

## 7 The Master Plan

### 7.1 Outline of the Master Plan

The M/P aims to establish plans for sustainable municipal SWM with primary target of 100% service coverage, and attempting to solve present problems of cleansing services that are observed through this Study.

Merits of regional management of municipal SW consist of the following:

- Large SWM facilities (e.g., a landfill) that one municipality can hardly have or manage due to problems of such as large financial burden, difficulty in recruiting technical human resources, administration complexity, can be controllable under a regional management scheme. Because, a burden on each member municipality is proportionally small in respective aspects.
- As for regional use facilities, economy of scale will be attained in facilities' size and such productivity will be in an optimum range compared with the individual municipal facilities. Consequently, its cost shared by member municipalities would be cheaper than the costs that an individual project requires.

On the other hand, it is sometimes very difficult for several municipalities that are politically financially autonomous to share the same scheme and to collaborate for an unanimous benefit.

Under the status quo, 10 municipalities out of 14 municipalities use MIDES Nejapa sanitary landfill (S/L), 2 municipalities use ESPIGA controlled dumping (C/D) site, and 2 municipalities dispose their waste at an open dumping (O/D) site that is within the respective jurisdiction (see Figure 7-1).

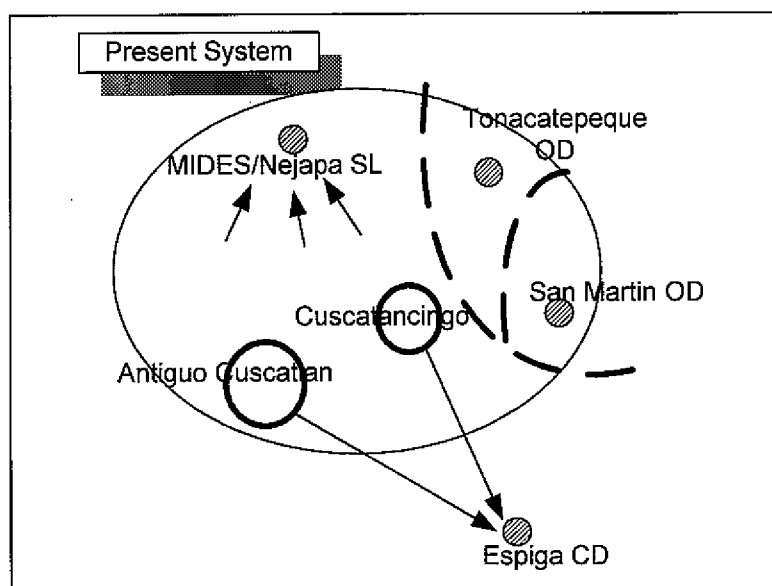


Figure 7-1: Present Municipal SWM System

Viewing the present municipal SWM system in AMSS, the M/P proposes plans that merits of regional SWM can as much as possible be enjoyed by 14 respective municipalities of AMSS. The proposed municipal SWM system is presented in Figure 7-2 below.

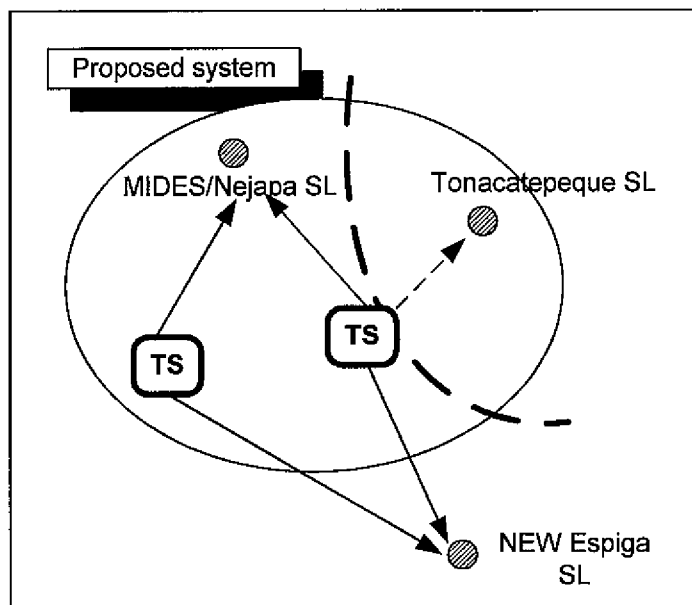


Figure 7-2: Proposed MSWM System

On the other hand, the M/P will also formulate individual municipal SWM plans that are correlated with the regional SWM system.

### 7.1.1 Regional Management System

The regional management system in this M/P comprises:

- systems that respective municipalities co-use such as transfer stations, intermediate processing facilities and final disposal sites; and
- system of medical waste intermediate treatment facilities.

The table below summarizes the outline of the regional management system.

Table 7-1: Regional Management System

		Phase I			Phase II			Phase III			
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Transfer system	TS 1 (350 t/d)	FS, EIA	B/D, D/D	Con.	OP	OP	OP	OP	OP	OP	OP
	TS 2 (900 t/d)	FS	EIA, B/D	D/D, Con.	Con.	OP	OP	OP	OP	OP	OP
Intermediate treatment	MRF					FS, EIA	B/D, D/D	Con.	OP	OP	OP
	Incineration									Begin examine	
Landfill	MIDES Nejapa	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP
	Tonacatepeque	FS, EIA	B/D, D/D	Con.	Con.	OP	OP	OP	OP	OP	OP
	New Espiga	Con.	Con.	OP	OP	OP	OP	OP	OP	OP	OP
Medical waste treatment	MIDES/Nejapa	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP
	New facility	FS, EIA	B/D, D/D	Con.	OP	OP	OP	OP	OP	OP	OP

Notes: FS: feasibility study      B/D: basic design      EIA : environmental impact assessment  
D/D : detailed design,      Con.: construction, OP: operation

### 7.1.2 Individual Management System

Program of actions plan for respective municipalities should be carefully considered reminding the intrinsic situation of each municipality. Therefore, when steps summarized in Table 7-2 should take place might be different municipality by municipality. Table 7-3 to Table 7-6 describe a timetable of actions plan proposed by the Team for further reviews by each municipality.

Table 7-2: Action plans of Technical Aspects

	Step I	Step II	Step III
Discharge/Storage	Improvement of hygienic condition of discharge areas	Implementation of pilot project for separate collection	Implementation of separate collection
Collection	Improvement of service coverage	Improvement of service coverage Renewal of collection vehicle	Improvement of service coverage after renewal of collection vehicle
Haulage	Direct transport		Transfer transport
Final disposal	Dispose to open dumping	Dispose to controlled dumping	Dispose to sanitary landfill

Table 7-3: Action Plan for Respective Municipalities (1)

			Phase I			Phase II			Phase III			
		Step	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SS	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
MJ	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										

Table 7-4: Action Plan for Respective Municipalities (2)

		Step	Phase I			Phase II			Phase III				
			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
CD	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
CT	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
AY	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											
SM	Discharge/ Storage	III											
		II											
		I											
	Collection	III											
		II											
		I											
	Haulage	III											
		II											
		I											
	Final disposal	III											
		II											
		I											

Table 7-5: Action Plan for Respective Municipalities (3)

		Step	Phase I			Phase II			Phase III			
			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ST	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
AC	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
SY	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										
IL	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
	Final disposal	III										
		II										
		I										

Table 7-6: Action Plan for Respective Municipalities (4)

		Step	Phase I			Phase II			Phase III			
			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SMT	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
Final disposal	III											
	II											
	I											
AP	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
Final disposal	III											
	II											
	I											
NJ	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
Final disposal	III											
	II											
	I											
TN	Discharge/ Storage	III										
		II										
		I										
	Collection	III										
		II										
		I										
	Haulage	III										
		II										
		I										
Final disposal	III											
	II											
	I											

## 7.2 Institutional and Organizational System

Table 7-7 shows the organization proposed for the municipal SWM institutional system in AMSS, and the implementation by phases during the M/P period (2001 to 2010) of its main three components:

- OPAMSS Solid Wastes Unit.
- San Salvador Municipal Public Company of Urban Cleansing (EMAUSS).
- Cleansing services of the remaining 13 municipalities of AMSS.

Organization of each one of them is detailed later.

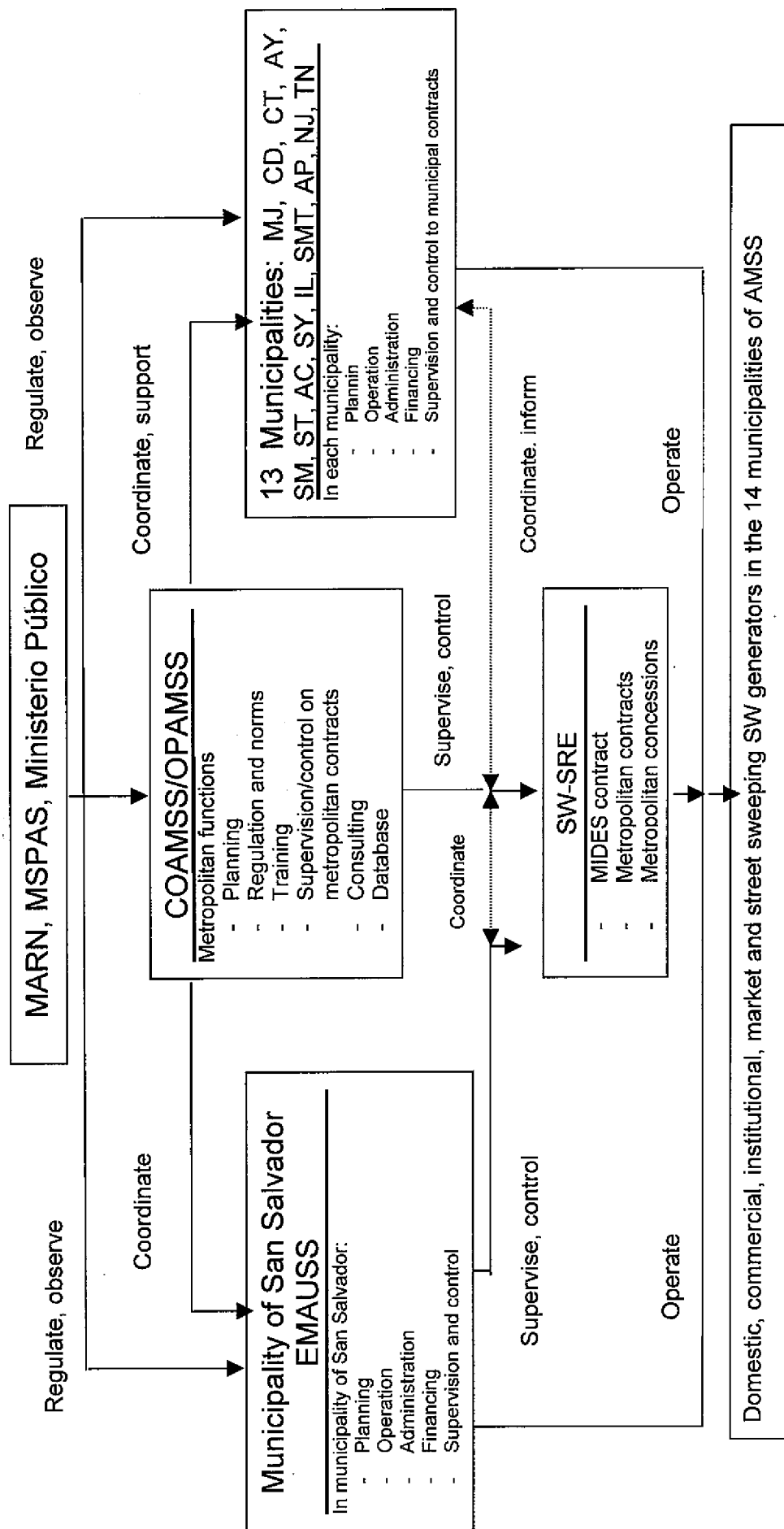
The institutional system for the hazardous medical SWM, which is shown in Figure 7-4 completes the institutional system of the M/P for SWM in AMSS, which is the subject of the current study.

Table 7-7: Institutionalization of the M/P for SWM in AMSS

Component	Phase I	Phase II	Phase III
	2001 – 2003	2004 – 2006	2007 – 2010
SW Unit of OPAMSS*	<ul style="list-style-type: none"> <li>• Approval for the establishment of the SW unit in OPAMSS.</li> <li>• Commissioning of the unit</li> </ul>	<ul style="list-style-type: none"> <li>• Supervision and control of metropolitan projects.</li> <li>• Consulting and training to 13 municipalities.</li> <li>• Monitoring of database.</li> <li>• Technical consulting to COAMSS in SWM.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue with the process</li> <li>• Technical consulting to COAMSS in SWM.</li> </ul>
Municipality of San Salvador (EMAUSS)	<ul style="list-style-type: none"> <li>• Approval for the establishment of EMAUSS.</li> <li>• Commissioning of EMAUSS</li> </ul>	<ul style="list-style-type: none"> <li>• Planning, operation, administration, commercialization and financing of SWM in the municipality of San Salvador.</li> <li>• Supervision and control.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue with the process</li> </ul>
Public cleansing sections of the 13 municipalities of AMSS: MJ, CD, CT, AY, SM, ST, AC, SY, IL, SMT, AP, NJ, TN	<ul style="list-style-type: none"> <li>• Improvement of operative, commercial, administrative and financial systems of the cleansing services in the 13 municipalities.</li> <li>• Implement supervision and control of SWM within each municipality.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue the improvement of organizational systems of supervision and control.</li> <li>• Study the possibility of providing autonomy for collection service in the municipalities of SY, ST and AC.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue with the process of organizational systems of supervision and control.</li> <li>• Administrative and operative autonomy in the cleansing services of SY, ST and AC.</li> </ul>

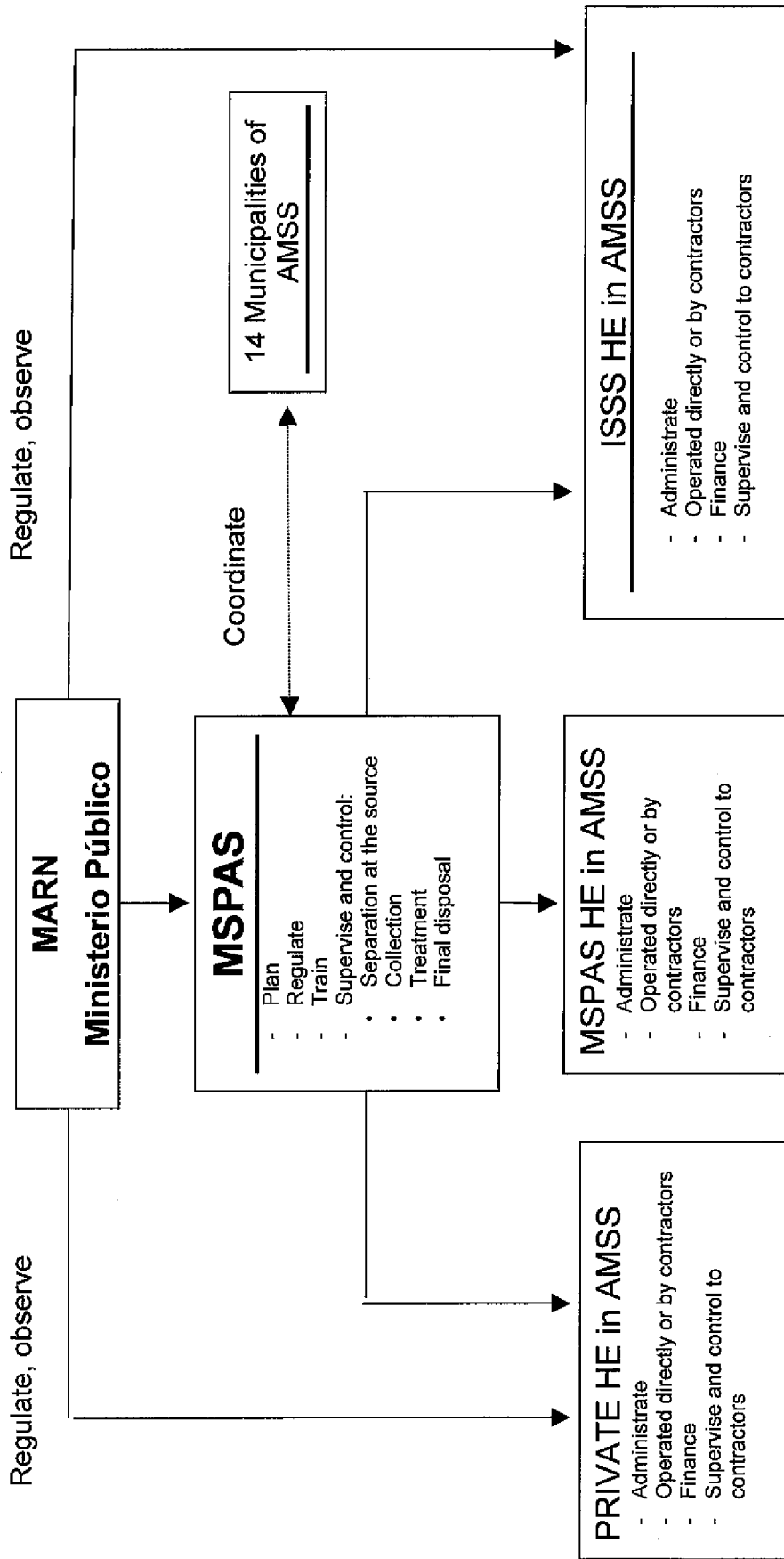
\* The Unit is not to deprive the municipalities of their works regarding SWM, but to support and help them.





EMAUSS: Municipal urban cleansing enterprise of San Salvador  
 SW-SRE: Solid waste service-rendering enterprises  
 Municipal wastes: Domestic, commercial, institutional, market and street sweeping SW

Figure 7-3: Regional Municipal Solid Waste Management in AMSS



HE: Health establishments

Figure 7-4: Metropolitan Hazardous Medical SWM System in AMSS

### 7.3 Financial System

In order to establish the financial system that enables sustainable municipal SWM with the target year of 2010, present tariff structure and fee collection system should be reviewed and improved to assure the stable income for the SWM services. Furthermore, the efficiency of this service should be raised by technical, administrative and institutional improvement. Practical measures to reduce the present costs should take place.

The M/P proposes projects that schematize the measures to improve the service efficiency. The table below summarizes financial scenarios of the 14 municipalities as a whole, for the cases of without M/P and with M/P (for the period of 2001 to 2010).

Table 7-8: Total Expenditure Comparison of With/Without M/P

	With M/P	Without M/P	Difference
Investment cost (million colon)	195.2	197.7	- 2.5
Operation and maintenance cost (million colon)	1,862.0	1,955.1	- 93.1
Total expenditure (million colon)	2,057.2	2,152.8	- 95.6

If the M/P is implemented, about 96million colon expenses will be curtailed for the period of 2001 to 2010.

#### 7.3.1 Basic Principles of Metropolitan Approach

In order to implement the proposed projects in the M/P that have metropolitan approaches, total investment costs of about 16 million US\$ and annual O&M costs of about 1 million US\$ will be required during the 2001 to 2010.

Table 7-9: Summary of Expenditure of Regional Management System

Unit : US\$ 1,000

		Phase I	Phase II	Phase III	Total
Investment	T/S #1 & Transport	2,845	0	1,096	3,941
	T/S #2 & Transport	1,217	3,867	314	5,398
	Tonacatepeque S/L	814	1,635	0	2,449
	S/P	0	123	1,199	1,322
	MWI	2,795	0	84	2,879
Investment total		7,671	5,625	2,693	15,989
O&M	T/S #1 & Transport	0	951	1,356	2,307
	T/S #2 & Transport	0	1,411	3,013	4,424
	Tonacatepeque S/L	0	112	224	336
	S/P	0	0	465	465
	MWI	0	606	808	1,414
	Exec. Unit in OPAMSS*	240	240	320	800
O&M total		240	3,320	6,186	9,746
Total		7,911	8,945	8,879	25,735

Note: \* Total amount of US\$ 80,000/year are assumed.

The above costs other than what required for medical waste incineration (MWT), should be incurred by municipalities that utilize these facilities in proportion to the waste amount handled by respective projects.

However, all municipalities are not in such financial conditions that can afford investment costs of in the order of million US\$. Therefore, it will be necessary to have a system that the projects be operated by private initiatives or regional entity or others, and the user municipalities pay the fees (in proportion to the amount handled).

Merits of having the private initiative system for municipalities are that they can avoid peak expenditure in municipal finance, etc., however, in exchanging contract between the user municipalities and private operator, it is important to reach fee rates paying attentions for the following:

- If the fee rate is set at lower than the appropriate range of fee rate (i.e., discounted non-lucrative rate), it means the appropriate works can not be done, or the private sector will not show interests in participating such activities.
- On the contrary, if the rate is set higher than the appropriate rate (i.e., very lucrative rate), private sector will have a strong incentive for the participation, however, cost burden by users (i.e., citizens) will be crucially heavy.

This fee rate should be determined through a public open bid. If the project is to be operated by private initiatives, the prerequisite for that will be that it should have more merits than the case that the project is operated by other means (e.g., the initiative of regional entity, public company, etc.).

Therefore, in order to show guidelines for reaching the appropriate fee rates, three (3) cases of project operation modalities are assumed and fee rates for respective project modalities are calculated with certain conditions.

#### **Case 1: Authority's Direct Operation**

OPAMSS/COAMSS becomes the project executor<sup>11</sup>, obtaining financing with conditions of 8.1% interest rate (i.e., London market rate 7.1% at June 2000 plus 1.0% is assumed as available).

#### **Case 2: Public Company**

It is assumed that OPAMSS/COAMSS establishes a public company<sup>12</sup> that will prepare the capital and obtain the financing of low interest rate (e.g., Japan Bank for International Cooperation loan for environmental improvement projects).

#### **Case 3: Private Initiative**

It is assumed that a private company execute the project with certain financing conditions estimated as shown in the table below.

<sup>11</sup> As for the medical waste incineration project, MSPAS is assumed as the project executor.

<sup>12</sup> As for the medical waste incineration project, MSPAS is assumed to establish a public company.

Table 7-10: Condition for Projects' Cost Estimation

	Case 1	Case 2	Case 3
Debt security	0 %	15.5%	15.5%
Interest rate	8.1 %	1.7 %*	10.75 %
Corporation tax	0%	25%	25%
Capital	0%	20% of capital investment	
Required achievement	FIRR>8.1%	Profit rate (profit after tax/revenue)>5%	Return on own capital>13.5%

Note: \* Loan rate for environmental improvement projects by Japan Bank for International Cooperation, 25 year repayment and 7 years deferment.

Based on the financing conditions assumed above, fee rate for respective cases are calculated (see the table below).

Table 7-11: Results of Projects' Cost Estimation

		Case 1	Case 2	Case 3
<b>Transfer station #1 &amp; Trailer Transport</b>				
Input waste amount		input amount of year 2004 to 2010		
Project period		20 years (trailer and heavy equipment 7 years)		
Evaluation period		year 2004 to 2010		
Base unit cost (US\$/ton)		5.43		
Required unit cost (US\$/ton)	inc. VAT (13%)	-	7.3	9.6
	exc. VAT(13%)	7.0	6.5	8.5
<b>Transfer station #2 &amp; Trailer Transport</b>				
Input waste amount		input amount of year 2005 to 2010		
Project period		20 years (trailer and heavy equipment 7 years)		
Evaluation period		year 2005 to 2010		
Base unit cost (US\$/ton)		4.70		
Required unit cost (US\$/ton)	inc. VAT (13%)	-	6.2	7.8
	exc. VAT(13%)	5.8	5.5	6.9
<b>Landfill (Tonacatepeque landfill)</b>				
Input waste amount		landfill amount of SMT & TN (2005 to 2022)		
Project period		18 years (heavy equipment 7 years)		
Evaluation period		year 2005 to 2022		
Base unit cost (US\$/ton)		13.6		
Required unit cost (US\$/ton)	inc. VAT (13%)	-	18.8	31.0
	exc. VAT(13%)	20.2	16.6	27.4
<b>Selection Plant</b>				
Input waste amount		recyclable waste from 14 cities (2008 to 2010)		
Project period		15 years (heavy equipment 7 years)		
Evaluation period		year 2005 to 2022		
Base unit cost (US\$/ton)		15.3		
Required unit cost (US\$/ton)	inc. VAT (13%)	-	28.9	41.0
	exc. VAT(13%)	27.2	25.6	36.3
<b>Medical Waste Incineration</b>				
Input waste amount		medical waste from 14 cities (2004 to 2010)		
Project period		15 years (heavy equipment 7 years)		
Evaluation period		year 2001 to 2018		
Base unit cost (US\$/ton)		234		
Required unit cost (US\$/ton)	inc. VAT (13%)	-	371.0	530.0
	exc. VAT(13%)	390.0	328.3	469.0

The above table clearly shows that project fees (US\$---/ton) of Case-3 (private initiative cases) turn out the most expensive, although it exempts authorities from troubles of finance recruitment, etc. Unit costs of Case-2 (public company cases) are almost always the cheapest if the VAT is exempted and the low interest international financing is gained. As the Case-1 (authority's direct operation) does not need to pay the VAT, project fees (US\$---/ton) of the case stand at very competitive places among the set of alternatives listed above.

Meanwhile, in order for a public company to receive an international finance, there are some prerequisites such as that a proper capital equal to 20% of the initial investment should be available for the authority (public company), etc.

### **7.3.2 Key Issues to Improve**

With an aim to consolidate financial sustainability of municipal SWM services, the following are listed as key issues for the improvement:

- Introduction and execution of independent accounting of SWM;
- Revision and improvement of tariff structure and fee collection system;
- Consolidation and utilization of SWM database;
- Expenditure monitoring and its feedback for cost reduction improvement;
- Human resource development and computer use for accounting; and
- Use of private sector.

## **7.4 Cost Estimation**

### **7.4.1 Regional Management System**

Overall cost required for the regional management between 2001 and 2010 is shown below. It should be noted that the overall cost does not include disposal fee for Nejapa SL, MIDES and New Espiga SL.

Table 7-12: Overall Cost

Unit: US\$ 1,000

		Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	
<b>Transfer station</b>														
TS 1	Investment													
	Land acquisition	0	183	0	0	0	0	0	0	0	0	0	183	
	Design & supervision	71	44	42	0	0	0	0	0	0	0	0	157	
	Construction	0	0	1,310	0	0	0	0	0	0	0	0	1,310	
	Equipment	0	0	255	0	0	0	0	0	0	0	0	255	
	total	71	227	1,607	0	0	0	0	0	0	0	0	1,905	
	O&M	0	0	0	94	94	94	94	94	94	94	94	94	658
Total	71	227	1,607	94	94	94	94	94	94	94	94	94	2,563	
TS 2	Investment													
	Land acquisition	0	286	0	0	0	0	0	0	0	0	0	286	
	Design & supervision	33	89	40	61	0	0	0	0	0	0	0	223	
	Construction	0	0	769	1,154	0	0	0	0	0	0	0	1,923	
	Equipment	0	0	0	303	0	0	0	0	0	0	0	303	
	total	33	375	809	1,518	0	0	0	0	0	0	0	2,735	
	O&M	0	0	0	0	139	139	139	139	139	139	139	139	834
Total	33	375	809	1,518	139	139	139	139	139	139	139	139	3,569	
Total	Investment													
	Land acquisition	0	469	0	0	0	0	0	0	0	0	0	469	
	Design & supervision	104	133	82	61	0	0	0	0	0	0	0	380	
	Construction	0	0	2,079	1,154	0	0	0	0	0	0	0	3,233	
	Equipment	0	0	255	303	0	0	0	0	0	0	0	558	
	total	104	602	2,416	1,518	0	0	0	0	0	0	0	4,640	
	O&M	0	0	0	94	233	233	233	233	233	233	233	233	1,492
Total	104	602	2,416	1,612	233	233	233	233	233	233	233	233	6,132	
<b>Transfer transport</b>														
TS 1	Investment													
	Design & supervision	0	0	45	0	0	0	0	0	0	0	0	52	97
	Equipment	0	0	895	0	0	0	0	0	0	0	1,044	1,939	
	total	0	0	940	0	0	0	0	0	0	0	1,096	2,036	
	O&M	0	0	0	218	222	229	237	241	249	253	253	253	1,649
Total	0	0	940	218	222	229	237	241	249	253	253	253	3,685	
TS 2	Investment													
	Design & supervision	0	0	0	112	0	0	0	8	0	0	8	128	
	Equipment	0	0	0	2,237	0	0	0	149	0	149	0	2,535	
	total	0	0	0	2,349	0	0	0	157	0	157	0	2,663	
	O&M	0	0	0	0	557	576	591	607	622	637	637	637	3,590
Total	0	0	0	2,349	557	576	591	764	622	794	622	794	6,253	
Total	Investment													
	Design & supervision	0	0	45	112	0	0	0	8	0	0	60	225	
	Equipment	0	0	895	2,237	0	0	0	149	0	1,193	0	4,474	
	total	0	0	940	2,349	0	0	0	157	0	1,253	0	4,699	
	O&M	0	0	0	218	779	805	828	848	871	890	890	890	5,239
Total	0	0	940	2,567	779	805	828	1,005	871	2,143	871	2,143	9,938	
<b>Intermediate treatment</b>														
S/P	Investment													
	Land acquisition	0	0	0	0	0	30	0	0	0	0	0	30	
	Design & supervision	0	0	0	0	42	51	0	0	0	0	0	93	
	Construction	0	0	0	0	0	0	235	0	0	0	0	235	
	Equipment	0	0	0	0	0	0	964	0	0	0	0	964	
	total	0	0	0	0	42	81	1,199	0	0	0	0	1,322	
	O&M	0	0	0	0	0	0	0	155	155	155	155	155	465
Total	0	0	0	0	42	81	1,199	155	155	155	155	155	1,787	

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
<b>Landfill</b>											
<b>New Tonacatepeque</b>											
Investment											
Land acquisition	27	0	0	0	0	0	0	0	0	0	27
Design & supervision	135	90	36	39	0	0	0	0	0	0	300
Construction	0	0	526	788	0	0	0	0	0	0	1,314
Equipment	0	0	0	808	0	0	0	0	0	0	808
total	162	90	562	1,635	0	0	0	0	0	0	2,449
O&M	0	0	0	0	56	56	56	56	56	56	336
Total	162	90	562	1,635	56	56	56	56	56	56	2,785
<b>Municipal Solid Waste Total</b>											
Investment											
Land acquisition	27	469	0	0	0	30	0	0	0	0	526
Design & supervision	239	223	163	212	42	51	0	8	0	60	998
Construction	0	0	2,605	1,942	0	0	235	0	0	0	4,782
Equipment	0	0	1,150	3,348	0	0	964	149	0	1,193	6,804
total	266	692	3,918	5,502	42	81	1,199	157	0	1,253	13,110
O&M	0	0	0	312	1,068	1,094	1,117	1,292	1,315	1,334	7,532
Total	266	692	3,918	5,814	1,110	1,175	2,316	1,449	1,315	2,587	20,642
<b>Medical Waste Treatment</b>											
Investment											
Land acquisition	105										105
Design & supervision	468	572									1,040
Construction			284								284
Equipment			1,366							84	1,450
total	468	677	1,650	0	0	0	0	0	0	84	2,879
O&M	0	0	0	202	202	202	202	202	202	202	1,414
Total	468	677	1,650	202	202	202	202	202	202	286	4,293
<b>Municipal &amp; Medical Total</b>											
Investment											
Land acquisition	27	574	0	0	0	30	0	0	0	0	631
Design & supervision	707	795	163	212	42	51	0	8	0	60	2,038
Construction	0	0	2,889	1,942	0	0	235	0	0	0	5,066
Equipment	0	0	2,516	3,348	0	0	964	149	0	1,277	8,254
total	734	1,369	5,568	5,502	42	81	1,199	157	0	1,337	15,989
O&M	0	0	0	514	1,270	1,296	1,319	1,494	1,517	1,536	8,946
Total	734	1,369	5,568	6,016	1,312	1,377	2,518	1,651	1,517	2,873	24,935



## 7.4.2 Individual Management System

### a. Storage

Table 7-13: Cost of Container Collection System

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
<b>San Salvador</b>												
required number of containers	unit	221	230	239	248	257	266	275	284	291	300	-
operable containers	unit	92	221	138	239	248	257	266	146	275	190	-
purchase of containers	unit	129	9	101	9	9	9	9	138	16	110	539
Investment cost	US\$	112,243	7,831	87,880	7,831	7,831	7,831	7,831	120,074	13,922	95,711	468,985
O&M cost	US\$	5,769	6,004	6,239	6,474	6,709	6,944	7,179	7,413	7,596	7,831	68,158
Total cost	US\$	118,012	13,835	94,119	14,305	14,540	14,775	15,010	127,487	21,518	103,542	537,143
<b>Mejicanos</b>												
required number of containers	unit	33	33	35	36	36	38	38	39	41	41	-
operable containers	unit	8	33	25	35	36	36	38	13	39	31	-
purchase of containers	unit	25	0	10	1	0	2	0	26	2	10	76
Investment cost	US\$	21,753	0	8,701	870	0	1,740	0	22,623	1,740	8,701	66,128
O&M cost	US\$	861	861	914	940	940	992	992	1,018	1,070	1,070	9,658
Total cost	US\$	22,614	861	9,615	1,810	940	2,732	992	23,641	2,810	9,771	75,786
<b>Ciudad Delgado</b>												
required number of containers	unit	14	15	15	15	17	17	17	17	18	18	-
operable containers	unit	7	14	8	15	15	17	17	10	16	11	-
purchase of containers	unit	7	1	7	0	2	0	0	7	2	7	33
Investment cost	US\$	6,091	870	6,091	0	1,740	0	0	6,091	1,740	6,091	28,714
O&M cost	US\$	365	392	392	392	444	444	444	444	470	470	4,257
Total cost	US\$	6,456	1,262	6,483	392	2,184	444	444	6,535	2,210	6,561	32,971
<b>Cuscatancingo</b>												
required number of containers	unit	12	12	14	14	14	14	14	15	15	15	-
operable containers	unit	6	12	6	14	14	14	14	8	15	7	-
purchase of containers	unit	6	0	8	0	0	0	0	7	0	8	29
Investment cost	US\$	5,221	0	6,961	0	0	0	0	6,091	0	6,961	25,234
O&M cost	US\$	313	313	365	365	365	365	365	392	392	392	3,627
Total cost	US\$	5,534	313	7,326	365	365	365	365	6,483	392	7,353	28,861
<b>Ayutuxtepeque</b>												
required number of containers	unit	5	5	5	5	6	6	6	6	6	6	-
operable containers	unit	8	8	0	5	5	6	6	6	6	1	-
purchase of containers	unit	0	0	5	0	1	0	0	0	0	5	11
Investment cost	US\$	0	0	4,351	0	870	0	0	0	0	4,351	9,572
O&M cost	US\$	131	131	131	131	157	157	157	157	157	157	1,466
Total cost	US\$	131	131	4,482	131	1,027	157	157	157	157	4,508	11,038
<b>San Marcos</b>												
required number of containers	unit	15	15	15	17	17	17	17	18	18	18	-
operable containers	unit	6	15	9	15	17	17	17	8	18	12	-
purchase of containers	unit	9	0	6	2	0	0	0	10	0	6	33
Investment cost	US\$	7,831	0	5,221	1,740	0	0	0	8,701	0	5,221	28,714
O&M cost	US\$	392	392	392	444	444	444	444	470	470	470	4,362
Total cost	US\$	8,223	392	5,613	2,184	444	444	444	9,171	470	5,691	33,076
<b>Nueva San Salvador</b>												
required number of containers	unit	39	41	42	44	45	45	47	48	50	50	-
operable containers	unit	28	39	13	42	44	45	45	36	46	21	-
purchase of containers	unit	11	2	29	2	1	0	2	12	4	29	92
Investment cost	US\$	9,571	1,740	25,233	1,740	870	0	1,740	10,441	3,480	25,233	80,048
O&M cost	US\$	1,018	1,070	1,096	1,148	1,175	1,175	1,227	1,253	1,305	1,305	11,772
Total cost	US\$	10,589	2,810	26,329	2,888	2,045	1,175	2,967	11,694	4,785	26,538	91,820

		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
<b>Antiguo Cuscatlan</b>												
required number of containers	unit	20	20	21	21	23	23	24	24	26	26	-
operatable containers	unit	2	20	18	21	21	23	23	6	24	23	-
purchase of containers	unit	18	0	3	0	2	0	1	18	2	3	47
Investment cost	US\$	15,662	0	2,610	0	1,740	0	870	15,662	1,740	2,610	40,894
O&M cost	US\$	522	522	548	548	600	600	626	626	679	679	5,950
Total cost	US\$	16,184	522	3,158	548	2,340	600	1,496	16,288	2,419	3,289	46,844
<b>Soyapango</b>												
required number of containers	unit	60	63	65	68	69	72	74	77	78	80	-
operatable containers	unit	29	60	34	65	68	69	72	43	74	47	-
purchase of containers	unit	31	3	31	3	1	3	2	34	4	33	145
Investment cost	US\$	26,973	2,610	26,973	2,610	870	2,610	1,740	29,583	3,480	28,713	126,162
O&M cost	US\$	1,566	1,644	1,697	1,775	1,801	1,879	1,931	2,010	2,036	2,088	18,427
Total cost	US\$	28,539	4,254	28,670	4,385	2,671	4,489	3,671	31,593	5,516	30,801	144,589
<b>Ilopango</b>												
required number of containers	unit	20	21	21	21	23	23	24	24	24	26	-
operatable containers	unit	6	20	15	21	21	23	23	10	23	18	-
purchase of containers	unit	14	1	6	0	2	0	1	14	1	8	47
Investment cost	US\$	12,181	870	5,221	0	1,740	0	870	12,181	870	6,961	40,894
O&M cost	US\$	522	548	548	548	600	600	626	626	626	679	5,923
Total cost	US\$	12,703	1,418	5,769	548	2,340	600	1,496	12,807	1,496	7,640	46,817
<b>San Martin</b>												
required number of containers	unit	12	12	12	12	12	14	14	14	14	14	-
operatable containers	unit	0	12	12	12	12	12	14	2	14	14	-
purchase of containers	unit	12	0	0	0	0	2	0	12	0	0	26
Investment cost	US\$	10,441	0	0	0	0	1,740	0	10,441	0	0	22,622
O&M cost	US\$	313	313	313	313	313	365	365	365	365	365	3,390
Total cost	US\$	10,754	313	313	313	313	2,105	365	10,806	365	365	26,012
<b>Apopa</b>												
required number of containers	unit	21	23	23	23	24	24	26	26	26	27	-
operatable containers	unit	19	21	4	23	23	24	24	24	24	7	-
purchase of containers	unit	2	2	19	0	1	0	2	2	2	20	50
Investment cost	US\$	1,740	1,740	16,532	0	870	0	1,740	1,740	1,740	17,402	43,504
O&M cost	US\$	548	600	600	600	626	626	679	679	679	705	6,342
Total cost	US\$	2,288	2,340	17,132	600	1,496	626	2,419	2,419	2,419	18,107	49,846
<b>Nejapa</b>												
required number of containers	unit	2	3	3	3	3	3	3	3	3	3	-
operatable containers	unit	0	2	3	3	3	3	3	1	2	3	-
purchase of containers	unit	2	1	0	0	0	0	0	2	1	0	6
Investment cost	US\$	1,740	870	0	0	0	0	0	1,740	870	0	5,220
O&M cost	US\$	52	78	78	78	78	78	78	78	78	78	754
Total cost	US\$	1,792	948	78	78	78	78	78	1,818	948	78	5,974
<b>Tonacatepeque</b>												
required number of containers	unit	11	11	11	11	11	11	12	12	12	12	-
operatable containers	unit	0	11	11	11	11	11	11	1	12	12	-
purchase of containers	unit	11	0	0	0	0	0	1	11	0	0	23
Investment cost	US\$	9,571	0	0	0	0	0	870	9,571	0	0	20,012
O&M cost	US\$	287	287	287	287	287	287	313	313	313	313	2,974
Total cost	US\$	9,858	287	287	287	287	287	1,183	9,884	313	313	22,986
<b>Total cost</b>												
required number of containers	unit	485	504	521	538	557	573	591	607	622	636	-
operatable containers	unit	211	488	296	521	538	557	573	314	588	397	-
purchase of containers	unit	277	19	225	17	19	16	18	293	34	239	1,157
Investment cost	US\$	241,018	16,531	195,774	14,791	16,531	13,921	15,661	254,939	29,582	207,955	1,006,703
O&M cost	US\$	12,659	13,155	13,600	14,043	14,539	14,956	15,426	15,844	16,236	16,602	147,060
Total cost	US\$	253,677	29,686	209,374	28,834	31,070	28,877	31,087	270,783	45,818	224,557	1,153,763

**b. Collection**

**Table 7-14: Collection Cost**

Unit: US\$ 1,000

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
<b>San Salvador</b>											
Investment	1,253	0	4,013	0	196	98	98	1,430	294	4,111	11,493
O&M	2,506	2,598	2,706	2,571	2,022	2,093	2,157	2,229	2,307	2,368	23,557
total	3,759	2,598	6,719	2,571	2,218	2,191	2,255	3,659	2,601	6,479	35,050
<b>Mejicanos</b>											
Investment	98	0	568	0	0	78	0	196	0	568	1,508
O&M	326	333	344	352	261	271	275	282	289	296	3,029
total	424	333	912	352	261	349	275	478	289	864	4,537
<b>Ciudad Delgado</b>											
Investment	0	0	372	0	98	0	0	0	0	372	842
O&M	139	143	150	153	157	161	165	168	172	175	1,583
total	139	143	522	153	255	161	165	168	172	547	2,425
<b>Cuscatancingo</b>											
Investment	0	0	274	0	0	0	98	0	0	274	646
O&M	147	158	158	166	105	105	109	109	112	116	1,285
total	147	158	432	166	105	105	207	109	112	390	1,931
<b>Ayutuxtepeque</b>											
Investment	0	0	98	0	0	0	0	0	0	98	196
O&M	44	44	51	51	51	55	55	55	55	58	519
total	44	44	149	51	51	55	55	55	55	156	715
<b>San Marcos</b>											
Investment	98	0	274	0	0	0	0	98	0	274	744
O&M	198	205	209	217	123	126	130	133	133	137	1,611
total	296	205	483	217	123	126	130	231	133	411	2,355
<b>Nueva San Salvador</b>											
Investment	372	0	470	0	98	0	0	372	0	568	1,880
O&M	501	520	532	318	328	336	346	353	360	370	3,964
total	873	520	1,002	318	426	336	346	725	360	938	5,844
<b>Antiguo Cuscatlan</b>											
Investment	294	0	176	0	0	0	0	294	0	176	940
O&M	245	252	260	148	152	158	162	165	169	179	1,890
total	539	252	436	148	152	158	162	459	169	355	2,830
<b>Soyapango</b>											
Investment	196	0	1,214	0	0	0	0	294	0	1,214	2,918
O&M	698	725	754	777	492	503	520	538	551	568	6,126
total	894	725	1,968	777	492	503	520	832	551	1,782	9,044
<b>Ilopango</b>											
Investment	0	0	470	0	0	0	0	0	0	568	1,038
O&M	256	260	268	279	173	176	183	187	190	194	2,166
total	256	260	738	279	173	176	183	187	190	762	3,204
<b>San Martin</b>											
Investment	0	0	274	0	98	0	0	0	0	274	646
O&M	76	79	82	86	112	115	119	119	126	130	1,044
total	76	79	356	86	210	115	119	119	126	404	1,690
<b>Apopa</b>											
Investment	0	0	470	0	0	98	0	0	0	470	1,038
O&M	170	174	180	188	192	195	202	206	209	213	1,929
total	170	174	650	188	192	293	202	206	209	683	2,967
<b>Nejapa</b>											
Investment	0	0	98	0	0	0	0	0	0	98	196
O&M	17	17	17	17	17	17	21	21	21	21	186
total	17	17	115	17	17	17	21	21	21	119	382

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
<b>Tonacatepeque</b>											
Investment	0	0	196	0	0	0	0	78	0	196	470
O&M	69	69	72	72	76	80	80	87	87	87	779
total	69	69	268	72	76	80	80	165	87	283	1,249
<b>Total</b>											
Investment	2,311	0	8,967	0	490	274	196	2,762	294	9,261	24,555
O&M	5,392	5,577	5,783	5,395	4,261	4,391	4,524	4,652	4,781	4,912	49,668
total	7,703	5,577	14,750	5,395	4,751	4,665	4,720	7,414	5,075	14,173	74,223

**c. Road Sweeping**

Table 7-15: Road Sweeping Cost (Manual Sweeping)

Unit: US\$/year

	length (km)	nos. of workers	personnel total (US\$)	nos. of handcarts*	handcart total (US\$)	Total (US\$)	Total (US\$ 1,000\$)
San Salvador	269.5	299	1,127,798	59.8	4,192	1,131,990	1,132
Mejicanos	29.1	32	120,701	6.4	448	121,149	121
Ciudad Delgado	15.0	17	64,122	3.4	238	64,360	64
Cuscatancingo	9.0	10	37,719	2.0	140	37,859	38
Ayutuxtepeque	2.7	3	11,316	0.6	42	11,358	11
San Marcos	7.0	8	30,175	1.6	112	30,287	30
Nueva San Salvador	43.1	48	181,051	9.6	673	181,724	182
Antiguo Cuscatlan	51.6	57	214,998	11.4	799	215,797	216
Soyapango	12.6	14	52,807	2.8	197	53,004	53
Ilopango	1.8	2	7,544	0.4	28	7,572	8
San Martin	1.7	2	7,544	0.4	28	7,572	8
Apopa	5.6	6	22,631	1.2	84	22,715	23
Nejapa	0.7	1	3,772	0.2	14	3,786	4
Tonacatepeque	3.2	4	15,088	0.8	56	15,144	15
Total	452.6	503	1,897,266	100.6	7,052	1,904,318	1,905

Note: \* Number of handcarts required to be purchased every year.

Table 7-16: Road Sweeping Cost (Mechanical Sweeping, San Salvador only)

Unit: US\$ 1,000

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Nos. of vehicle	5	5	5	5	5	5	5	5	5	5	
Nos. of purchase			2		3					2	7
Investment	0	0	258	0	387	0	0	0	0	258	903
O&M	91	91	91	91	91	91	91	91	91	91	910
Total	91	91	349	91	478	91	91	91	91	349	1,813