch with chemical sedimentation, sand filtration and activated carbon absorption) Intake water quality : BOD 10,000 mg/l, COD 18,000 mg/l, Org-N 200 mg/l, NH_3-N 200 mg/l, P 30mg/l Treated water quality ; BOD 35 mg/l, COD 100 mg/l, Org-N 10 mg/l, NH_3-N 3 mg/l, P 5mg/l (comply the ANAM discharge limit)				
Landfill gas management	Gas ventilation pipe (PVC 200 mm) : 92 nos.	23 nos.	22 nos.	21 nos.	26 nos.
Rain water management	Trapezoidal lined ditch (wide 800 to 1,700 mm): 2,300 m and daily cover soil	1,190 m	700 m	410 m	-
Landfill operation	Cell method with compaction, daily soil cover thickness15cm, final soil cover thickness 60cm				
Aesthetic design	Daily soil cover				
Closure and post-closure	Final soil cover 60 cm Greening by seeding the final cover with grass				

Table 8: Outline of the Transfer and Transport Project (Pre-feasibility Study)

Items	Facilities		
	Overall	Phase 1	Phase 2
Construction site	Possibly along the American Highway in Pacora Corregimiento (the site will be looked for later by DIMAUD)		
Construction period	-	2004	2007
Operation period	From 2005 (economic life of the transfer station is assumed as 20 years)	From 2005	From 2008
Site area	5 ha	-	-
Target Waste	Municipal waste generated from Tocumen, Pacora and San Martin corregimientos		
Facilities	Direct dump station		
Platform	2,500 m^2	1,250 m^2	1,250 m^2
Hopper	4 units	2 units	2 units
Weighbridge	2 units	1 unit	1 unit
Others	Office, workshop, fence, gate, car washer, buffer zone		
Transport Equipment	Tractor-trailer (20 ton); 17 units of tractor and 25 units of trailer are to be purchased in total between 2005 and 2015.		
Collection Vehicle	16 yd^3 (12.2m^3) compactor truck; 67 units are to be purchased in total between 2005 and 2015.		

6.3 Cost Estimation

6.3.1 New Landfill

Overall cost for new landfill shows below table.

Table 9 : Overall Cost

unit : U$ 1,000

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Landfill site													
Investment													
Design & supervision	66	66	306	306	341	341	8	8					1,442
Construction		4,400		20,400		22,700		500					48,000
O&M		2,811	2,811	2,811	2,811	2,811	2,811	2,811	3,469	3,469	3,469	3,469	33,553
Total	**66**	**7,277**	**3,117**	**23,517**	**3,152**	**25,852**	**2,819**	**3,319**	**3,469**	**3,469**	**3,469**	**3,469**	**82,995**
Leachate treatment													
Investment													
Design & supervision	75	75											150
Construction		5,000											5,000
O&M		135	135	135	135	135	135	135	135	135	135	135	1,485
Total	**75**	**5,210**	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**135**	**6,635**
Overall cost													
Investment total	141	9,541	306	20,706	341	23,041	8	508	0	0	0	0	54,592
O & M total	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
Total	**141**	**12,487**	**3,252**	**23,652**	**3,287**	**25,987**	**2,954**	**3,454**	**3,604**	**3,604**	**3,604**	**3,604**	**89,630**

6.3.2 Transfer and Transport Project

Table 10 shows overall costs required for the transport ant transport system.

Table 10 : Overall Cost of the Transfer and Transport System in the East

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Transfer station														
Design and supervision	67	67	0	0	55	0	0	0	0	0	0	0	0	189
Capital	0	3,039	0	0	1,821	0	0	0	0	0	0	0	0	4,860
O&M	0	0	211	211	211	270	270	270	270	270	270	270	270	2,793
Total	67	3,106	211	211	2,087	270	270	270	270	270	270	270	270	7,842
Transport														
Capital			682	143	143	252	0	0	143	682	287	143	395	2,870
O&M			129	160	192	225	225	225	257	257	288	288	321	2,567
Total			811	303	335	477	225	225	400	939	575	431	716	5,437
Collection														
Capital			978	623	178	89	89	1,156	800	267	267	178	1,334	5,959
O&M			604	989	1,099	1,153	1,208	1,319	1,428	1,484	1,593	1,648	1,759	14,284
Total			1,582	1,612	1,277	1,242	1,297	2,475	2,228	1,751	1,860	1,826	3,093	20,243
Total Cost	67	3,106	2,604	2,126	3,699	1,989	1,792	2,970	2,898	2,960	2,705	2,527	4,079	33,522

6.4 Financial Evaluation

From a viewpoint of DIMAUD, it was evaluated in the M/P that such concession contract would be financially feasible. The financial analysis conducted in the F/S also concluded that the concession contract would be financially feasible for contractor(s) as shown in Table 11.

Table 11 : Results of Financial Analysis

Case	FIRR (%)
Landfill	5.2
Transfer transport system	3.5
Landfill and Transfer transport system	4.9

The FIRRs in the table do not exceed annual interests set by commercial banks in Panama, that is about 9.5%. However, those FIRRs are over 1.8% of annual interest used in the Study, which takes into consideration risks on interest rates set by international financial institutions, such as LIBOR.

Consequently, it is evaluated that the implementation of the priority projects will be financially feasible under concession contract. International tender should be held, in which private companies that are capable to procure the international fund can participate.

6.5 Economic Evaluation

Willingness to Pay (WTP) of the citizens to MSWM obtained from POS is considered as benefit, as well as for the economic evaluation of the M/P.

6.5.1 Final Disposal Project

Table 12presents 1.215 of Benefit-Cost Ratio (B/C) and 8.9% of Economic Internal Rate of Return (EIRR) resulted from calculation with the benefit and costs required for the project. Consequently, it is evaluated that the project will be economically feasible.

Table 12: Cost and Benefit (Final Disposal Project)

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Cost	Investment (Exc. TAX 5%)	134	9,087	291	19,720	325	21,944	8	484	0	0	0	0	51,993
	O & M	0	2,946	2,946	2,946	2,946	2,946	2,946	2,946	3,604	3,604	3,604	3,604	35,038
	Total	134	12,033	3,237	22,666	3,271	24,890	2,954	3,430	3,604	3,604	3,604	3,604	87,031
Benefit	Disposal amount (ton/year)	0	0	262,276	535,966	551,004	567,393	582,102	597,943	613,930	631,414	649,189	668,096	
	Willingness to pay (U$1,000)	0	0	4,899	10,012	10,293	10,599	10,874	11,170	11,468	11,795	12,127	12,480	105,717
	Balance	-134	-12,033	1,662	-12,654	7,022	-14,291	7,920	7,740	7,864	8,191	8,523	8,876	
													EIRR	**8.9%**
													B/C	**1.215**

6.5.2 Transfer and Transport Project

Table 13presents 1.251 of Benefit-Cost Ratio (B/C) and 17.5% of Economic Internal Rate of Return (EIRR) resulted from calculation with the benefit and costs required for the project. Consequently, it is evaluated that the project will be economically feasible.

Table 13 : Cost and Benefit (Transfer and Transport Project)

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Waste amount (1000ton)			57	78	105	111	117	126	135	144	153	162	171	1,359
Cost (U$1000)														
Invest (ex. 5% tax)	64	2951	1577	728	2087	324	85	1098	896	902	526	305	1643	13,186
O&M	0	0	944	1,360	1,502	1,648	1,703	1,814	1,955	2,011	2,151	2,206	2,350	19,644
Total	64	2,951	2,521	2,088	3,589	1,972	1,788	2,912	2,851	2,913	2,677	2,511	3,993	32,830
Benefit (U$1000)														
WTP			1,723	2,358	3,174	3,356	3,537	3,809	4,081	4,353	4,625	4,897	5,169	41,083
Balance	-64	-2,951	-798	270	-415	1,384	1,749	897	1,230	1,440	1,948	2,386	1,176	8,253
													EIRR	17.5%
													B/C	1.251

6.6 Conclusions and Recommendations

6.6.1 Conclusions

1. Present Situation

Panama District, which has a population of about 744,000 as of 2002, is kept clean. The results of Public Opinion Survey (POS) curried out in the Study clarified that about 70% of the citizens (very satisfied 31%, satisfied 39%) are satisfied with the present Solid Waste Management. This is considered due to efforts of DIMAUD (Municipal Bureau for Urban and Household Cleansing) and organizations/persons concerned, and is highly appreciated.

However, large costs are required for waste collection and street sweeping in order to maintain the city cleanly. It is difficult to say that such works are efficient. If the inefficient works lower collection service quality in the future, the citizens' satisfaction would also lower; the citizens who answered "satisfied," would change "not satisfied."

About 1,200 ton of waste is disposed of at Cerro Patacon Landfill everyday. 80% of it is from Panama District. Medical and industrial wastes are included in the waste brought in. The waste is compacted by heavy equipment, but daily cover soil is not practiced strictly. Furthermore, there are many waste-pickers working inside the landfill, then, it reduces the landfill operation efficiency.

Meanwhile, large quantity of waste from business establishments is assumed as household waste and applied the tariff for household, i.e., waste collection fee per unit of those wastes are same or lower than of household. This is against the Polluter-Pay-Principle (PPP), as well as it reduces DIMAUD's revenue and makes its management unstable.

2. Master Plan

The principal goal of the Master Plan is to establish a sound Solid Waste Management System by the target year 2015 in Panama District, which practically aims to promote the citizens' well-being, to implement sustainable SWM and to contribute to environmental conservation.

Maintenance and improvement of the city's cleanliness and establishment of cost-effective SWM will lead to promotion of the citizens' well-being. Sustainable SWM will be established through Institutional Capacity Building (ICB). And, encouragement of waste reduction, reuse and recycling with environmental education will contribute to environmental conservation.

These issues are not achieved by only DIMAUD's effots. Those can be realized under where the citizens and the SWM executing bodies cooperate each other. The Municipal Ordinance proposed in the Study defines responsibilities and roles of actors, such as dischargers, DIMAUD and the private sector. It is expected that the actors will cooperate each other under the legal framework set by the Municipal Ordinance in order to realize the Sound SWM. For encouraging cooperation from the citizens, it is crucial to carry out educational campaign such as environmental education. Educational methods/skills and materials transferred to the Panamanian side through implementation of the Environmental Education Pilot Project will secure expansion of environmental education and its effectiveness after the Study.

As for the waste collection work, it is important to improve its efficiency without reduction of the service quality. The Collection Improvement Pilot Project transferred skills and knowledge how to do so. It is expected that DIAMUD will expand the pilot project to other areas based on the experience.

As for the final disposal, DIMAUD can improve the landfill operation by adapting cell methods transferred to them through the Landfill Operation Improvement Pilot Project.

At present, hazardous waste is mixed with non-hazardous municipal waste. Facilities to deal with hazardous waste are required to dispose of such mixed waste properly. In this case, costs per ton of waste for construction and O&M of such facilities will surely be much higher than facilities for non-hazardous waste. Then, such costly facilities are not recommendable. In principle, generators should appropriately dispose of their hazardous waste by themselves. However, taking into account the present situation, it is recommendable to properly separate the hazardous waste and to set up a facility for only hazardous waste in the Cerro Patacon Final Disposal Site apart from the proposed landfill for non-hazardous waste.

The issue of waste-pickers is typical in developing and intermediately developed countries. This is usually solved by economic growth that creates job opportunities and by efforts of organizations and persons concerned, but it takes for a long period. Measures that should be taken against this issue in Panama are to control waste-pickers activities hampering the landfill operation and to establish rules of waste picking with taking into account their safety.

As for leachate from the landfill, the existing treatment system cannot meet with the standard set by ANAM, then, the M/P recommends a methods that suites to it.

In views of PPP and DIMAUD's management state, origins and amounts of wastes from business establishments should be clarified and appropriate tariff should be applied for the wastes. In this case, the business establishments need to pay more than before. In order to

induce them to do so, a special collection service that meets with their needs shall be provided.

3. Feasibility Study

Out of the projects and improvement measures proposed in the M/P, the Final Disposal Project and the Transfer and Transport Project are selected as the priority projects for the Feasibility Study and the Pre-feasibility Study from viewpoints of importance and urgency.

It was evaluated that those priority projects would not cause serious technical and social problems. However, it was found that large deficits would happen in the DIMAUD's cash flow, if the priority projects are implemented directly by DIMAUD. Then, the Study recommends to make good use of the private sector in a scheme of concession contract. Open market rates in Panama are considerably high, about 9.5% annually. However, some international banking institutions provide lower interest rates. For example, JBIC, or Japan Bank for International Cooperation, has a financing scheme named as Overseas Investment Loans, which lends money at lower interest rates, e.g., LIBOR plus 0.4 to 0.5%, to Japanese companies or joint ventures of Japanese and local companies. Consequently, it is recommendable to hold an international tender, in which foreign and/or joint companies including from Japan can participate, in order to make DIAMUD's cash flow stable for provision of sound SWM.

4. Cost-Benefit Ratio

1.002 of Cost-Benefit Ratio was obtained by dividing WTP of the citizens for SWM by the total costs for implementation of the all project proposed in the M/P (inc. cost reduction), as shown in the table below.

Total Cost (Cost, U$1,000)	Willingness to Pay (Benefit, U$1,000)	Benefit / Cost
438,206	438,905	1.002

Consequently, it can be said that the society of Panama will be able to bear the costs incurred by implementation of the M/P during 2003 and 2015 as well as achievement of the M/Ps goal.

6.6.2 Recommendations

1. DIMAUD´s Vision and Mission

The population of the District deserves a Great City; that is the vision of the Mayor´s office and the Municipality. DIMAUD´s vision forms part of standards of life that is being pursued and has the purpose to recover the nickname of "golden cup" for Panama City which used to distinguish this city due to the ornate and cleansing of its roads and public areas.

Within this vision, DIMAUD has a mission that is to implement a sustainable solid waste management to promote the well-being of citizens through the protection of their health and the preservation of the environment.

The Master Plan submitted to the authorities proposes various improvement measures. Of course, DIMAUD will be able to fulfill its mission through implementation of the M/P.

The execution and successful finalization of the M/P depends on the degree of willingness of the Panamanian side, especially DIMAUD.

2. SWM: a public service

A public service should be effective and also efficient. Effectiveness is linked to the attainment of objectives and efficiency is linked to the results.

The main objectives of DIMAUD are linked to two factors, i.e., health and the environment. Both of them are social goods which can be immediately deteriorated if SWM is ineffective. The costs of health service is extremely high for the society; and environmental deterioration is, in cases, irreversible. DIMAUD and competent institutions should join efforts under the principle that it is preferable to invest in public services than to pay the costs for negative externalities derived from deficient SWM.

Effectiveness of the service should be measured based on how diseases linked to deficient solid waste management are being controlled, the preservation of the environment, and better use of the natural resources.

A healthy city has a clean city image. We are going on the right path.

3. Service sustainability: a need

If we are already effective; now, we should be efficient. The M/P could be a guide if the proposed decisions are taken. As a public service which should be provided along the time with quality and efficient costs, it is necessary to structure SWM service with a long term vision. The M/P has a target year set as 2015.

4. Institution

The city is a kind of organizations in which the citizens conduct their activities. Every organization needs “rules of game”, i.e., institutions.

The current legislative period of the Honorable Municipal Council is considering a project of legislation which has, as main purpose, the regulation of the relations between the Municipality, its clients and the private sector. It is necessary that the service has a normative which regulates its operation. It will be the first step to establish responsibilities, duties, and rights of the main actors. Subsequently, the normative could be perfected through the experience attained.

If all actors fulfill their responsibilities, the health and the environment will be protected. At this point, the effective coordination among the competent authorities is of vital importance.

5. Organization

The M/P incorporates a proposal to adjust the organizational structure of DIMAUD. The adjustments are directed to obtain as much synergy as possible among the different administrative units. If we keep in mind that DIMAUD has a social mission to satisfy and objectives to attain, it is necessary that all activities are directed to satisfy that mission and to attain those objectives. As a result, teamwork will be strengthened a matter of course.

The top management has decided to initiate these adjustments which should be permanently evaluated in the face of the operational changes that are also being proposed. Readjustments should be implemented as they are needed.

The experience obtained through the adjustment of the organizational structure will be highly valuable to evaluate the possibility to create a new municipal enterprise for Solid Waste Management for the District. The proposed structure in the M/P corresponds to a kind of enterprise structures. An organization of this type would strengthen the sustainability of the service because it would incorporate long-term planning. Additionally, technical, organizational, and financial capacities can be integrated. A successful example which can be analyzed is the case of the Urban Planning and Research Institute of Curitiba Municipality. This is a municipal enterprise which is world-famous. This way, independence from politics can be attained.

6. Planning

The M/P incorporates planning as a routine task during the development of DIMAUD´s activities. It is necessary to know the direction, the means, and the cost.

Establishment of the Executive Unit would be highly beneficial to plan the attainment of the objectives defined for the entity and the strategies of the top management. The M/P provides a detailed listing of activities to be undertaken by the Executive Unit.

It should be emphasized the need to assign a personnel having enough knowledge and experiences in the SWM sector on a full time basis to integrate various activities assigned to the Executive Unit. The results of the service provision will be linked to the performance of this team.

DIMAUD´s Executive Unit will only be the second unit formed under JICA´s SWM Studies. It is highly recommendable to create a network of executive units on solid waste management which would interact between them. The first unit successfully working is the Planning Office for the Metropolitan Area of San Salvador (OPAMSS).

Monitoring and control of management is a tool for the sustainability of the service. The top management has decided to organize an administrative unit for the control of management as proposed in the M/P. The JICA Study has equipped this unit and the personnel have received training material. The following step would be establish an accounting system which is able to clarify costs of respective activities. With the previous activity, management indicators such as collection cost per ton of waste will be prepared which would be sent to the appointed officers.

Every customer service activity should be personalized. The characteristic of the SWM service requires an active participation of the client in particular and of the public in general. Success in providing the service largely depends on an effective coordination and support between the different actors: DIMAUD and its clients. The M/P introduces a policy of customer service which should be implemented and intensified.

Consequently, the top management has decided to organize an administrative unit for Customer Attention which is formed by S.O.C.I.O., Public Relations and Quality Control sections. The activities to be developed are diverse, but complementary. Teamwork is fundamental i.e., an effective coordination will be of vital importance.

On DIMAUD´s part, the communication system in solid waste management has been organized by creating an administrative unit for customer service. Additionally, the 800ASEO service has been expanded and improved. Now, S.O.C.I.O should be strengthened to complement the communication system.

S.O.C.I.O should promote the constitution of the Committees for Cleansing and Ornate. The Honorable Representatives of the Corregimiento in the District should be informed about the

results which are being obtained in Juan Diaz and Rio Abajo corregimientos in order to include these experiences in their respective corregimientos.

7. Minimization

The Panama District should conduct every effort to encourage waste minimization which is one of the main policies of the M/P.

In this effort, all actors should participate: the customer, the commerce, the industries, the NGO´s, the public entities. All of them should receive DIMAUD´s message: to minimize waste generation.

In order to attain this objective of the policy, DIMAUD should continue the education campaign that initiated in some schools in the Environmental Education Pilot Project. Excellent educational materials are available which should be used rationally and should be reproduced whenever it is necessary. The materials should be delivered to all schools in the District. The goal is to promote public participation in waste minimization activities.

Several schools have joined the recycling program "Cumple tu papel". The program should reinitiate at the beginning of the next school year (2003). DIMAUD should support, strengthen, and expand this program as a manner to promote minimization and education to preserve the environment and conservation of the natural resources.

The private sector should assume its responsibility on generating large amount of waste. This practice is transforming a private cost into a social cost. "Polluters Pay Principle are not well practiced in the Panamanian environmental arrangement. The participation of the private sector is of vital importance to stop the continuous waste generation increment.

The multi-national companies which operate in Panama could transfer their experience, procedures, and practices to minimize solid wastes which are implemented in their respective countries and can become true allies in this crusade. It is necessary to convoke them and motivate their interest.

8. Operations

The operation of the services is the most important activity conducted by DIMAUD. The effectiveness in their performance is a parameter which serves to qualify DIMAUD. However, it is necessary to attain efficiency in the service in order to make SWM sustainable.

The M/P proposes to adjust the organizational structure of DIMAUD in order to improve the efficiency through the integration of all the operations into a single administrative unit: the Operations Department. DIMAUD´s top management has considered convenient this proposal and it has been approved.

It is expected for the Operations Department to achieve a better quality in service and a significant reduction in costs, i.e., to do more with less costs.

9. Collection and Maintenance

During the year 2001, the collection service represented 53% of total expenditures. The Collection Improvement Pilot Project showed that efficiency levels, which are competitive in the Latin-American market, can be attained. The direct costs of labor and associated to vehicle were reduced in about 21% which represents approximately 10% of total collection costs.

Currently, the improvement of two routes has initiated by making use of the Manual of Procedures to Optimize the Routes in the pilot project. If this improvement practice is expanded to the other routes, around of U$.1.4 millions/year could be saved.

Now, DIMAUD has a digitalized map which could be used for planning and optimization of collection routes.

The top management of DIMAUD has decided to organize a Collection Special Service for ICI's (for institutional, commercial, and industrial clients). The wastes collected by DIMAUD from ICI's clients represent about 50% of the total amount of solid wastes.

The participation of ICI's clients in the total income of DIMAUD could increase if the service meets with needs of ICI's.

The M/P includes a strategic procedure to implement this special collection service and DIMAUD could and should initiate procedures to organize it and provide it.

The maintenance activities are linked to the collection activities. The procedures that are used for maintenance should follow necessarily the instructions provided by the manufacturer. The formalities for the procurement of spare parts should be simplified to a minimum.

10. Street Sweeping

With taking into account the present situation, mechanical street sweeping should be incorporated in the roads in the future.

The deployment of waste bins for pedestrians along the roads is part of a program to provide the city with urban furniture which should contribute to keep clean the roads and public areas. This deployment should be continued with taking into consideration DIMAUD's technical input to improve the street sweeping performance.

11. Transfer

DIMAUD should implement the Transfer and Transport Project. The pre-feasibility study should be taken as a base for this purpose. As a priority and due to the urbanization process, the Municipality should consider the acquisition of land which will be necessary for a transfer station.

12. Final Disposal

The M/P has given a significant importance to the final disposal.

The plan to give in concession to the private sector the sanitary landfill operation should be proceeded by taking as a base the M/P feasibility study.

However, some limitations have been detected during the concession process. Among these limitations, there are land ownership issues, San Miguelito Municipality solid waste discharge, and extraction of materials in the operation areas. In order to have a high participation of bidders, it is convenient that those limitations have been overcome at the beginning of the bidding process.

13. Commercialization

The clients database should be completed and updated with the tools provided by General Controller Office (the District database and digitalized map).

The identification of ICI´s clients should be prioritized in order to initiate the Special Collection Service for ICI´s.

The 800ASEO system should be expanded and strengthened. This system will be of great value to support a telephone marketing program which is directed to the new service for ICI´s clients. In the M/P, a scheme is presented which will serve to develop this telephone marketing program to support the activities by the Commercialization Department.

14. Finances

A cash flow projected until 2015 is presented in the M/P. DIMAUD should continue working with these figures and should adjust them to the variations which might occur in the financial sector. Fund requirements should be foreseen well in advance.

The new Management Unit should provide information about the performance of the entity. Management indicators should be used to monitor the performance levels. The efficiency levels projected can be attained if any deviation from them is corrected on time as they occur.

15. Human Resources

The adjustment of the administrative structure which was approved requires an extensive training program. The need to provide training has been detailed in the description of every administrative unit. A continuous training program is essential to achieve an improvement in the performance of the human resources in the whole entity.

The worker should be protected from labor accidents and professional diseases. Coordination with Caja del Seguro Social (Social Security Institution) is essential in occupational health, and medical and emotional attention.

The self-esteem of workers should be developed through a well structured program. A day dedicated to the cleansing workers should be established as an important sign of appreciation from the city to the workers.

16. Organizational Environment

The approval of the Cleansing Regulation (Municipal Ordinance), the definition of objectives for the entity, the adjustment of the organizational structure, and the implementation of the Master Plan requires an extensive and detailed explanation to all members of the working community in DIMAUD.

It is necessary to generate a team work spirit in order to increment the synergy and improve the performance. Similarly, a policy to recognize the work done and to provide incentives and rewards for the workers should improve the organizational environment.

Last Words

We thank the municipality and DIMAUD authorities, as well as the technical and operative personnel who work in those entities because they have helped us to conduct and finalize successfully, in a joint effort, this Study.

We acknowledge the Panamanian C/P for their permanent support and interest in this endeavor.

The learning experiences acquired in this new way to conduct and develop the technical assistance will be of great value for us in future undertakings.

The Study on Solid Waste Management Plan for Municipality of Panama in the Republic of Panama

List of Volumes

Volume I	Summary
Volume I (S)	Summary (Spanish Version)
Volume II	Main Report
Volume II (S)	Main Report (Spanish Version)
Volume III	Annex
Volume III (S)	Annex (Spanish Version)
Volume IV	Data Book
Volume IV (S)	Data Book (Spanish Version)

This is the Summary.

In this report, the project cost is estimated by using the May 2002 price and an exchange rate of U$1.00=B/1.00(Balboa)=JP¥125.00.

Location Map of the Study Area

（Source: Microsoft Encarta Interactive World Atlas）