Annex K

Framework of Master Plan

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K Framework of Master Plan

K.1 Goals, Targets and Strategies

K.1.1 Goals and Target Year

a. Goals

The principal goal of the Master Plan is to establish a sound Solid Waste Management System by the target year 2010 in AMSS, where the major population and economic activities of the country are centered.

The Master Plan aims to:

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

The goals in practice of the Master Plan are as follows:

1. The improvement of public health and the reduction of health hazards in and around the AMSS will be a primary task of the SWM, in order to promote the citizens' well-being.
2. As sustainable SWM services is required as the duty and mandate of the municipalities, the COAMSS/OPAMSS and municipalities should expedite:
   - cost-effective SWM from technical improvement;
   - cost-effective SWM from institutional/organizational improvement; and
   - auto-sustainable SWM from adequate financial planning and management.
3. As the environmental conservation through SWM is today's requirement, the COAMSS/OPAMSS and municipalities should expedite the following:
   - SW treatment and disposal facilities should be operated not to pollute the environment;
   - public should be encouraged to be more environmentally aware of waste minimization; and
   - environmental conservation through "reduction", "re-use" and "recycling" of waste should be promoted.

b. Target Year

In accordance with the "scope of work" of the Study, the target year for the master plan is set up as follows

Master Plan: Year 2010

K.1.2 Targets and Strategies

In line with respective goals mentioned above, targets should be set up for clarifying area to which efforts should be made, and strategies should be further outlined for specifying the ways in which actions are to be focused.

a. Targets for "well-being"

In order to achieve the goal of "well-being" through SWM, the following targets can be raised.

- Improvement of public health and reduction of health hazard by SWM.

Meanwhile,

- welfare of those whose work and life are related with SWM activities should not be forgotten; and
- medical waste should be appropriately treated and disposed in order to safeguard the public.

a.1 Strategies for Public health Improvement

In order to achieve the target of "public health improvement", the primary strategies are:

- to raise the collection service coverage ratio; and
- waste collection and transport method should be improved (e.g., collection point management, incorporation of primary collection by micro-enterprises etc.) to reduce the health hazard and nuisance to public.
- citizens should be reminded that appropriate SW handling by citizens themselves will improve their health as a consequence.

a.2 Strategies for Welfare of Stakeholders in SWM Activities

With regard to SWM, stakeholders are diverse such as marginal/vulnerable waste-pickers, municipal workers, micro-enterprises, NGOs, lucrative private companies, municipalities of course, etc. The primary strategies in this context could be as follows:

- Marginal stakeholders (i.e., waste-pickers in disposal sites) are trying to survive their lives by picking recyclable materials at unsanitary waste disposal sites where great health hazards and accident risks exist. It is necessary for such waste-pickers to find job opportunity that they can work sanitarily; and
- It is necessary to promote all stakeholders to provide competitive services.

It should be the responsibility of the whole society to consider the welfare of marginal/vulnerable stakeholders.

On the other hand, in order to achieve the target of "welfare of stakeholders", the stakeholders should be oriented and motivated to improve their work output in order for them in return to enjoy the benefit of improved works.

All stakeholders should be encouraged and motivated to provide competitive services in gaining the remunerative return. It is necessary for all stakeholders to remind that whenever they provide competitive works or services they will be gaining their interests.

In other words, it should be acknowledged by all stakeholders that interests shall not be vested with any party who loose willingness to improve its competitive services.

a.3 Strategies for Medical Waste Management

In order to achieve the target of "appropriate medical waste management", the primary strategies are:

- Deployment of appropriate intra-hospital management of medical waste; and
- Execution and supervision of reliable treatment/disposal of medical waste that are separately collected.

b. Targets for "sustainability in SWM"

In order to achieve the goal of "sustainability" in SWM, the following should be targeted for raising the cost-effectiveness of SWM activities.

- Improving technical performance (achievement) for higher efficiency and effectiveness, etc.
- Improvement of institutional and organizational management.
- Improvement of financial stability in SWM services through e.g., improved fee collection, appropriate investment planning, effectual cost accounting, etc.

b.1 Strategies of Technical Improvement for Cost-effective SWM

In order to achieve the target of "technical improvement for cost-effective SWM", the primary strategies are:

- municipalities should become capable of examining plural technical alternatives with cost-consciousness and be flexible and proficient in converting the present technical system to another if it turns out more beneficial and is selected.
- regional technical system in SWM should be expedited to improve cost-efficiency; and
- technical improvement of SWM offices in 14 municipalities by OPAMSS's support.

b.2 Strategies of Institutional/organizational Improvement for Cost-effective SWM

In order to achieve the target of "institutional/organizational improvement for cost-effective SWM", the primary strategies are:

- to strengthen institutions and to improve organizations in order to be more aware of cost-conscious;
- to implement cost-effective administration on regional issues in SWM by initiatives of COAMSS/OPAMSS; and
- to collaborate with education sectors to promote citizens to have a sense of public duty on "not to throw away refuse", which in return will reduce municipal cost burden on street sweeping, although it will take a longer time for all citizens to share the sense and to practice it.

b.3 Strategies of Financial Planning and Arrangement for Auto-sustainable SWM

In order to achieve the target of "appropriate financial planning and arrangement for auto-sustainable SWM", the primary strategies are:

- efficient fee collection should be expedited to secure the income for SWM services;
- clear cost accounting on SWM should be established by respective municipalities in order to systematically monitor the expenditure of SWM services and be utilized in its management; and
- appropriate investment planning should be expedited.

c. Targets for "Environmental Conservation" through SWM

In order to achieve the goal of "environmental conservation" in SWM, there are two major category of SWM contribution.

- Prevention of pollution related with SWM activities: and
- Natural resource conservation through SWM

c.1 Strategies of "environmental protection" through SWM

In order to achieve the target of "pollution prevention", the primary strategies are:

- SW treatment and final disposal facilities are operated not to pollute the environment.

c.2 Strategies of "resource conservation" through SWM

In order to achieve the target of "resource conservation", the primary strategies are:

- public should be encouraged to be more environmentally aware of waste minimization; and

- environmental conservation through "reduction", "re-use" and "recycling" of waste should be promoted.

It should also be highlighted that collaboration with education sectors is indispensable for these strategies of public involvement.

Scheme of relations among goals, targets and strategies are illustrated in Table K-1.

Table K-1: Goals, Targets, and Strategies

M/P aims	Target	Strategies	Specific action
Promote the citizens' well-being	Improvement of public health and reduction of health hazard	To raise collection service coverage ratio	• Improvement of collection efficiency • Service expansion to non-served areas
		Improvement of collection and transport method, to reduce health hazard and public nuisance	• Collection vehicle management system • Collection point (e.g., $2m^3$ container) management system • Primary collection management system (e.g., micro-enterprises control system)
		To promote appropriate SW handling by citizens	• public education program
	Welfare of those who are related with SWM activities	marginal stakeholders (i.e., disposal site waste-pickers) to find sanitary job opportunity	• promote to change from downstream "waste-picking" to upstream "recyclable recovery" • other job opportunities
		provision of competitive services by stakeholders	• create mechanism to promote stakeholders to provide competitive services
	Appropriate medical waste management	Appropriate intra-hospital management of medical waste	• To deploy appropriate intra-hospital management
		Reliable treatment/disposal	• To execute and supervise reliable treatment/disposal
Sustainable SWM	Improvement of technical performance	• To be capable of examining technical alternatives and of converting the present to another if it turns out more beneficial and is selected • Regional approach in SWM • Technical support by OPAMSS	• Collection rout improvement • Improvement of transportation system • Improvement of collection vehicle management system
	Institutional/organizational improvement	• Establishment of regional approach in SWM • Strengthening of each municipal SWM • Strengthening of national approach in medical SWM • Plans for competitive services (e.g., appropriate contract management)	• Creation of SW unit in OPAMSS to support 14 municipalities • San Salvador Municipal Public Company of Urban Cleansing • Strengthening of cleansing services in 13 municipalities • Improvement of medical SWM (competencies of MSPAS) • Improvement of contract management
	Financial planning and arrangement for auto-sustainable SWM	To secure sufficient and stable income for the SWM services	• Improvement of fee collection system
		To establish clear cost accounting and utilize in its management	• Establishment of clear cost accounting • training
		Appropriate investment plan	• Establish cleansing fund
Contribute to environmental conservation	Environment protection	Improvement of landfill level	• sanitary landfill
	Resources conservation	Promotion of recycle and recovery	• Source separation and separate collection • Collaboration with education sectors

K.1.3 Compatibility of 3 Major Goals

It is important to sustain compatibility among three (3) goals.

For example if a municipality that does not yet achieve 100% service coverage places its major emphasis on the goal of "environmental conservation" and spends considerable resources of municipal budget in activities of such as separate collection and recycling, which might possibly turn out low-efficiency collection and very costly activities. Then in the consequence, ordinary cleansing services might be deteriorated and the service coverage will be lowered since the resources for this principal service is already limited and/or further reduced. As a result, more waste will be left uncollected in streets and controversially create health hazard and jeopardize the public health that is an important another goal.

K.1.4 Regional Issues and Municipal Issues in M/P Components

Regional issues and municipal issues are categorized in the M/P scheme as shown in Table K-2.

Table K-2: Master Plan Components

	Regional management system (for COAMSS/OPAMSS)	Individual management system (for Municipalities)
Collection and transportation	Transfer station Transport system	Discharge/ storage system Collection system
Intermediate treatment	Material recovery facility	Separate collection
Final disposal	Technical and institutional management system	Landfill level (i.e., open dumping, controlled dumping, sanitary landfill)
Medical waste management	National/regional management by MSPAS	Coordination with MSPAS

K.1.5 Action Plan for Regional Management System

Actions plan for regional management system of principal technical components in the M/P scheme are shown in Table K-3.

Table K-3: Action Plan for Regional Management System

		Phase I			Phase II			Phase III			
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Transfer system	TS 1	FS, EIA	B/D, D/D	Con.	OP	OP	OP	OP	OP	OP	OP
	TS 2	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
	New 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

K.1.6 Actions plan for Individual Management System

Actions plan of principal technical components in the M/P scheme are shown in Table K-4.

Table K-4: Action plans of Technical Aspects

	Step I	Step II	Step III
Discharge/Storage	Improvement of hygienic condition of discharge station ($2m^3$ container yard)	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	Open dumping	Controlled dumping	Sanitary landfill

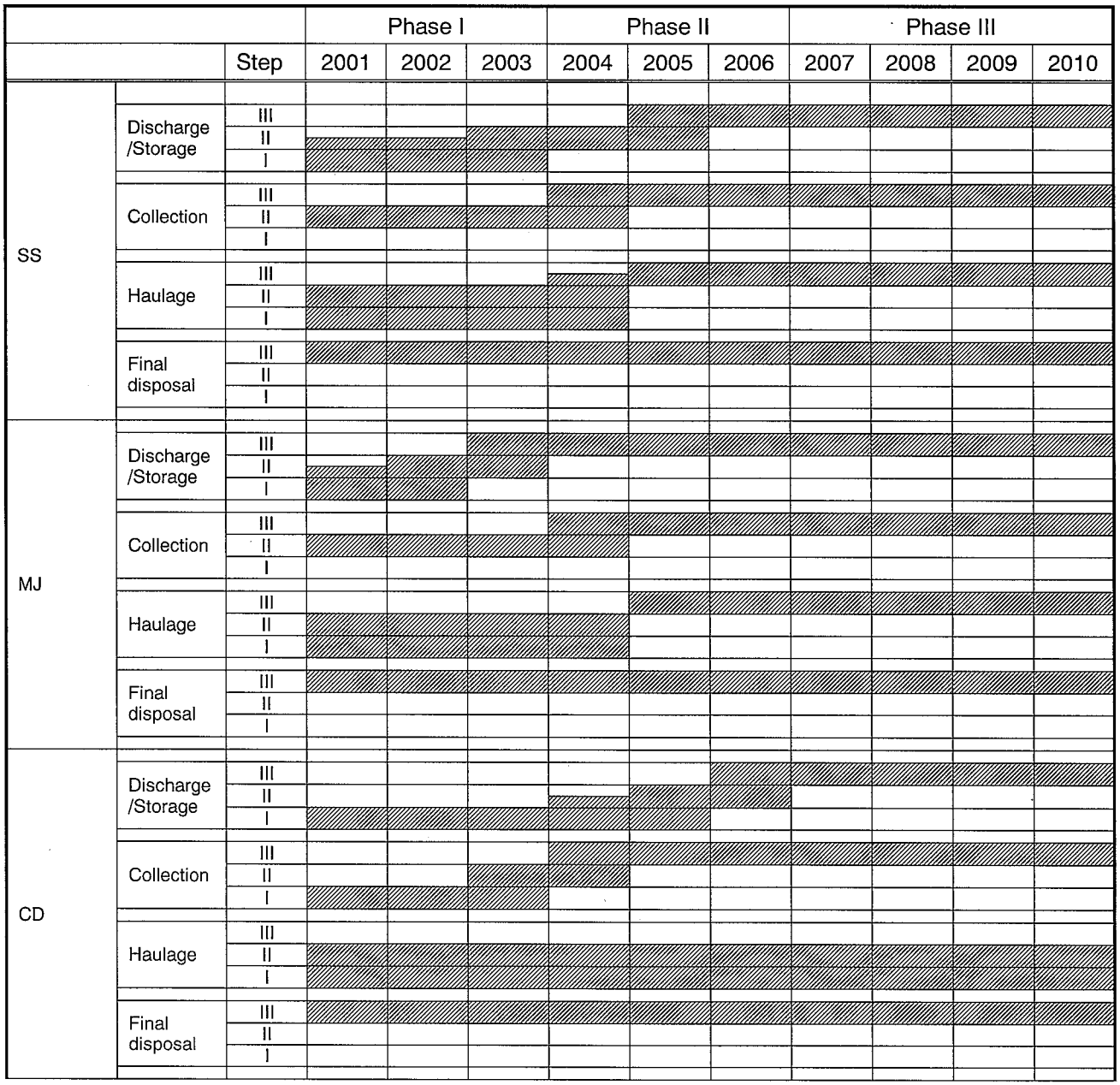
K.1.7 Action Plan for Respective Municipalities

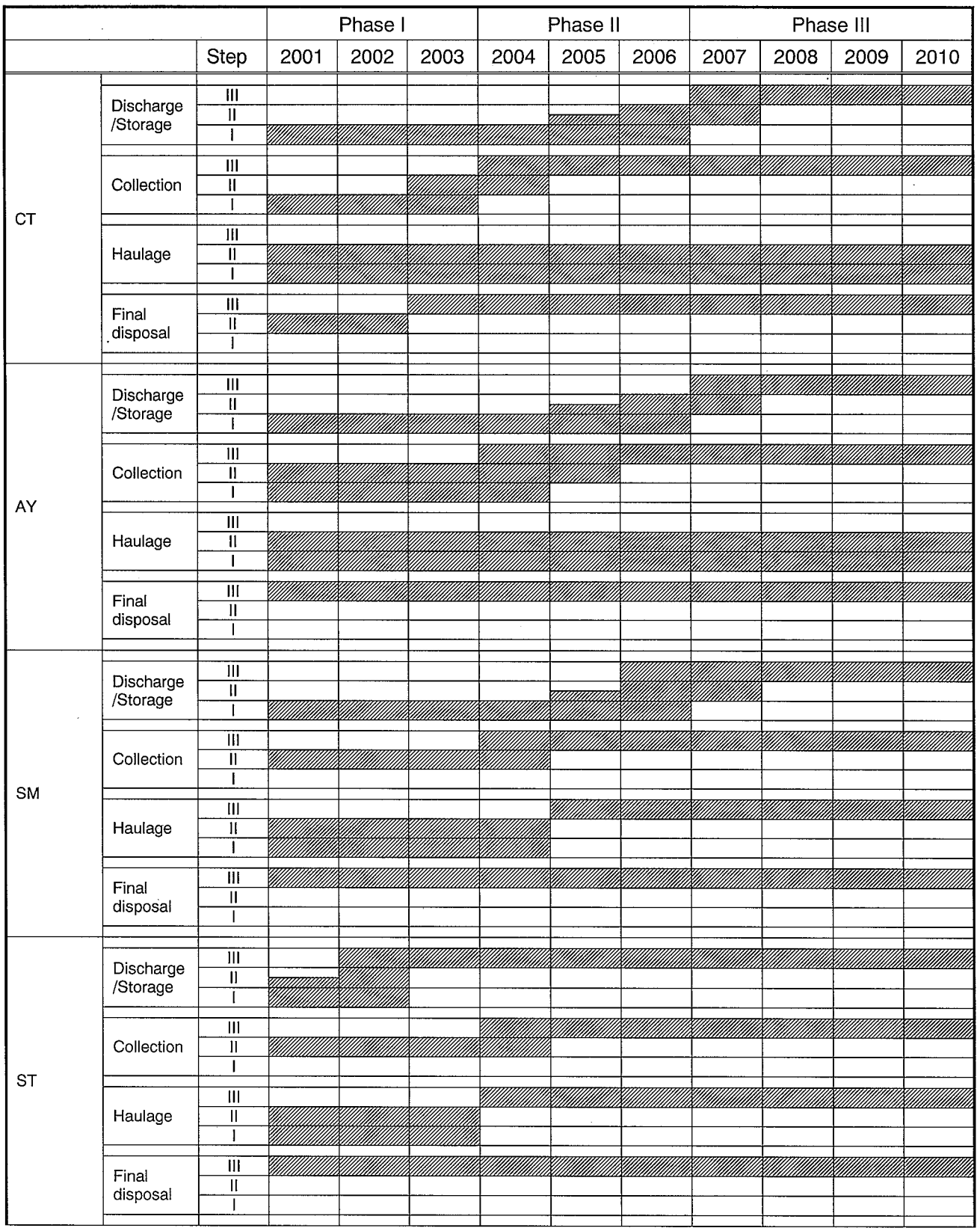
Actions to achieve the above goals targets and strategies should be, in practice, introduced step-wise manner toward the target year 2010. Hence, years till the target year 2010 are divided into three phases for the reference as shown in the table below.

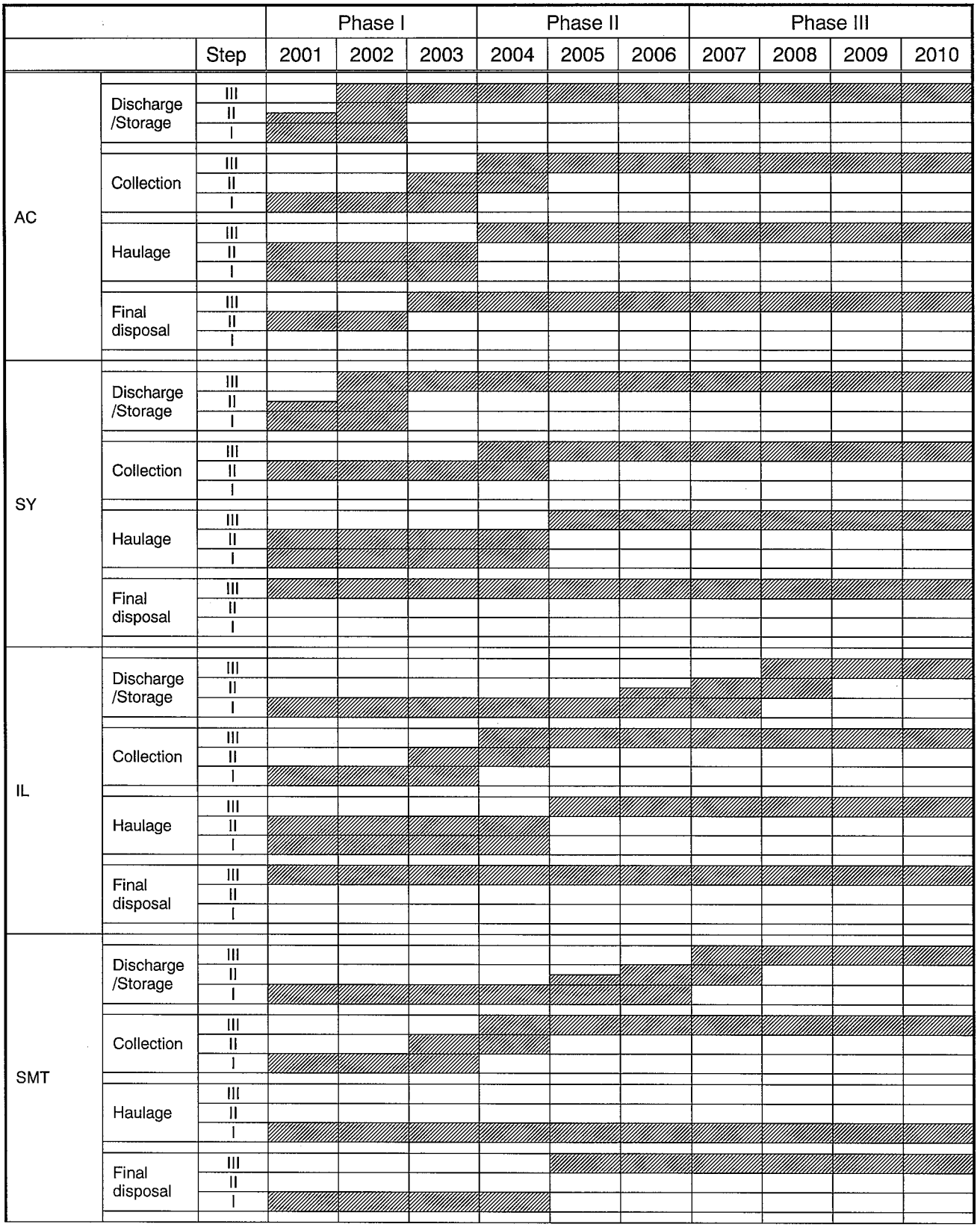
Meanwhile, situations and conditions intrinsic to each municipality are diversely different. For example, in what year to enter to the Step II or Step III from present Step I should be different municipality by municipality. It is recommended that each municipality should consider time program (e.g., in what year to enter to the Step II or Step III) by examining their own intrinsic situation and conditions.

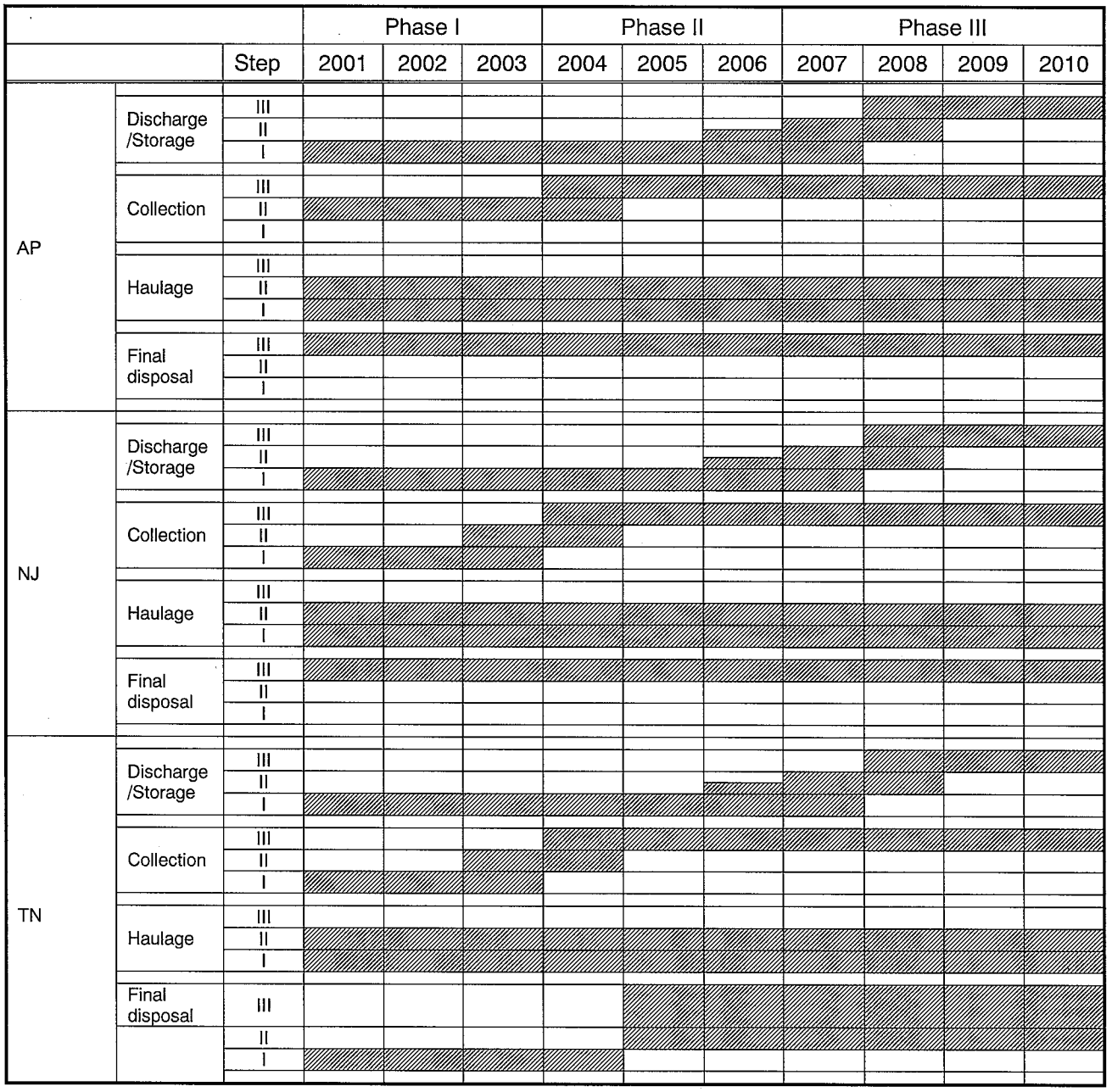
Table K-5 below shows time program proposed by the Team which should always be subject to further examination by respective municipality.

Table K-5: Action Plan for Respective Municipalities




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


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



K.2 Forecast of Future Waste Amount and Composition

K.2.1 Population Forecast

a. Future Population Applied to the Study

Population forecast from 1999 to 2010 shown in
Table K-7 and Table K-8, which is arranged by the Study Team on the basis of "Proyección de la Población de El Salvador" and information from the municipalities, is applied to this Study.

"Proyección de la Población de El Salvador" and other materials such as "Encuesta de Hogares de Propósitos Múltiples 1998[1]" consider no rural area in AMSS except Tonacatepeque. In view of waste collection service, however, the Study Team take into account rural area in some municipalities. The municipalities have some population whom the municipalities conceive that waste collection service is not possible because they are living in rural areas. The population forecast reflects this point of view.

The future population is forecast as follows:

- Total population is quoted from "Proyección de la Población de El Salvador."
- Population growth rate in rural area for the whole country in "Proyección de la Población de El Salvador" is applied to the forecast (See Table K-6).
- Population in urban area is obtained by subtracting the rural population from the total population.

Table K-6: Population Growth Rate in Rural Area

Year	Growth rate (%)
1995-2000	1.3
2001-2005	1.2
2006-2010	0.9

Source: "Proyección de la Población de El Salvador"

Table K-7: Population Forecast in AMSS in Year 1999, 2000, 2005 and 2010

Municipality	Year	1999	2000	2005	2010
San Salvador	Total	473,374	479,605	507,666	512,873
	Urban	473,374	479,605	507,666	512,873
	Rural	0	0	0	0
Mejicanos	Total	185,204	189,392	207,153	217,248
	Urban	185,204	189,392	207,153	217,248
	Rural	0	0	0	0
Ciudad Delgado	Total	149,394	153,350	170,014	180,727
	Urban	149,394	153,350	170,014	180,727
	Rural	0	0	0	0
Cuscatancingo	Total	90,079	94,062	111,011	125,618
	Urban	90,079	94,062	111,011	125,618
	Rural	0	0	0	0
Ayutuxtepeque	Total	38,158	39,953	47,622	54,427
	Urban	28,000	29,663	36,700	43,005
	Rural	10,158	10,290	10,922	11,422
San Marcos	Total	69,660	70,610	74,864	76,106
	Urban	69,660	70,610	74,864	76,106
	Rural	0	0	0	0
Nueva San Salvador	Total	152,723	158,207	186,636	213,431
	Urban	138,723	144,025	171,584	197,690
	Rural	14,000	14,182	15,052	15,741

[1] Ministerio de Economía Dirección General de Estadística y Censos Digestyc, 1999, Encuesta de Hogares de Propósitos Múltiples 1998, El Salvador

Municipality	Year	1999	2000	2005	2010
Antigo Cuscatlan	Total	42,773	45,123	58,273	72,950
	Urban	42,773	45,123	58,273	72,950
	Rural	0	0	0	0
Soyapango	Total	283,598	285,286	294,604	309,772
	Urban	283,598	285,286	294,604	309,772
	Rural	0	0	0	0
Ilopango	Total	127,434	132,231	152,465	168,554
	Urban	127,434	132,231	152,465	168,554
	Rural	0	0	0	0
San Martin	Total	101,086	107,212	134,152	160,949
	Urban	73,000	78,761	103,952	129,365
	Rural	28,086	28,451	30,200	31,584
Apopa	Total	163,974	171,833	205,488	235,614
	Urban	163,974	171,833	205,488	235,614
	Rural	0	0	0	0
Nejapa	Total	31,466	32,172	35,171	36,866
	Urban	15,000	15,492	17,466	18,350
	Rural	16,466	16,680	17,705	18,516
Tonacatepeque	Total	39,871	41,277	47,192	51,733
	Urban	29,000	30,265	35,503	39,509
	Rural	10,871	11,012	11,689	12,224
Total	Total	1,948,794	2,000,313	2,232,311	2,416,868
	Urban	1,869,213	1,919,698	2,146,743	2,327,381
	Rural	79,581	80,615	85,568	89,487

Source: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador

Table K-8: Population Forecast in AMSS (1999 – 2010)

Muni.		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SS	T	473,374	479,605	485,845	492,001	497,844	503,143	507,666	510,367	512,681	513,869	513,488	512,873
	U	473,374	479,605	485,845	492,001	497,844	503,143	507,666	510,367	512,681	513,869	513,488	512,873
	R	0	0	0	0	0	0	0	0	0	0	0	0
MJ	T	185,204	189,392	193,400	197,273	200,917	204,240	207,153	209,708	211,878	213,779	215,528	217,248
	U	185,204	189,392	193,400	197,273	200,917	204,240	207,153	209,708	211,878	213,779	215,528	217,248
	R	0	0	0	0	0	0	0	0	0	0	0	0
CD	T	149,394	153,350	157,094	160,684	164,069	167,196	170,014	172,570	174,825	176,873	178,808	180,727
	U	149,394	153,350	157,094	160,684	164,069	167,196	170,014	172,570	174,825	176,873	178,808	180,727
	R	0	0	0	0	0	0	0	0	0	0	0	0
CT	T	90,079	94,062	97,758	101,276	104,640	107,876	111,011	114,077	117,013	119,877	122,727	125,618
	U	90,079	94,062	97,758	101,276	104,640	107,876	111,011	114,077	117,013	119,877	122,727	125,618
	R	0	0	0	0	0	0	0	0	0	0	0	0
AY	T	38,158	39,953	41,616	43,201	44,720	46,189	47,622	49,034	50,395	51,731	53,068	54,427
	U	28,000	29,663	31,203	32,663	34,056	35,397	36,700	38,014	39,276	40,512	41,748	43,005
	R	10,158	10,290	10,413	10,538	10,664	10,792	10,922	11,020	11,119	11,219	11,320	11,422
SM	T	69,660	70,610	71,575	72,542	73,452	74,246	74,864	75,326	75,635	75,838	75,979	76,106
	U	69,660	70,610	71,575	72,542	73,452	74,246	74,864	75,326	75,635	75,838	75,979	76,106
	R	0	0	0	0	0	0	0	0	0	0	0	0
ST	T	152,723	158,207	163,793	169,515	175,286	181,023	186,636	192,131	197,568	202,935	208,225	213,431
	U	138,723	144,025	149,441	154,991	160,588	166,149	171,584	176,944	182,244	187,473	192,624	197,690
	R	14,000	14,182	14,352	14,524	14,698	14,874	15,052	15,187	15,324	15,462	15,601	15,741
AC	T	42,773	45,123	47,578	50,140	52,790	55,507	58,273	61,090	63,969	66,906	69,899	72,950
	U	42,773	45,123	47,578	50,140	52,790	55,507	58,273	61,090	63,969	66,906	69,899	72,950
	R	0	0	0	0	0	0	0	0	0	0	0	0
SY	T	283,598	285,286	287,034	288,694	290,412	292,333	294,604	297,183	299,275	301,885	305,729	309,772
	U	283,598	285,286	287,034	288,694	290,412	292,333	294,604	297,183	299,275	301,885	305,729	309,772
	R	0	0	0	0	0	0	0	0	0	0	0	0
IL	T	127,434	132,231	136,696	140,945	144,985	148,822	152,465	155,957	159,232	162,370	165,452	168,554
	U	127,434	132,231	136,696	140,945	144,985	148,822	152,465	155,957	159,232	162,370	165,452	168,554
	R	0	0	0	0	0	0	0	0	0	0	0	0
SMT	T	101,086	107,212	112,906	118,362	123,663	128,898	134,152	139,463	144,722	150,008	155,396	160,949
	U	73,000	78,761	84,114	89,224	94,175	99,056	103,952	108,991	113,976	118,985	124,094	129,365
	R	28,086	28,451	28,792	29,138	29,488	29,842	30,200	30,472	30,746	31,023	31,302	31,584
AP	T	163,974	171,833	179,122	186,064	192,728	199,180	205,488	211,715	217,733	223,652	229,580	235,614
	U	163,974	171,833	179,122	186,064	192,728	199,180	205,488	211,715	217,733	223,652	229,580	235,614
	R	0	0	0	0	0	0	0	0	0	0	0	0
NJ	T	31,466	32,172	32,849	33,504	34,119	34,680	35,171	35,601	35,966	36,285	36,578	36,866
	U	15,000	15,492	15,969	16,421	16,831	17,185	17,466	17,737	17,941	18,098	18,227	18,350
	R	16,466	16,680	16,880	17,083	17,288	17,495	17,705	17,864	18,025	18,187	18,351	18,516
TN	T	39,871	41,277	42,588	43,836	45,020	46,139	47,192	48,193	49,122	50,005	50,868	51,733
	U	29,000	30,265	31,444	32,558	33,607	34,589	35,503	36,399	37,222	37,998	38,753	39,509
	R	10,871	11,012	11,144	11,278	11,413	11,550	11,689	11,794	11,900	12,007	12,115	12,224
Total	T	1,948,794	2,000,313	2,049,854	2,098,037	2,144,645	2,189,472	2,232,311	2,272,415	2,310,014	2,346,013	2,381,325	2,416,868
	U	1,869,213	1,919,698	1,968,273	2,015,476	2,061,094	2,104,919	2,146,743	2,186,078	2,222,900	2,258,115	2,292,636	2,327,381
	R	79,581	80,615	81,581	82,561	83,551	84,553	85,568	86,337	87,114	87,898	88,689	89,487

Note: T: total, U: urban, and R: rural

Source: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador

b. Population Growth Rate

Population growth rates of municipalities in AMSS are shown in Table K-9 and Table K-10. The growth rate in AMSS is higher than that in the whole country until 2005, and those are the same from 2006 to 2010 as shown in Table K-11.

Table K-9: Annual Population Growth Rate (average in respective period)

Municipality	Area	1999-2000	2001-2005	2006-2010
San Salvador	Total	1.3	1.1	0.2
	Urban	1.3	1.1	0.2
	Rural	-	-	-
Mejicanos	Total	2.3	1.8	1.0
	Urban	2.3	1.8	1.0
	Rural	-	-	-
Ciudad Delgado	Total	2.6	2.1	1.2
	Urban	2.6	2.1	1.2
	Rural	-	-	-
Cuscatancingo	Total	4.4	3.4	2.5
	Urban	4.4	3.4	2.5
	Rural	-	-	-
Ayutuxtepeque	Total	4.7	3.6	2.7
	Urban	5.9	4.3	3.2
	Rural	1.3	1.2	0.9
San Marcos	Total	1.4	1.2	0.3
	Urban	1.4	1.2	0.3
	Rural	-	-	-
Nueva San Salvador	Total	3.6	3.4	2.7
	Urban	3.8	3.6	2.9
	Rural	1.3	1.2	0.9
Antigo Cuscatlan	Total	5.5	5.2	4.6
	Urban	5.5	5.2	4.6
	Rural	-	-	-
Soyapango	Total	0.6	0.6	1.0
	Urban	0.6	0.6	1.0
	Rural	-	-	-
Ilopango	Total	3.8	2.9	2.0
	Urban	3.8	2.9	2.0
	Rural	-	-	-
San Martin	Total	6.1	4.6	3.7
	Urban	7.9	5.7	4.5
	Rural	1.3	1.2	0.9
Apopa	Total	4.8	3.6	2.8
	Urban	4.8	3.6	2.8
	Rural	-	-	-
Nejapa	Total	2.2	1.8	0.9
	Urban	3.3	2.4	1.0
	Rural	1.3	1.2	0.9
Tonacatepeque	Total	3.5	2.7	1.9
	Urban	4.4	3.2	2.2
	Rural	1.3	1.2	0.9
Total	Total	2.6	2.2	1.6
	Urban	2.7	2.3	1.6
	Rural	1.3	1.2	0.9

Note: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador

Table K-10: Annual Population Growth Rate (1999-2000)

Municipality	Area	1999 - 2000	2000 - 2001	2001 - 2002	2002 - 2003	2003 - 2004	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 – 2010
SS	Total	1.3	1.3	1.3	1.2	1.1	0.9	0.5	0.5	0.2	-0.1	-0.1
	Urban	1.3	1.3	1.3	1.2	1.1	0.9	0.5	0.5	0.2	-0.1	-0.1
	Rural	-	-	-	-	-	-	-	-	-	-	-
MJ	Total	2.3	2.1	2.0	1.8	1.7	1.4	1.2	1.0	0.9	0.8	0.8
	Urban	2.3	2.1	2.0	1.8	1.7	1.4	1.2	1.0	0.9	0.8	0.8
	Rural	-	-	-	-	-	-	-	-	-	-	-
CD	Total	2.6	2.4	2.3	2.1	1.9	1.7	1.5	1.3	1.2	1.1	1.1
	Urban	2.6	2.4	2.3	2.1	1.9	1.7	1.5	1.3	1.2	1.1	1.1
	Rural	-	-	-	-	-	-	-	-	-	-	-
CT	Total	4.4	3.9	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.4	2.4
	Urban	4.4	3.9	3.6	3.3	3.1	2.9	2.8	2.6	2.4	2.4	2.4
	Rural	-	-	-	-	-	-	-	-	-	-	-
AY	Total	4.7	4.2	3.8	3.5	3.3	3.1	3.0	2.8	2.7	2.6	2.6
	Urban	5.9	5.2	4.7	4.3	3.9	3.7	3.6	3.3	3.1	3.1	3.0
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9
SM	Total	1.4	1.4	1.4	1.3	1.1	0.8	0.6	0.4	0.3	0.2	0.2
	Urban	1.4	1.4	1.4	1.3	1.1	0.8	0.6	0.4	0.3	0.2	0.2
	Rural	-	-	-	-	-	-	-	-	-	-	-
ST	Total	3.6	3.5	3.5	3.4	3.3	3.1	2.9	2.8	2.7	2.6	2.5
	Urban	3.8	3.8	3.7	3.6	3.5	3.3	3.1	3.0	2.9	2.7	2.6
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9
AC	Total	5.5	5.4	5.4	5.3	5.1	5.0	4.8	4.7	4.6	4.5	4.4
	Urban	5.5	5.4	5.4	5.3	5.1	5.0	4.8	4.7	4.6	4.5	4.4
	Rural	-	-	-	-	-	-	-	-	-	-	-
SY	Total	0.6	0.6	0.6	0.6	0.7	0.8	0.9	0.7	0.9	1.3	1.3
	Urban	0.6	0.6	0.6	0.6	0.7	0.8	0.9	0.7	0.9	1.3	1.3
	Rural	-	-	-	-	-	-	-	-	-	-	-
IL	Total	3.8	3.4	3.1	2.9	2.6	2.4	2.3	2.1	2.0	1.9	1.9
	Urban	3.8	3.4	3.1	2.9	2.6	2.4	2.3	2.1	2.0	1.9	1.9
	Rural	-	-	-	-	-	-	-	-	-	-	-
SMT	Total	6.1	5.3	4.8	4.5	4.2	4.1	4.0	3.8	3.7	3.6	3.6
	Urban	7.9	6.8	6.1	5.5	5.2	4.9	4.8	4.6	4.4	4.3	4.2
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9
AP	Total	4.8	4.2	3.9	3.6	3.3	3.2	3.0	2.8	2.7	2.7	2.6
	Urban	4.8	4.2	3.9	3.6	3.3	3.2	3.0	2.8	2.7	2.7	2.6
	Rural	-	-	-	-	-	-	-	-	-	-	-
NJ	Total	2.2	2.1	2.0	1.8	1.6	1.4	1.2	1.0	0.9	0.8	0.8
	Urban	3.3	3.1	2.8	2.5	2.1	1.6	1.6	1.2	0.9	0.7	0.7
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9
TN	Total	3.5	3.2	2.9	2.7	2.5	2.3	2.1	1.9	1.8	1.7	1.7
	Urban	4.4	3.9	3.5	3.2	2.9	2.6	2.5	2.3	2.1	2.0	2.0
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9
Total	Total	2.6	2.5	2.4	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.5
	Urban	2.7	2.5	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.5
	Rural	1.3	1.2	1.2	1.2	1.2	1.2	0.9	0.9	0.9	0.9	0.9

Note: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador.

Table K-11: Population Growth Rate in the Country and AMSS (1999 – 2000)

Year	Urban area		Rural area		Total	
	Country	AMSS	Country	AMSS	Country	AMSS
1999-2000	2.6	2.7	1.3	1.3	2.1	2.6
2001-2005	2.3	2.3	1.2	1.2	1.8	2.2
2006-2010	2.0	1.6	0.9	0.9	1.6	1.6

Note: arranged by the Study Team on the basis of information from the municipalities and Dirección General de Estadística y Censos, Ministerio de Economíca, 1995, "Proyección de la Población de El Salvador," El Salvador

K.2.2 Assumption for Waste Amount and Composition Forecast

K.2.2.1 Waste Amount

Assumptions for the waste amount forecast are as follows.

- Waste generation ratio (---g/day/capita) is constant from present to future.
- The increase in numbers of establishments (such as offices, market and restaurant), their employees and/or other related parameters was obtained by assuming that it is proportional to the population growth from 1999 to 2010, and used to estimate the future waste generation from those establishments.

K.2.2.2 Waste Composition

If the life-style including dietary habits does not change to a length, waste composition in general might not change considerably. It is difficult to forecast that the life-style in AMSS be altered substantially in 10 years. Therefore, it is assumed that the waste composition till the target year 2010 be same that of today.

K.2.3 Waste Composition

K.2.3.1 Waste Composition (wet base)

Table K-12 shows composition of residential waste and Table K-13 shows of restaurant, other commercial, institutional, market and road sweeping wastes.

Table K-12: Composition of Residential Waste

Unit: %

Composition	High income	Middle income	Low income
Combustible	95.5	94.4	93.4
Food waste	59.5	57.6	66.0
Papers	18.5	13.0	13.1
Textiles	1.2	1.1	2.5
Grass, wood, bamboo	2.7	16.8	4.0
Plastics	12.1	5.8	7.8
Rubber, leather	1.5	0.1	0.0
Incombustible	4.5	5.6	6.6
Metals	1.3	1.1	1.2
Bottles, glass	1.3	2.6	3.7
Ceramics and soil	0.2	0.7	0.6
Others	1.7	1.2	1.1
Total	100.0	100.0	100.0

Table K-13: Composition of Commercial, Institutional, Market and Road Sweeping Wastes

Unit: %

Composition	Commercial		Institutional	Market	Road sweeping
	restaurant	Other			
Combustible	95.1	97.5	89.3	96.8	88.3
Food waste	62.2	6.4	19.0	78.1	2.6
Papers	22.1	63.1	35.0	9.5	6.4
Textiles	0.0	5.2	1.1	0.3	0.4
Grass, wood, bamboo	0.3	11.8	12.3	1.4	75.3
Plastics	10.2	10.6	20.5	7.2	3.6
Rubber, leather	0.3	0.4	1.4	0.3	0.0
Incombustible	4.9	2.5	10.7	3.2	11.7
Metals	0.7	1.3	0.5	0.4	0.1
Bottles, glass	2.4	0.3	4.6	0.8	0.3
Ceramics and soil	0.0	0.0	1.6	0.7	9.8
Others	1.8	0.9	4.0	1.3	1.5
Total	100.0	100.0	100.0	100.0	100.0

K.2.3.2 Moisture Content

Table K-14 shows moisture content of each category.

Table K-14: Moisture Content

Category		Moisture content (%)
Residential	High income	51.45
	Middle income	46.97
	Low income	46.61
Commercial	Restaurant	58.83
	Other	12.79
Institutional		19.19
Market		64.85
Road sweeping		16.60

K.2.3.3 Carbon and Nitrogen Content

Table K-15 shows carbon and nitrogen contents of residential (middle income), restaurant and market waste.

Table K-15: Carbon and Nitrogen Content

Category	Content (%)		C/N ratio
	Carbon	Nitrogen	
Residential *	42.74	2.81	15.2
Restaurant	45.16	3.52	12.8
Market	44.55	3.28	13.6

Note: * middle income

K.2.4 Waste Amount

Future waste generation amount is calculated based on the assumptions above.

K.2.4.1 Waste Generation Ratio

Waste generation ratio is show in Table K-16.

Table K-16: Waste Generation Ratio

Source		unit	Generation ratio
Household waste	High income	g/person/day	600
	Middle income		540
	Low income		420
Commercial waste	Restaurant	g/seat/day	466
	Others	g/employee/day	482
Institutional waste		g/employee/day	196
Market waste		g/stall/day	1,674
Street sweeping waste		g/m/day	198

K.2.4.2 Forecast Parameters

Parameters necessary for future waste amount forecast, except for street sweeping length, are set up assuming that they are on a proportional increase to the population growth. Forecast parameters in 2010 are listed in Table K-17.

Table K-17: Forecast Parameters in 2010

	Population				Commercial		Institutional waste	Market waste	Street sweeping waste
	Total	High income	Middle income	Low income	Restaurant	Others			
					Nos. of seat	Nos. of employee	Nos. of employee	Nos. of stall	km
San Salvador	512,873	155,606	117,858	239,409	20,253	51,173	93,374	23,429	324,769
Mejicanos	217,248	6,713	71,670	138,865	10,389	22,644	43,366	1,698	29,060
Delgado	180,727	5,837	23,314	151,576	8,960	21,989	23,509	532	15,036
Cuscatancingo	125,618	0	14,773	110,845	8,693	12,466	15,195	0	8,970
Ayutuxtepeque	43,005	4,270	19,369	19,366	1,287	3,811	10,473	317	2,660
San Marcos	76,106	0	20,488	55,618	3,782	5,548	6,569	515	7,010
Nueva San Salvador	197,690	48,039	126,304	23,347	7,143	17,029	41,170	3,288	43,080
Antiguo Cuscatlan	72,950	41,107	26,065	5,778	2,455	7,469	23,301	704	51,630
Soyapango	309,772	0	51,949	257,823	24,097	27,772	45,385	3,693	12,618
Ilopango	168,554	0	38,312	130,242	8,363	12,137	17,206	553	1,760
San Martin	129,365	0	26,636	102,729	12,794	13,915	14,681	4,644	1,700
Apopa	235,614	0	11,616	223,998	19,895	18,481	16,371	6,771	5,615
Nejapa	18,350	0	9,175	9,175	1,598	2,637	1,872	108	668
Tonacatepeque	39,509	0	19,755	19,754	1,815	5,525	17,234	197	3,225
Total	2,327,381	261,572	577,284	1,488,525	131,524	222,596	369,706	46,449	507,801

K.2.4.3 Future Waste Generation Amount

Table K-18 summarizes waste generation amount in 2010 calculated by incorporating the figures in Table K-16 and Table K-17.

Table K-18: Waste Generation Amount in 2010

Unit : ton/day

	Household	Restaurant	Other than restaurant	Institutional	Market	Road sweeping	Total
San Salvador	257.6	9.4	24.7	18.3	39.2	64.4	413.6
Mejicanos	101.0	4.8	10.9	8.5	2.8	5.8	133.8
Delgado	79.8	4.2	10.6	4.6	0.9	3.0	103.1
Cuscatancingo	54.6	4.1	6.0	3.0	0.0	1.8	69.5
Ayutuxtepeque	21.2	0.6	1.8	2.1	0.5	0.5	26.7
San Marcos	34.5	1.8	2.7	1.3	0.9	1.4	42.6
Nueva San Salvador	106.8	3.3	8.2	8.1	5.5	8.5	140.4
Antiguo Cuscatlan	41.2	1.1	3.6	4.6	1.2	10.2	61.9
Soyapango	136.4	11.2	13.4	8.9	6.2	2.5	178.6
Ilopango	75.4	3.9	5.9	3.4	0.9	0.3	89.8
San Martin	57.5	6.0	6.7	2.9	7.8	0.3	81.2
Apopa	100.4	9.3	8.9	3.2	11.3	1.1	134.2
Nejapa	8.9	0.7	1.3	0.4	0.2	0.1	11.6
Tonacatepeque	19.0	0.8	2.7	3.4	0.3	0.6	26.8
Total	1,094.3	61.2	107.4	72.7	77.7	100.5	1,513.8

K.2.5 Medical Waste

For the forecast of future medical waste generation, it is assumed that the total number of beds in AMSS increases in proportion to the increase rate of the urban population in AMSS, and that the medical waste generation as well increases in proportion to the number of beds. The table below shows the population increase rate until year 2010 (population in year 1999 given as 1.0).

Table K-19: Future Population Increase Rate

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
San Salvador	1.000	1.013	1.026	1.039	1.052	1.063	1.072	1.078	1.083	1.086	1.085	1.083
Mejicanos	1.000	1.023	1.044	1.065	1.085	1.103	1.119	1.132	1.144	1.154	1.164	1.173
Ciudad Delgado	1.000	1.026	1.052	1.076	1.098	1.119	1.138	1.155	1.170	1.184	1.197	1.210
Cuscatancingo	1.000	1.044	1.085	1.124	1.162	1.198	1.232	1.266	1.299	1.331	1.362	1.395
Ayutuxtepeque	1.000	1.059	1.114	1.167	1.216	1.264	1.311	1.358	1.403	1.447	1.491	1.536
San Marcos	1.000	1.014	1.027	1.041	1.054	1.066	1.075	1.081	1.086	1.089	1.091	1.093
Nueva San Salvador	1.000	1.038	1.077	1.117	1.158	1.198	1.237	1.276	1.314	1.351	1.389	1.425
Antigo Cuscatlan	1.000	1.055	1.112	1.172	1.234	1.298	1.362	1.428	1.496	1.564	1.634	1.706
Soyapango	1.000	1.006	1.012	1.018	1.024	1.031	1.039	1.048	1.055	1.064	1.078	1.092
Ilopango	1.000	1.038	1.073	1.106	1.138	1.168	1.196	1.224	1.250	1.274	1.298	1.323
San Martin	1.000	1.079	1.152	1.222	1.290	1.357	1.424	1.493	1.561	1.630	1.700	1.772
Apopa	1.000	1.048	1.092	1.135	1.175	1.215	1.253	1.291	1.328	1.364	1.400	1.437
Nejapa	1.000	1.033	1.065	1.095	1.122	1.146	1.164	1.182	1.196	1.207	1.215	1.223
Tonacatepeque	1.000	1.044	1.084	1.123	1.159	1.193	1.224	1.255	1.284	1.310	1.336	1.362
Total	1.000	1.027	1.053	1.078	1.103	1.126	1.148	1.170	1.189	1.208	1.227	1.245

The above table indicates that the urban population in 2010 will be 1.245 times of that in 1999. Therefore, it is forecast that the medical waste generation amount in 2010 will also be 1.245 times of that generated in 1999, whose amount was estimated after examining and comparing the Study's field investigation results carried out in 1999/2000 and MSPAS's data and information.

The medical waste generation amount in 1999 was estimated to be 3.2 ton/day as shown in the section of "Current Situation of Solid Waste Management".

Table K-20: Medical Waste Generation Amount in 1999

	Category	Generation ratio (kg/bed/day)	Generation amount (ton/day)
JICA field investigation	I	0.553	2.0
	II	0.676	0.7
	III	0.327	0.2
	Total	0.513	2.9
MSPAS	I	0.652	2.4
	II	0.699	0.7
	III	0.465	0.3
	Total	0.636	3.4
Average		**0.575**	**3.2**

Accordingly, medical waste generation amount from 2001 to 2010 is forecast based on the assumptions above (see the table below).

Table K-21: Forecast of Future Medical Waste Generation Amount

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Increase Rate	1.000	1.027	1.053	1.078	1.103	1.126	1.148	1.170	1.189	1.208	1.227	1.245
Amount (ton/day)	3.20	3.29	3.37	3.45	3.53	3.60	3.67	3.74	3.80	3.87	3.93	3.98

K.3 Other Pre-Conditions

K.3.1 Financial Conditions

K.3.1.1 Economic Growth Rate

Economic growth rate until year 2004 is forecast by FUSADES(Fundacion Salvadorena para el Desarrollo Economico y Sociales) for 3 scenario cases of for low, base and high growth (see the table below).

Table K-22: Forecast of Economic Growth Rate until 2004

Case	Model without Human Capital	Model with Human Capital
Low	4.2%	4.1%
Base	5.1%	5.0%
High	6.1 – 6.2%	6.0 – 6.1%

In paying attention to the above forecast, past 5 years national economic growth records (about 5.0%) and the recent global lower growth rate on average, the economic growth rate in this country is assumed to be 5.0% until year 2005 and 4.0% after that time for the analyses and examinations given by this study. Meanwhile, the growth rates of GRDP, municipal budget and household income in AMSS are estimated to be 0.5% above the GDP growth rate considering that the AMSS continues to receive localization of more weighted central functions of most production and consumption activities than other areas.

Table K-23: GRDP in San Salvador Metropolitan Area

	Unit	1999	2000	2001 to 2005	2006 to 2010
GDP growth rate	%	2.1%	3.5%	5.0%	4.0%
GRDP growth rate	%	2.6%	4.0%	5.5%	4.5%

Table K-24: GRDP in San Salvador Metropolitan Area

	Unit	1999	2000	2005	2010
GRDP	million colon in 1998 price	42,057	43,739	57,166	71,239
GRDP/capita *	US$	2,466	2,500	2,927	3,369

Note: * divided by total population of 14 municipalities

K.3.1.2 Financial Conditions

a. Financial Scale of Municipalities

Estimations on 14 municipal budgets are shown in the table below assuming that will be increased proportion to the GRDP growth rates estimated.

Table K-25: Financial Scale of Municipalities

Unit: 1000 colons in 1999 price

Year / City	1999	2005	2010
San Salvador	322,537	438,409	546,335
Mejicanos	15,227	20,697	25,793
Delgado	18,175	24,704	30,786
Cuscatancingo	13,016	17,692	22,047
Ayutuxtepeque	8,652	11,760	14,655
San Marcos	10,662	14,492	18,060
Nueva San Salvador	56,785	77,185	96,186
Antiguo Cuscatlan	21,265	28,904	36,020
Soyapango	40,332	54,821	68,317
Ilopango	12,970	17,629	21,969
San Martin	6,743	9,165	11,422
Apopa	13,994	19,021	23,704
Nejapa	8,554	11,627	14,489
Tonacatepeque	5,986	8,136	10,139

b. Prediction of Average Household Income

Household income in AMSS is predicted to grow in proportion to the growth rate of GRDP/capita (see the table below).

Table K-26: Prediction of Average Household Income

Unit: colones/year in 1999 price

Year / City	1999	2005	2010
San Salvador	76,110	96,464	116,518
Mejicanos	60,340	73,326	87,132
Delgado	46,901	56,018	65,671
Cuscatancingo	46,355	51,127	56,305
Ayutuxtepeque	57,500	59,629	63,414
San Marcos	50,212	63,506	77,849
Nueva San Salvador	81,776	89,867	97,201
Antiguo Cuscatlan *	149,969	149,625	148,945
Soyapango	56,757	74,265	88,016
Ilopango	47,871	54,386	61,306
San Martin	37,264	35,569	35,618
Apopa	40,705	44,151	47,985
Nejapa	32,089	37,459	44,432
Tonacatepeque	31,718	35,216	39,435

Note: * The increase rate of population is higher than that of GRDP.

c. Current Financial System of Municipalities

The status quo of municipal financial system is assessed as shown in the table below, based on the information received by the Team through inquiries and on the data forwarded by C/P.

Table K-27: Current Financial System of Municipality

	Separate accounting	Fee collection through CAESS/ DELSUR	Computerized DB for fee collection	Financial Analysis
San Salvador	Sufficient	Cleansing fee & S/L	Exist	Sufficient
Mejicanos	Not sufficient	S/L	Not sufficient	Not sufficient
Delgado	Sufficient	S/L	Not sufficient	Not sufficient
Cuscatancingo	Not sufficient	Cleansing fee	No	Not sufficient
Ayutuxtepeque	Not sufficient	S/L	Not sufficient	Not sufficient
San Marcos	Not sufficient	S/L	Not sufficient	Not sufficient
Nueva San Salvador	Sufficient	Cleansing fee & S/L	Not sufficient	Not sufficient
Antiguo Cuscatlan	Not sufficient	No	Not sufficient	Not sufficient
Soyapango	Sufficient	S/L	Exist	Sufficient
Ilopango	Sufficient	S/L	Not sufficient	Sufficient
San Martin	Not sufficient	No	Exist	Not sufficient
Apopa	Not sufficient	S/L	Not sufficient	Not sufficient
Nejapa	Sufficient	No	No	Not sufficient
Tonacatepeque	Not sufficient	No	No	Not sufficient