

Figure 2.1 Waste Reduction Method

The above method continued until the volume of the remaining waste was reduced to the amount designated for the waste composition analysis (20 to 30 liters). Then, the waste was loaded into a plastic bucket.

The plastic bucket containing the waste was tapped three times from a height of 30 centimeters to the ground, then the volume was measured visually and the weight by a platform balance.

The ASG (Apparent Specific Gravity) was calculated through the following formula.

$$ASG = \frac{\text{Weight of Waste (Kg)}}{\text{Volume of Waste (l)}}$$

After the ASG was measured, the waste underwent the composition survey.

Waste Composition Analysis

The procedure of the physical composition and chemical analysis is shown in Figure 2.2.

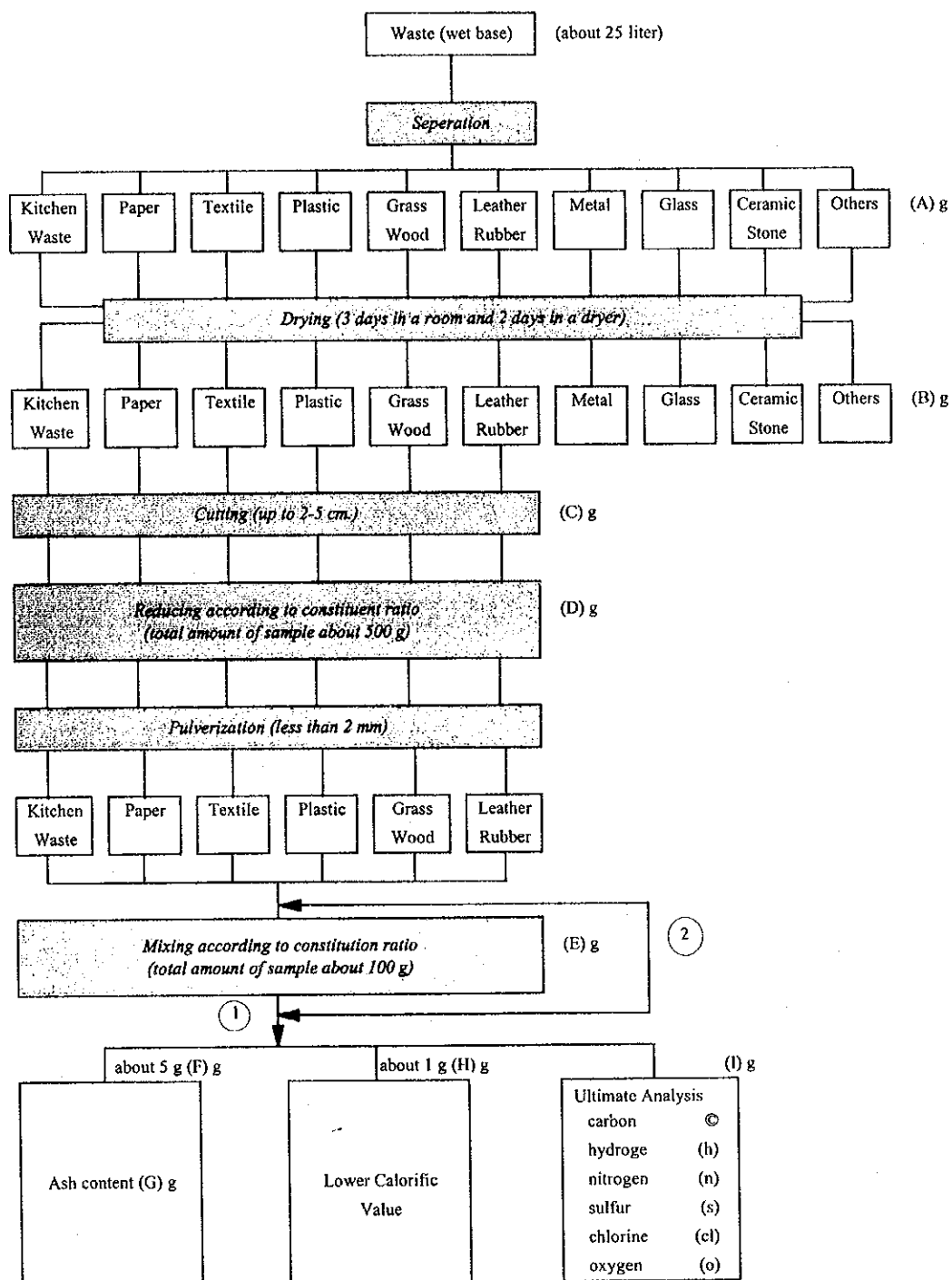


Figure 2.2 Procedure of Waste Composition Analysis

1) Physical composition

The physical composition was measured in wet base. The samples were divided into the following 10 items and weighed individually before they were dried.

1. kitchen waste
2. paper
3. textile
4. plastic
5. grass and wood
6. leather and rubber
7. metal
8. glass
9. ceramic and stone
10. other (soil, etc.)

After the samples are weighed, they usually undergo drying for three days in a room and two days in a dryer (105°C) before they are individually weighed again. The results of the physical composition are presented in percentages.

2) Moisture content(W)

Moisture content was calculated by the following formula.

$$\text{Moisture Content (\%)} = \frac{\text{Original Weight (A)} - \text{Dry Weight (B)}}{\text{Original Weight (A)}} \times 100$$

3) Chemical analysis

Chemical analysis and removal of combustibles were carried out after drying. The following are six samples of combustibles:

1. kitchen waste
2. paper
3. textile
4. plastic
5. grass and wood
6. leather and rubber

The combustible samples were cut into 2 to 5 mm pieces. The six samples were reduced in size until they totaled about 500 g in accordance with each constituent ratio. The combustible samples were pulverized into less than 2 mm in size by a cutting mill and then mixed together again prior to undergoing chemical analysis.

The following items underwent chemical analysis:

. Ash content (A)

Ashes resulting from the combustion of combustible materials and the following non-combustible items:

- metal
- glass
- ceramic and stone
- others

• Combustible content (B)

Combustible content was obtained by subtracting the weight of the ash from that of the combustible materials.

$$(B) = 100 - (W) - (A)$$

• Lower calorific value

Lower calorific value was obtained by combustion in a calorimeter bomb, measuring the increase in water temperature through a calorimetric vessel which surrounds the bomb.

$$HCV(wet) = HCV(dry) * \{ 100 - (Incombustible\ contents)\% - (W)\% \}$$

$$LCV(wet) = HCV(wet) - 6 \{ 9 * (h)\% + (W)\% \} * (H)$$

• Ultimate analysis

Ultimate analysis was carried out on the combustibles to check the following 6 items:

- carbon
- hydrogen
- nitrogen
- sulphur
- chlorine
- oxygen

2.3.3 Period and Schedule of the Survey

The survey was conducted during the dry season, from the 11th April to 23rd April 1997 and for rainy season, from 25th June to 2nd July 1997.

The schedule of the survey in both seasons is shown in Table 2.4.

Table 2.4 Survey Period of the WACS

Items	Survey Period					
	Quezon City		Makati		Parañaque	
	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season
Delivery of plastic bags and instruction papers	April 8 th	June 23 rd	April 11 th	June 23 rd	April 14 th	June 23 rd
Waste collection from each generation source	April 10 th - April 17 th	June 24 th - July 1 st	April 13 th - April 20 th	June 24 th - July 1 st	April 15 th - April 22 nd	June 24 th - July 1 st
Waste amount measurement and waste composition analysis	April 11 th - April 18 th	June 25 th - July 2 nd	April 14 th - April 21 st	June 25 th - July 2 nd	April 16 th - April 23 rd	June 25 th - July 2 nd

2.4 Results of the Survey

2.4.1 Waste amount

Household waste

A summary results of the waste amount survey in dry and rainy seasons are tabulated in Table 2.5. Generation rate of household waste are characterized as follows;

- There is not so big difference of rate between dry and rainy season.
- There is not big difference of rate among LGUs
- Generation rate in high income residential area was regularly highest, and generation rate in low income residential area was lowest.

The detailed results of the waste amount survey in dry and rainy season in Quezon City, Makati and Paranaque are shown in Annex A and B, in Chapter 1 in the Data Book, respectively.

Table 2.5 Summary Results of Generation Rate of Household Waste in Dry and Rainy Season
unit : g/person/day

Items	Quezon City		Makati		Paranaque		Average
	Dry	Rainy	Dry	Rainy	Dry	Rainy	
High Income	459	471	534	572	517	448	500
Middle Income	445	453	463	401	494	452	451
Low Income	400	344	352	327	305	337	344

- Quezon city

The waste generation rate, differs in accordance with the income levels both in dry and rainy seasons. The average generation ratio for high income was 465 g/person/day, middle income was 449 g/person/day and low income was 372 g/person/day.

- Makati

The waste generation ratio differs in accordance with the income levels in both seasons. The waste generation ratios in high income was 553 g/person/day, middle income was 432 g/person/day and low income was 340 g/person/day.

- Paranaque

As same as the results in Quezon city and Makati, the waste generation ratio in Paranaque differs in accordance with the income levels both in dry and rainy seasons. The average generation ratio for high income was 483 g/person/day, middle income was 473 g/person/day and low income was 321 g/person/day.

Commercial, institutional, market, street sweeping and river waste

A summary of the results of waste amount survey is tabulated in Table 2.6.

Table 2.6 Summary Results of Generation Rate of Household Waste in Dry and Rainy Season

Items	Unit	Quezon City		Makati		Paranaque		Average
		Dry	Rainy	Dry	Rainy	Dry	Rainy	
Commercial (Restaurant)	g/shop/day	9,807	20,760	42,307	41,157	8,471	5,407	21,318
Commercial (Other Shops)	g/shop/day	1,568	1,807	2,379	1,921	1,205	2,030	1,818
Institution	g/person/day	57	60	156	46	36	78	72
Market	g/shop/day	4,390	3,740	2,910	4,980	20,417	7,130	7,261
Street Sweeping	g/km/day	9,700	11,420	21,860	16,160	3,430	1,640	10,702
River	g/km/day	80,060	3,050	4,270	2,920	13,250	4,820	18,062

For commercial waste, the average generation rate in Makati is more than the other 2 cities in restaurant. The average generation ratio for commercial waste (restaurant) in Quezon City, Makati and Paranaque was 15,284 g/shop/day, 41,732 g/shop/day and 6,939 g/shop/day respectively.

The waste generation rate in commercial waste (other shops) in Quezon City, Makati and Paranaque was 1,688 g/shop/day, 2,150 g/shop/day and 1,618 g/shop/day respectively.

The reason why waste amount in commercial shop like restaurant may be different among sampling areas due to the selection of sampling points. It is quite difficult to select the samples with same conditions in each city such as floor area, no. of employees, popularity of the shop, etc..

Institutional waste among 3 areas are not so big difference. The waste generation ratio in institutional waste in Quezon City, Makati and Paranaque was 59 g/person/day, 101 g/person/day and 57 g/person/day respectively.

As same as the results in dry season, the average generation rate for market waste in rainy season in Paranaque is more than in Quezon City and Makati. The average generation rate for market waste in Paranaque was 13,774 g/shop/day while in Quezon City was 4,065 g/shop/day and Makati was 3,945 g/shop/day.

For street sweeping waste, the average generation rate in Makati in rainy season is more than the other 2 cities as same as the result of dry season. The average generation rate in Makati for street sweeping waste was 19,010 g/km/day while the average generation ratios in Quezon City and Paranaque were 10,560 g/km/day and 2,535 g/km/day respectively.

For river waste in rainy season, the average generation in Quezon is more Makati and Paranaque. The average generation ratio of river waste in Quezon was 41,555 g/km/day while in Makati was 3,595 g/km/day and 9,035 g/km/day in Paranaque.

2.4.2 Waste Composition Dry Season

The detail results of the waste composition survey in Quezon City, Makati and Paranaque in dry season are shown in Annex A in Chapter 1 in the Data Book.

Physical composition

(1) Household waste

- Quezon city

The results of the waste composition survey in Quezon City in dry season are tabulated in Table 2.7.

The characteristics of the composition of the household waste in Quezon City are described as follows;

- The kitchen waste occupies the largest percentage of the composition in dry season in all income residences. Kitchen waste was about 45%, 53% and 43% in high income, middle income and low income respectively. Meanwhile, paper, plastic and garden waste, which consists of grass/wood and others, occupies the large percentage in all income residences.
- The other remaining components such as textile, leather and rubber, metal and ceramic and stone occupy almost similar amount in all income levels.

- Makati

The results of the waste composition survey in Makati in dry season are tabulated in Table 2.8.

The characteristics of the composition of the household waste in Makati are described as follows;

- The kitchen waste in dry season occupies the largest percentage of the composition about 64% and 43% in middle income and low income residences respectively. Meanwhile, garden waste, which consists of grass/wood and others (soil, etc.) are normally generated by cleaning work, occupy the largest percentage component in high income (36%) while the second largest percentage is kitchen waste (32%). At the same time, plastic occupies the large percentage in high income, middle income and low income residences for 11%, 15% and 18% respectively.
- The paper occupies a larger percentage of the composition in high income residences than in middle income and low income ones.

- Paranaque

The results of the waste composition survey in Paranaque in dry season are shown in Table 2.9.

The characteristics of the composition of the household waste in Paranaque are described as follows;

- The kitchen waste occupies the largest percentage of the composition in high income, middle income and low income residences about 47%, 54% and 49% in dry season respectively.
- Paper and plastic components occupy the large percentage in all income levels. The percentage of paper composition in high income, middle income and low income residences is 15%, 15% and 9% respectively. While the percentage of plastic is 12%, 14% and 20% in high income, middle income and low income households.
- The grass/wood occupies about 6% of the waste in high income residences while in middle income and low income levels is only 1% and 3% respectively.

(2) Commercial waste

The characteristics of the composition of the commercial waste in each city are as follows:

- Quezon city
 - Kitchen waste in dry season occupies the highest percentage about 54% of waste in restaurant while paper shares the second largest part (14%).
 - In other shop waste, kitchen waste occupies about 11% of total waste composition. Paper component occupies about 42% which is the largest percentage.
- Makati
 - Kitchen waste occupies about 58% of waste in restaurant in dry season while the second largest percentage is paper component (16%).
 - Kitchen waste also occupies the largest component about 35% in other shops while plastic and paper occupy 19% and 13% respectively.
- Paranaque
 - Kitchen waste in dry season occupies about 60% of waste in restaurant while the second largest percentage is plastic component (14%).
 - Kitchen waste also occupies the largest amount about 37% of waste in other shops in dry season while paper shares the second largest percentage about 21%.

(3) Other wastes

The characteristics of the composition of other waste in each city are summarized as follows:

- Quezon city
 - Paper occupies the largest share about 45% in dry season in institutional waste while kitchen waste occupies the largest percentage (64%) in market waste.
 - In street sweeping waste, the largest percentage of waste composition is grass and wood (38%) while the largest percentage in river waste is plastic component (84%).
- Makati
 - Paper occupies about 46% in dry season for institutional waste.
 - Kitchen waste and paper components occupy 61% and 19% in market waste in dry season respectively.

- Plastic is the largest component for river waste which shares about 59%.
- Paranaque
 - Paper occupies about 42% in dry season in institutional waste.
 - Kitchen waste, paper occupy 63% and 17% in market waste respectively.
 - Grass/wood occupies the largest percentage of street sweeping waste about 81%.

Apparent specific gravity (ASG)

- Quezon city
ASG of household waste, restaurant and market in dry season was 0.16, 0.15 and 0.31 kg/l.
ASG of institutional waste and other shops was the same at 0.05 kg/l.
- Makati
ASG of household waste, restaurant and market was 0.19, 0.28 and 0.37 kg/l respectively.
ASG of institutional waste was 0.09 kg/l while for street sweeping waste and river waste was 0.31 and 0.25 kg/l respectively.
- Paranaque
ASG of household waste, restaurant and market was 0.17, 0.24 and 0.30 kg/l respectively.
ASG of institutional waste was 0.04 kg/l. For other shops waste, ASG was 0.09 kg/l and 0.13 kg/l for street sweeping waste.

Table 2.7 Results of Waste Composition Survey (Dry Season) in Quezon

Table 2.7 Results of Waste Composition Survey (Dry Season) in Quezon													
Classification			Household					Commercial		Institution	Market	Street Sweeping	River
			High Inc.	Middle Inc.	Low Inc.	Average	Restaurant	Others					
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.17	0.15	0.16	0.16	0.15	0.05	0.05	0.31	0.14	0.27	
	Kitchen waste	(%)	45.32	53.48	43.38	47.39	54.66	11.93	29.68	64.61	2.08	0.35	
	Paper	(%)	12.77	12.32	14.11	13.07	14.75	42.81	45.02	11.36	6.63	1.18	
	Textile	(%)	6.41	3.10	5.95	5.15	2.37	4.56	0.40	2.33	6.15	4.56	
	Plastic	(%)	13.36	11.61	10.09	11.69	9.25	18.77	15.14	10.24	10.95	84.23	
	Grass and wood	(%)	9.75	11.96	15.71	12.47	7.46	1.23	1.39	7.53	38.99	6.85	
	Leather and rubber	(%)	0.80	0.14	0.11	0.35	0.00	0.18	0.00	0.86	0.36	0.28	
	Sub-total	(%)	88.41	92.61	89.35	90.12	88.49	79.48	91.63	96.93	65.16	97.45	
	Metal	(%)	4.71	4.93	4.91	4.85	9.31	4.39	5.58	0.83	2.24	0.83	
	Glass	(%)	4.66	0.63	1.93	2.41	0.75	15.44	0.00	1.60	1.28	1.73	
Incombustibles	Ceramic and stone	(%)	2.07	1.41	2.76	2.08	1.39	0.35	2.39	0.61	9.43	0.00	
	Others (soil, etc.)	(%)	0.14	0.42	1.05	0.54	0.06	0.35	0.40	0.03	21.89	0.00	
	Sub-total	(%)	11.58	7.39	10.65	9.87	11.51	20.53	8.37	3.07	34.84	2.56	
	Total	(%)	99.99	100.00	100.00	100.00	100.00	100.01	100.00	100.00	100.00	100.01	
Chemical Analysis	Combustibles	(%)	44.77	37.48	53.77	45.34	42.43	83.21	61.28	36.50	69.80	40.75	
	Moisture	(%)	43.84	56.95	34.40	45.06	43.47	9.70	33.08	56.48	19.78	52.90	
	Ash	(%)	11.39	5.57	11.83	9.60	14.10	7.09	5.64	7.02	10.42	6.35	
	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
	Carbon	(%)	11.01	13.30	13.95	12.75	12.62	31.67	23.99	11.99	8.60	11.83	
	Hydrogen	(%)	1.60	1.94	2.04	1.86	1.83	4.39	3.60	1.41	1.10	1.86	
	Nitrogen	(%)	0.36	0.87	0.44	0.56	0.50	1.25	0.28	0.53	0.16	0.38	
	Sulphur	(%)	0.13	0.00	0.03	0.05	0.04	0.01	0.09	0.07	0.05	0.08	
	Chlorine	(%)	0.36	1.08	0.38	0.61	0.20	0.82	1.39	0.20	0.31	0.49	
	Oxygen	(%)	31.31	20.29	36.93	29.51	26.97	45.71	31.67	22.20	59.59	26.10	
Total	(%)	44.77	37.48	53.77	45.34	42.16	83.85	61.02	36.40	69.81	40.74		
Lower Calorific Value (LCV)		(kcal/kg)	1,655	1,172	1,459	1,429	1,251	3,891	2,274	1,289	2,202	2,671	
C/N Ratio		-	30.58	15.29	31.70	22.91	25.24	25.34	85.68	22.62	53.75	31.13	

Table 2.8 Results of Waste Composition Survey (Dry Season) in Makati

Classification		Kg/l	Household				Average	Commercial		Institution	Market	Street Sweeping	River
			High Inc.	Middle Inc.	Low Inc.			Restaurant	Others				
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)		0.17	0.19	0.21		0.19	0.28	0.11	0.09	0.37	0.31	0.25
	Kitchen waste	(%)	32.71	64.67	43.69		47.02	58.80	35.31	12.88	61.84	28.16	10.28
	Paper	(%)	14.89	6.68	7.60		9.72	16.13	13.78	46.99	16.86	19.68	0.93
	Textile	(%)	0.91	1.46	7.00		3.12	0.00	0.71	0.41	1.02	1.97	1.60
	Plastic	(%)	11.06	15.81	18.71		15.19	13.43	19.08	12.60	15.87	12.67	59.08
	Grass and wood	(%)	36.59	3.91	4.64		15.05	3.61	3.25	1.37	2.59	16.80	25.57
	Leather and rubber	(%)	0.05	0.05	2.23		0.78	0.53	0.08	0.00	0.02	0.82	2.54
	Sub-total	(%)	96.21	92.58	83.87		90.89	92.50	72.21	74.25	98.20	80.10	100.00
	Metal	(%)	1.58	5.22	4.12		3.64	3.96	7.52	5.75	0.97	0.36	0.00
	Glass	(%)	1.92	0.16	5.02		2.37	3.37	18.61	5.75	0.29	1.22	0.00
Incombustibles	Ceramic and stone	(%)	0.24	1.98	2.32		1.51	0.00	1.11	0.41	0.53	3.10	0.00
	Others (soil, etc.)	(%)	0.05	0.05	4.68		1.59	0.18	0.55	13.84	0.00	15.22	0.00
	Sub-total	(%)	3.79	7.41	16.14		9.11	7.51	27.79	25.75	1.79	19.90	0.00
	Total	(%)	100.00	100.00	100.01		100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Combustibles	(%)	37.42	38.26	52.26		42.65	37.71	58.96	72.58	32.82	49.71	26.72
Three contents	Moisture	(%)	55.43	53.31	39.70		49.48	54.58	34.18	19.47	61.08	37.63	68.38
	Ash	(%)	7.15	8.43	8.04		7.87	7.71	6.86	7.95	6.10	12.66	4.90
Chemical Analysis	Total	(%)	100.00	100.00	100.00		100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Carbon	(%)	12.56	9.28	15.36		12.40	9.71	19.42	22.27	14.56	14.98	12.97
	Hydrogen	(%)	1.67	1.31	1.76		1.58	1.38	3.18	3.01	1.70	1.92	1.87
	Nitrogen	(%)	0.39	0.33	0.39		0.37	0.59	0.72	0.59	0.53	0.15	0.57
	Sulphur	(%)	0.03	0.02	0.08		0.04	0.05	0.05	0.09	0.06	0.02	0.04
	Chlorine	(%)	0.14	0.20	0.46		0.27	0.13	0.16	0.21	0.18	0.18	0.24
	Oxygen	(%)	22.64	27.12	34.22		27.99	25.74	35.49	46.49	15.64	32.45	11.03
	Total	(%)	37.43	38.26	52.27		42.65	37.60	59.02	72.66	32.67	49.70	26.72
	Lower Calorific Value (LCV)	(kcal/kg)	1,069	1,270	1,789		1,376	1,364	1,531	3,012	1,441	1,488	1,425
	C/N Ratio	-	32.21	28.12	39.38		33.51	16.46	26.97	37.75	27.47	99.87	22.75

Table 2.9 Results of Waste Composition Survey (Dry Season) in Paranaque

Table 2.9 Results of Waste Composition Survey (Dry Season) in Paranaque													
Classification			Household				Commercial		Institution	Market	Street Sweeping	River	
			High Inc.	Middle Inc.	Low Inc.	Average	Restaurant	Others					
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)		Kg/l	0.17	0.19	0.15	0.17	0.24	0.09	0.04	0.30	0.13	0.18
	Combustibles	Kitchen waste	(%)	47.56	54.94	47.43	49.98	60.19	37.62	20.78	63.78	0.10	15.08
		Paper	(%)	15.43	15.91	9.73	13.69	9.86	21.92	42.72	17.09	2.77	3.31
		Textile	(%)	0.37	1.76	4.53	2.22	2.62	10.57	0.78	0.89	2.77	6.71
		Plastic	(%)	12.74	14.49	20.13	15.79	14.42	11.12	19.81	11.05	4.30	59.73
		Grass and wood	(%)	6.09	1.63	3.64	3.79	4.78	0.87	3.30	3.02	81.25	3.11
		Leather and rubber	(%)	2.09	0.04	0.00	0.71	0.00	0.00	1.17	0.00	0.82	7.59
		Sub-total	(%)	84.28	88.77	85.46	86.17	91.87	82.10	88.56	95.83	92.01	95.53
	Incombustibles	Metal	(%)	6.46	4.10	6.04	5.53	5.54	5.99	4.47	2.17	2.05	2.72
		Glass	(%)	9.02	5.74	7.27	7.34	2.41	9.07	0.00	1.79	1.13	0.78
Ceramic and stone		(%)	0.05	0.67	0.73	0.48	0.00	2.84	0.39	0.21	0.72	0.00	
Others (soil, etc.)		(%)	0.19	0.71	0.50	0.47	0.17	0.00	6.60	0.00	4.10	0.97	
Sub-total		(%)	15.72	11.22	14.54	13.83	8.12	17.90	11.46	4.17	8.00	4.47	
Total		(%)	100.00	99.99	100.00	100.00	99.99	100.00	100.02	100.00	100.01	100.00	
Chemical Analysis	Combustibles		(%)	54.85	40.44	55.75	50.35	35.12	45.21	60.97	43.72	36.64	28.81
	Three contents	Moisture	(%)	36.41	52.49	36.45	41.78	59.87	49.41	33.57	49.13	39.55	65.79
		Ash	(%)	8.74	7.07	7.80	7.87	5.01	5.38	5.45	7.16	23.81	5.40
		Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Ultimate analysis of combustibles	Carbon	(%)	12.27	9.35	12.31	11.31	11.61	17.34	20.29	10.67	13.48	8.95
		Hydrogen	(%)	1.62	1.47	1.91	1.67	1.87	2.76	2.94	1.38	2.23	1.38
		Nitrogen	(%)	0.59	0.50	0.62	0.57	0.55	0.86	0.48	0.51	0.23	0.34
		Sulphur	(%)	0.05	0.11	0.13	0.10	0.00	0.04	0.05	0.00	0.01	0.02
		Chlorine	(%)	0.46	0.24	0.18	0.29	0.26	0.26	0.20	0.21	0.14	0.18
		Oxygen	(%)	39.87	28.77	40.61	36.42	20.83	23.95	37.02	30.96	20.55	17.96
Total		(%)	54.86	40.44	55.76	50.35	35.12	45.21	60.98	43.73	36.64	28.83	
Lower Calorific Value (LCV)		(kcal/kg)	1,741	1,017	2,126	1,628	1,086	1,226	2,373	1,616	1,112	1,147	
C/N Ratio		-	20.80	18.70	19.85	19.84	21.11	20.16	42.27	20.92	58.61	26.32	

2.4.3 Waste Composition Rainy Season

The detail results of the waste composition survey in Quezon City, Makati and Paranaque in rainy season are shown in Annex B in Chapter 1 in the Data Book.

Physical composition

1) Household waste

Physical composition of household waste are characterized as follows;

- A big difference of physical composition was not recognized between dry and rainy seasons.
- Composition ratio of paper in high income residential area was higher than low income. Otherwise textile and plastic contents in high income were lower than low income.
- Other physical compositions were not recognized typical difference among incoming level.

- Quezon city

The results of the waste composition survey in Quezon city in rainy season are tabulated in Table 2.10.

The characteristics of the composition of the household waste in Quezon city are described as follows;

- The kitchen waste occupies the largest percentage of the composition in rainy season in all income residences. Kitchen waste was about 45%, 48% and 43% in high income, middle income and low income respectively. Meanwhile, paper and plastic occupy the large percentage in all income residences as same as the result in dry season.
- The results of waste composition in rainy season as same as the dry season for the other remaining components such as textile, leather and rubber, metal and ceramic and stone occupy almost similar amount in all income levels.

- Makati

The results of the waste composition survey in Makati in rainy season are tabulated in Table 2.11.

The characteristics of the composition of the household waste in Makati are described as follows;

- Almost same as the results in dry season, the kitchen waste in rainy season occupies the largest percentage of the composition about 39% and 35% in middle income and low income residences respectively. Meanwhile, garden waste, which consists of grass/wood and others (soil, etc.) are normally generated by cleaning work, occupy the largest percentage component in high income (30%) while the second largest percentage is kitchen waste (24%). At the same time, paper and plastic occupied the large percentage in all income residences.

- Paranaque

The results of the waste composition survey in Paranaque in rainy season are shown in Table 2.12. The characteristics of the composition of the household waste in Paranaque are described as follows;

- The kitchen waste occupies the largest percentage of the composition in high income, middle income and low income residences about 56%, 38% and 39% in rainy season respectively.
- Paper and plastic components occupy the large percentage in all income levels. The percentage of paper composition in high income, middle income and low income residences is 17%, 19% and 20% respectively. While the percentage of plastic is 11%, 12% and 20% in high income, middle income and low income households.
- The metal occupies about 4% of the waste in high income residences while in middle income and low income levels is 14% and 4% respectively.
- Commercial waste

The characteristics of the composition of the commercial waste in each area in rainy season are as follows:

- Quezon city

- Kitchen waste in rainy season occupies the highest percentage about 49% of waste in restaurant while paper shares the second largest part (19%) and plastic occupies about 16%.
- In other shop waste, paper occupies the largest percentage about 34% of total waste composition. Kitchen waste takes the second biggest share about 30%.

- Makati

- Kitchen waste occupies about 51% of waste in restaurant in rainy season while the second largest percentage is paper component (27%).
- On the other hand, paper occupies the largest component about 26% in other shops while kitchen waste shares the second largest part (24%).

- Paranaque

- Kitchen waste in rainy season occupies about 53% of waste in restaurant while the second largest percentage is plastic component (26%).
- Kitchen waste also occupies the largest amount about 45% of waste in other shops in rainy season while paper shares the second largest percentage about 24%.

2) Other wastes

The characteristics of the composition of other waste in rainy season in each area are summarized as follows:

- Quezon city

- Paper occupies the largest share about 51% in rainy season in institutional waste while kitchen waste occupies the largest percentage (61%) in market waste.
- In street sweeping waste, the largest percentage of waste composition is others (55%). The largest percentage in river waste in rainy season is paper component (27%) while plastic which occupied the largest percentage of waste composition in dry season (84%) takes the second largest share in rainy season (26%)

- Makati

- Paper occupies about 42% in rainy season for institutional waste while the kitchen waste shares about 20%.

- Kitchen waste and paper components occupy 43% and 20% in market waste in rainy season respectively.
- Grass and wood is the largest component for river waste in rainy season which shares about 32%.
- Paranaque
 - Paper occupies about 53% in rainy season in institutional waste.
 - Kitchen waste, paper occupy 51% and 17% in market waste respectively.
 - Grass/wood and kitchen waste occupies the largest composition of street sweeping waste at the same percentage about 27%.

Apparent specific gravity (ASG)

- Quezon city

ASG of household waste, restaurant and market in rainy season was 0.18, 0.21 and 0.32 kg/l. ASG of institutional waste and other shops was the same at 0.08 kg/l.

- Makati

ASG of household waste, restaurant and market in rainy season was 0.16, 0.26 and 0.34 kg/l respectively. ASG of institutional waste was 0.07 kg/l while for street sweeping waste and river waste was 0.30 and 0.28 kg/l respectively.

- Paranaque

ASG of household waste, restaurant and market in rainy season was 0.24, 0.23 and 0.37 kg/l. ASG of institutional waste and other shops was 0.07 kg/l and 0.12 kg/l respectively.

Table 2.10 Results of Waste Composition Survey (Rainy Season) in Quezon

Classification		Household					Commercial		Institution	Market	Street Sweeping	River
		High Inc.	Middle Inc.	Low Inc.	Average		Restaurant	Others				
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.18	0.20	0.16	0.18	0.21	0.08	0.08	0.32	0.19	0.20
	Kitchen waste	(%)	45.70	48.21	43.03	45.65	49.50	30.50	22.84	61.49	0.00	9.89
	Paper	(%)	25.78	15.71	16.78	19.42	16.77	34.52	51.54	9.33	2.77	27.00
	Textile	(%)	0.90	2.97	3.16	2.34	0.14	6.42	0.00	1.87	0.92	9.71
	Plastic	(%)	11.43	19.52	18.07	16.34	18.07	18.35	19.77	12.10	3.04	26.76
	Grass and wood	(%)	2.06	4.87	7.51	4.81	3.26	3.56	2.34	12.36	34.35	11.80
	Leather and rubber	(%)	2.24	1.11	1.92	1.76	0.04	0.80	0.00	1.01	0.00	2.56
	Sub-total	(%)	88.11	92.39	90.47	90.32	87.78	94.15	96.49	98.16	41.08	87.72
	Metal	(%)	5.16	3.45	5.59	4.73	6.97	4.59	3.51	0.41	1.19	10.13
	Glass	(%)	4.89	0.40	1.04	2.11	4.13	0.00	0.00	0.79	0.00	0.00
	Ceramic and stone	(%)	1.39	1.06	0.67	1.04	0.77	0.00	0.00	0.64	2.25	0.00
	Others (soil, etc.)	(%)	0.45	2.70	2.23	1.79	0.35	1.26	0.00	0.00	55.48	2.15
Chemical Analysis	Sub-total	(%)	11.89	7.61	9.53	9.68	12.22	5.85	3.51	1.84	58.92	12.28
	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Combustibles	(%)	49.18	46.40	44.67	46.18	55.61	54.36	56.01	50.66	56.83	40.25
	Moisture	(%)	40.19	44.78	46.02	44.55	36.97	39.09	38.11	40.81	27.58	51.13
	Ash	(%)	10.63	8.82	9.31	9.27	7.42	6.55	5.88	8.53	15.59	8.62
	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Carbon	(%)	14.16	18.35	20.51	18.52	16.44	25.26	25.86	22.54	16.03	19.88
	Hydrogen	(%)	2.09	2.79	3.01	2.77	2.27	3.39	4.06	3.48	2.37	2.93
	Nitrogen	(%)	0.12	0.62	0.41	0.47	0.44	0.47	0.23	0.40	0.32	0.27
	Sulphur	(%)	0.04	0.09	0.06	0.07	0.03	0.06	0.11	0.12	0.06	0.03
	Chlorine	(%)	0.17	0.39	0.36	0.35	0.17	2.81	0.24	0.42	0.23	0.35
	Oxygen	(%)	32.60	24.16	20.32	24.00	36.26	22.37	25.51	23.70	37.82	16.79
	Total	(%)	49.18	46.40	44.67	46.18	55.61	54.36	56.01	50.66	56.83	40.25
Lower Calorific Value (LCV)		(kcal/kg)	1,845	1,883	2,172	1,984	1,794	2,296	2,157	2,518	2,919	1,641
C/N Ratio		-	118.00	29.60	50.02	39.40	37.36	53.74	112.43	56.35	50.09	73.63

Table 2.1) Results of Waste Composition Survey (Rainy Season) in Makati

Classification			Household					Commercial		Institution	Market	Street Sweeping	River
			High Inc.	Middle Inc.	Low Inc.	Average	Restaurant	Others					
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.18	0.15	0.16	0.16	0.16	0.26	0.08	0.07	0.34	0.30	0.28
	Kitchen waste	(%)	24.28	39.84	35.43	33.18	51.12	24.65	20.75	43.95	18.36	13.63	
	Paper	(%)	19.16	24.81	14.23	19.40	27.84	26.50	42.79	20.34	31.36	2.94	
	Textile	(%)	0.28	5.56	16.17	7.34	0.36	1.96	1.30	3.76	3.82	0.76	
	Plastic	(%)	10.48	19.21	15.38	15.02	10.53	18.97	14.10	18.80	16.19	31.00	
	Grass and wood	(%)	30.97	2.17	8.56	13.90	5.87	2.40	3.24	8.24	11.89	32.09	
	Leather and rubber	(%)	0.28	0.11	1.52	0.64	0.00	2.29	1.30	0.59	1.69	15.23	
	Sub-total	(%)	85.45	91.70	91.29	89.48	95.72	76.77	83.48	95.68	83.31	95.65	
	Metal	(%)	2.13	5.93	4.46	4.17	2.90	5.89	7.62	0.98	1.08	2.54	
	Glass	(%)	1.80	2.06	1.00	1.62	1.01	15.16	6.48	0.56	0.51	1.16	
	Ceramic and stone	(%)	3.56	0.21	2.15	1.97	0.36	0.22	1.78	0.46	8.25	0.11	
	Others (soil, etc.)	(%)	7.06	0.11	1.10	2.76	0.00	1.96	0.65	2.32	6.85	0.54	
Sub-total	(%)	14.55	8.31	8.71	10.52	4.27	23.23	16.53	4.32	16.69	4.35		
Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.01	100.00	100.00	100.00		
Three contents	Combustibles	(%)	37.53	53.80	43.38	47.5	40.79	61.99	50.19	39.12	45.49	36.40	
	Moisture	(%)	52.72	39.30	49.56	45.11	54.41	29.62	41.29	53.52	37.29	55.86	
	Ash	(%)	9.75	6.90	7.06	7.39	4.80	8.39	8.52	7.36	17.22	7.74	
	Total	(%)	100.00	100.00	100.00	100	100.00	100.00	100.00	100.00	100.00	100.00	
Chemical Analysis	Carbon	(%)	13.72	19.14	14.18	16.49	16.65	20.51	21.49	16.52	12.92	16.88	
	Hydrogen	(%)	2.08	2.84	2.26	2.51	2.66	3.04	3.11	2.33	1.66	2.29	
	Nitrogen	(%)	0.59	0.52	0.75	0.62	0.47	0.50	0.32	0.64	0.14	0.18	
	Sulphur	(%)	0.02	0.03	0.11	0.06	0.01	0.07	0.07	0.19	0.06	0.05	
	Chlorine	(%)	0.18	0.23	0.24	0.23	0.26	1.07	0.20	0.34	0.17	0.20	
	Oxygen	(%)	20.94	31.04	25.84	27.59	20.74	36.80	25.00	19.1	30.54	16.80	
	Total	(%)	37.53	53.80	43.38	47.5	40.79	61.99	50.19	39.12	45.49	36.40	
	Lower Calorific Value (LCV)	(kcal/kg)	1,263	2,526	1,620	2,001	1,727	2,425	1,665	1,261	978	1,893	
C/N Ratio	-	23.25	36.81	18.91	26.60	35.43	41.02	67.16	25.81	92.29	93.78		

Table 2.12 Results of Waste Composition Survey (Rainy Season) in Paranaque

Classification			Household					Commercial		Institution	Market	Street Sweeping	River
			High Inc.	Middle Inc.	Low Inc.	Average	Restaurant	Others					
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.29	0.23	0.21	0.24	0.23	0.12	0.07	0.37	0.29	0.20	
		(%)	56.24	38.70	39.08	44.67	53.14	45.05	13.55	51.54	27.02	31.99	
	Combustibles	Paper	(%)	17.70	19.96	20.44	19.37	7.73	24.16	53.70	17.71	18.80	11.20
		Textile	(%)	2.01	1.69	7.48	3.73	0.85	1.79	8.16	0.68	3.80	3.23
		Plastic	(%)	11.65	12.84	20.69	15.06	26.95	16.68	14.05	13.14	8.59	30.20
		Grass and wood	(%)	3.59	6.97	3.76	4.77	0.39	0.39	2.63	12.33	27.22	6.63
		Leather and rubber	(%)	2.58	0.84	0.99	1.47	0.04	2.03	1.63	0.65	0.06	0.09
		Sub-total	(%)	93.77	81.00	92.44	89.07	89.10	90.10	93.72	96.05	85.49	83.34
	Incombustibles	Metal	(%)	4.10	14.45	4.38	7.64	6.92	3.74	2.38	2.68	0.93	5.73
		Glass	(%)	1.97	2.09	3.18	2.41	3.83	5.30	0.63	0.32	1.25	0.00
		Ceramic and stone	(%)	0.04	1.43	0.00	0.49	0.15	0.86	0.13	0.92	0.81	1.25
		Others (soil, etc.)	(%)	0.12	1.03	0.00	0.38	0.00	0.00	3.14	0.03	11.52	9.68
Chemical Analysis	Sub-total	(%)	6.23	19.00	7.56	10.93	10.90	9.90	6.28	3.95	14.51	16.66	
		Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Three contents	Combustibles	(%)	44.43	43.05	47.00	44.72	42.65	45.97	55.13	34.95	41.81	32.14
		Moisture	(%)	48.79	45.72	46.07	46.31	43.90	43.02	30.46	54.33	38.01	57.86
		Ash	(%)	6.78	11.23	6.93	8.97	13.45	11.01	14.41	10.72	20.18	10.00
	Ultimate analysis of combustibles	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
		Carbon	(%)	22.60	15.81	20.46	18.55	14.77	18.58	28.98	17.40	15.42	19.90
		Hydrogen	(%)	3.07	2.31	2.87	2.63	2.27	2.83	4.41	2.24	2.29	2.94
		Nitrogen	(%)	0.41	0.88	0.53	0.68	0.38	0.20	0.46	0.46	0.23	0.36
		Sulphur	(%)	0.05	0.10	0.04	0.07	0.04	0.09	0.00	0.04	0.07	0.13
		Chlorine	(%)	0.28	0.13	0.23	0.19	0.11	0.38	1.06	0.21	0.18	1.20
		Oxygen	(%)	18.02	23.82	22.87	22.60	25.08	23.88	20.22	14.60	23.62	7.61
Total		(%)	44.43	43.05	47.00	44.72	42.65	45.96	55.13	34.95	41.81	32.14	
Lower Calorific Value (LCV)	(kcal/kg)	2,038	1,786	1,758	1,861	1,089	1,496	2,343	1,615	2,027	1,368		
C/N Ratio		55.12	17.97	38.60	27.28	38.87	92.90	63.00	37.83	67.04	55.28		

2.5 Findings of the Survey

2.5.1 Waste amount

Generation ratio

1) Household waste

- Population by income level

As mentioned in Progress Report (1), the Study Team set up the population ratio by income level according to the data from National Statistics Office (NSO) for this study as follows:

Income Level	Percentage of Families by Income Class
High Income	15%
Middle Income	48%
Low Income	37%

- Generation ratio obtained from WACS

Generation ratio obtained from WACS both in dry and rainy seasons is tabulated in Table 2.13. The Study Team decided to use the average data of 3 areas to apply for all Metro Manila because it seem to be more representative data.

Table 2.13 : Generation Ratio of Household Waste Obtained from WACS both in Dry and Rainy Season

unit : g/person/day

Items	Quezon City		Makati		Paranaque		Average
	Dry	Rainy	Dry	Rainy	Dry	Rainy	
High Income	459	471	534	572	517	448	500
Middle Income	445	453	463	401	494	452	451
Low Income	400	344	352	327	305	337	344

A weighted average of generation ratio in the Study Area was calculated as shown below:

$$500 \times 0.15 + 451 \times 0.48 + 344 \times 0.37 = 419 \text{ g/person/day}$$

Accordingly, the Study Team adopted the generation ratio of household waste 419 g/person/day for the Study Area.

• Commercial, market, institution, street sweeping and river waste

As the same reason as the household waste, the Study Team adopted the average generation ratios among 3 areas in commercial, market, institution, street sweeping and river waste both in dry and rainy season for the generation ratio in the Study Area.

Generation ratios of each category of waste are shown in Table 2.14.

Table 2.14 Generation Ratio of Commercial Shop, Institution, Market, Street Sweeping and River Waste Obtained from WACS both in Dry and Rainy Season

Items	Unit	Quezon City		Makati		Paranaque		Average
		Dry	Rainy	Dry	Rainy	Dry	Rainy	
Commercial (Restaurant)	g/shop/day	9,807	20,760	42,307	41,157	8,471	5,407	21,318
Commercial (Others Shop)	g/shop/day	1,568	1,807	2,379	1,921	1,205	2,030	1,818
Institution	g/person/day	57	60	156	46	36	78	72
Market	g/shop/day	4,390	3,740	2,910	4,980	20,417	7,130	7,261
Street Sweeping	g/km/day	9,700	11,420	21,860	16,160	3,430	1,640	10,702
River	g/km/day	80,060	3,050	4,270	2,920	13,250	4,820	18,062

2.5.2 Waste composition

The physical composition, ASG of household waste was calculated, taking the weighted average into consideration, in accordance with the following population ratios:

- Population ratio
 - High income 15%
 - Middle income 48%
 - Low income 37%
- Weighted average

The Study Team calculated the physical composition ratio for the Study Area from the results of survey both in rainy seasons in 3 areas as follows:

Average physical composition in high income residents in 3 areas	x 0.15 +	Average physical composition in middle income residents in 3 areas	x 0.48 +	Average physical composition in low income residents in 3 areas	x 0.37
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Results of waste composition in rainy season are summarized in Table 2.15.

From results of waste composition both in dry and rainy seasons, the Study Team calculated the results of waste composition by using both results and tabulated in Table 2.16.

Table 2.15 Results of Waste Composition Survey (Rainy Season) in the Study Area

Classification			Household				Commercial		Institution	Market	Street Sweeping	River
			High Inc.	Middle Inc.	Low Inc.	Weighted Av.	Restaurant	Others				
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.22	0.19	0.18	0.19	0.23	0.09	0.07	0.34	0.26	0.23
	Kitchen waste	(%)	42.08	42.24	39.17	41.08	51.24	33.40	19.05	52.33	15.13	18.50
	Paper	(%)	20.88	20.16	17.15	19.15	17.45	28.39	49.34	15.79	17.64	13.71
	Textile	(%)	1.06	3.41	8.94	5.10	0.45	3.39	3.15	2.10	2.85	4.57
	Plastic	(%)	11.19	17.19	18.05	16.61	18.52	18.00	15.97	14.68	9.27	29.33
	Grass and wood	(%)	12.20	4.67	6.61	6.52	3.17	2.12	2.74	10.98	24.48	16.84
	Leather and rubber	(%)	1.70	0.69	1.48	1.13	0.03	1.71	0.98	0.75	0.58	5.96
	Sub-total	(%)	89.11	88.36	91.40	89.60	90.86	87.01	91.23	96.63	69.95	88.91
	Metal	(%)	3.80	7.94	4.81	6.16	5.60	4.74	4.50	1.36	1.07	6.13
	Glass	(%)	2.89	1.52	1.74	1.81	2.99	6.82	2.37	0.56	0.59	0.39
	Ceramic and stone	(%)	1.66	0.90	0.94	1.03	0.43	0.36	0.64	0.67	3.77	0.45
	Others (soil, etc.)	(%)	2.54	1.28	1.11	1.41	0.12	1.07	1.26	0.78	24.62	4.12
	Sub-total	(%)	10.89	11.64	8.60	10.40	9.14	12.99	8.77	3.37	30.05	11.09
Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
Chemical Analysis	Combustibles	(%)	43.71	47.75	45.02	46.13	46.35	54.11	53.78	41.58	48.04	36.26
	Moisture	(%)	47.23	43.27	47.22	45.33	45.09	37.24	36.62	49.55	34.29	54.95
	Ash	(%)	9.06	8.98	7.76	8.54	8.56	8.65	9.60	8.87	17.67	8.79
	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Carbon	(%)	16.83	17.77	18.38	17.85	15.95	21.45	25.44	18.82	14.79	18.89
	Hydrogen	(%)	2.41	2.65	2.71	2.64	2.40	3.09	3.86	2.68	2.11	2.72
	Nitrogen	(%)	0.37	0.67	0.56	0.58	0.43	0.39	0.34	0.50	0.23	0.27
	Sulphur	(%)	0.04	0.07	0.07	0.07	0.03	0.07	0.06	0.12	0.06	0.07
	Chlorine	(%)	0.21	0.25	0.28	0.26	0.18	1.42	0.50	0.32	0.19	0.58
	Oxygen	(%)	23.85	26.34	23.00	24.73	27.36	27.69	23.58	19.14	30.66	13.73
	Total	(%)	43.71	47.75	45.00	46.13	46.35	54.11	53.78	41.58	48.04	36.26
	Lower Calorific Value (LCV)	(kcal/kg)	1,715	2,065	1,850	1933	1,537	2,072	2,055	1,798	1,975	1,634
	C/N Ratio	-	45.49	26.52	32.82	30.78	37.09	55.00	74.82	37.64	64.30	69.96

Table 2.16 Results of Waste Composition Survey in the Study Area

Table 2.16 Results of Waste Composition Survey in the Study Area														
Classification			Household					Institution	Market	Street Sweeping	River Cleansing			
			High Inc.	Middle Inc.	Low Inc.	Weighted Av.	Restaurant					Others		
Physical Composition (Wet base)	Apparent Specific Gravity (ASG)	Kg/l	0.20	0.19	0.18	0.18	0.23	0.09	0.07	0.34	0.21	0.23		
		(%)	41.97	49.97	42.00	45.82	54.56	30.85	20.08	57.88	12.62	13.54		
	Combustibles	Paper	(%)	17.62	15.90	13.82	15.39	15.52	27.28	47.12	15.45	13.67	7.76	
		Textile	(%)	1.81	2.76	7.39	4.33	1.06	4.34	1.84	1.76	3.24	4.43	
		Plastic	(%)	11.79	15.58	17.18	15.60	15.45	17.16	15.91	13.54	9.29	48.51	
		Grass and wood	(%)	14.84	5.25	7.31	7.45	4.23	1.95	2.38	7.68	35.08	14.34	
		Leather and rubber	(%)	1.34	0.39	1.13	0.80	0.11	0.90	0.69	0.52	0.63	4.72	
		Sub-total	(%)	89.37	89.85	88.81	89.39	90.91	82.47	88.02	96.81	74.52	93.29	
	Incombustibles	Metal	(%)	4.03	6.35	4.92	5.47	5.94	5.36	4.89	1.34	1.31	3.66	
		Glass	(%)	4.05	1.85	3.24	2.69	2.59	10.60	2.15	0.90	0.90	0.62	
Ceramic and stone		(%)	1.23	1.13	1.44	1.26	0.45	0.90	0.85	0.56	4.10	0.23		
Others (soil, etc.)		(%)	1.34	0.84	1.60	1.19	0.13	0.69	4.11	0.40	19.18	2.22		
Sub-total		(%)	10.63	10.16	11.19	10.61	9.10	17.53	11.99	3.19	25.49	6.72		
Chemical Analysis	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		
	Three contents	Combustibles	(%)	44.70	43.24	49.48	45.77	42.38	58.29	59.36	39.63	50.05	34.18	
		Moisture	(%)	46.23	48.76	42.04	45.89	48.87	34.17	32.67	52.56	33.31	58.66	
		Ash	(%)	9.07	8.00	8.48	8.34	8.75	7.54	7.97	7.81	16.64	7.16	
	Ultimate analysis of combustibles	Total	(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
		Carbon	(%)	14.39	14.21	16.13	14.95	13.63	22.13	23.81	15.62	13.57	15.07	
		Hydrogen	(%)	2.02	2.11	2.31	2.17	2.01	3.26	3.53	2.14	1.93	2.21	
		Nitrogen	(%)	0.41	0.62	0.52	0.55	0.59	0.59	0.42	0.51	0.21	0.35	
		Sulphur	(%)	0.06	0.06	0.08	0.07	0.03	0.05	0.07	0.08	0.05	0.06	
		Chlorine	(%)	0.27	0.38	0.31	0.34	0.19	0.92	0.55	0.26	0.20	0.44	
Lower Calorific Value (LCV)	(kcal/kg)	1,602	1,609	1,821	1,686	1,385	2,144	2,304	1,623	1,788	1,691			
C/N Ratio		35.10	22.92	31.02	27.18	23.10	37.51	56.69	30.63	64.62	43.06			

CHAPTER 3

INCOMING WASTE SURVEY

3 INCOMING WASTE SURVEY (WASTE DISPOSAL AMOUNT SURVEY)

3.1 Objectives of the Survey

The incoming waste survey (waste disposal amount survey) was carried out at 4 disposal sites and 1 transfer station in order to:

- Understand the present disposal waste amount.
- Properly classify the present incoming waste prior to installation of truck scale.
- Prepare the waste stream in Metro Manila based on incoming waste data

The disposal volume obtained from this survey will be converted to weight based on the loading waste amount survey by truck scale conducted to obtain the compaction rate of collection vehicles.

3.2 Review of Previous Incoming Waste Data (1991-1996)

3.2.1 Incoming Waste Data (1991-1996)

The present main disposal sites for waste generated in Metro Manila are the sanitary landfill sites in San Mateo and Carmona, and the open dump sites in Payatas and Catmon. Previously, some LGUs used small size disposal sites such as Bagunbong and Lingunan. And because of this it is quite difficult to determine the past waste disposal volume in Metro Manila on a yearly basis. The changes in the waste disposal volume in the above mentioned sanitary landfill sites between 1991 to 1996 are shown in Table 3.1 and Figure 3.1. In 1993, the sanitary disposal site in Carmona was opened and since then the disposal volume has rapidly increased. In 1996, the total annual disposal volume exceeded 2,000,000m³, a figure which also surpassed the disposal volume at the San Mateo sanitary landfill site.

Table 3.1 Annual Waste Disposal Volume in Sanitary Landfill Sites
(unit: m³)

	San Mateo	Carmona	Total
1991	258,880	-	258,880
1992	344,562	-	344,562
1993	572,716	133,871	706,587
1994	1,259,792	552,935	1,812,727
1995	1,799,300	957,518	2,756,818
1996*	1,971,186	2,098,239	4,069,425

Note: The disposal volume in 1996 is based on the monthly records of MMDA.

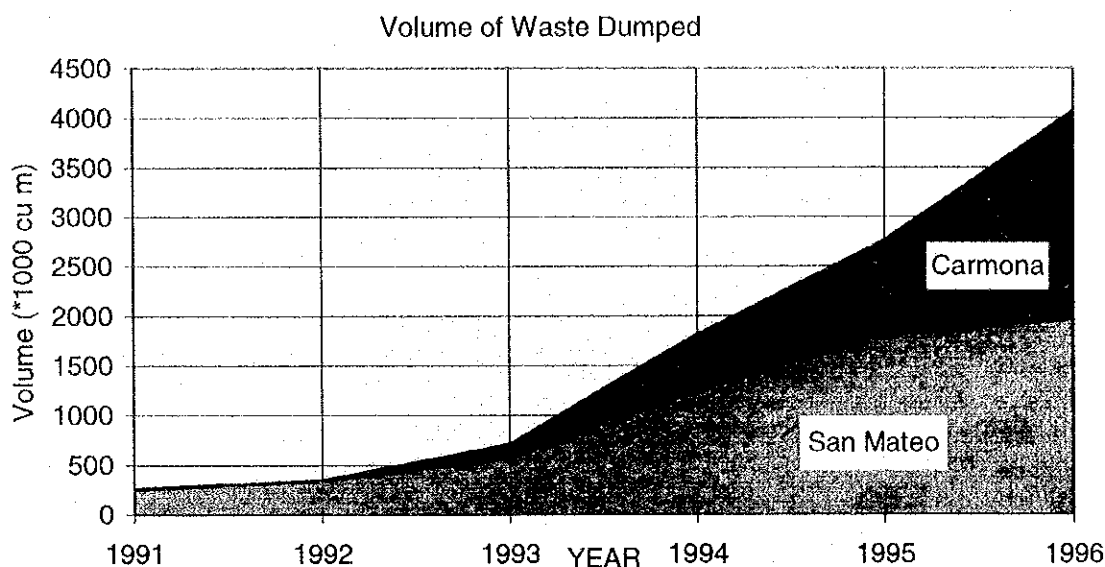


Figure 3.1 Annual Disposal Volume in Sanitary Landfill Sites

3.2.2 Incoming waste data in 1996

Of the total volume of waste generated in Metro Manila in 1996, the amount disposed in San Mateo and Carmona sanitary landfill sites totaled 1,971,000m³ and 2,114,000m³, respectively. The waste volume from Quezon and Makati disposed in the Payatas disposal site totaled 2,166,000m³ and 290,000 m³, respectively, while the waste volume from Malabon disposed in the Catmon disposal site was 193,000m³. In 1996, Caloocan disposed 648,000m³ of waste at the Bagunbong disposal site, while Valenzuela disposed 260,000m³. These figures make up the amount of waste generated in Metro Manila in 1996, which totaled 7,642,000m³ and is broken down to 20,900m³ a day. MMDA, LGUs, and private contractors made up 15%, 5%, and 77%, respectively, of the amount of waste disposed in these disposal sites.

Table 3.2 Waste Amount Disposed in Disposal Sites (1996)

	San Mateo	Carmona	Payatas		Catmon	Bagunbong	Valenzuela	Total
			Quezon	Makati	Malabon	Caloocan		
MMDA	67,432	1,087,936*	0	0	0	0	0	1,155,368
LGU	315,117	15,341	0	0	46,344***	0	0	376,802
Private	1,434,401	938,354	2,165,669	290,238**	146,762***	647,616	260,153****	5,883,193
Out of Metro Manila	71,265	72,562	0	0	0	0	0	143,827
Special Operations	82,971	0	0	0	0	0	0	82,971
Total	1,971,186	2,114,193	2,165,669	290,238	193,106	647,616	260,153	7,642,161

* Disposal waste volume hauled from Las Piñas transfer station to Carmona includes MMDA waste volume.

** Disposal waste generation volume of Makati City was estimated by the Study Team based on the average daily disposal volume obtained from the incoming waste survey (793m³/d × 366 days = 290,238m³/year).

*** Disposal volume of LGU and private contractor was calculated as 24% and 76%, respectively, based on their share of trips in the total number of haulage trips.

Figure 3.2 shows the estimated waste haulage volume to disposal sites in 1996, while Figure 3.3 shows the estimated waste haulage amount by collection organization, and Figure 3.4 shows waste haulage amount by LGU.

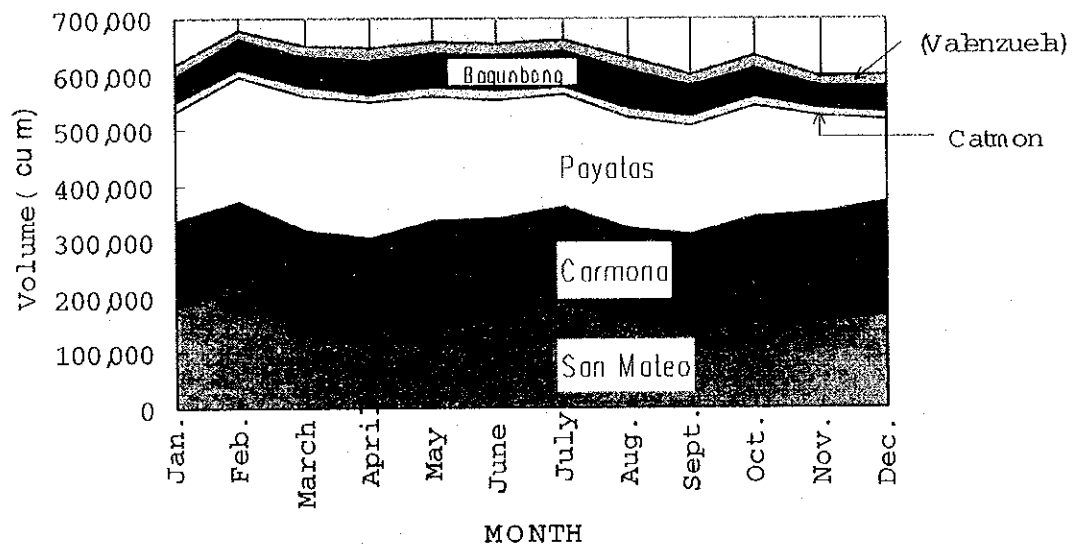


Figure 3.2 Waste Haulage Volume to disposal sites in 1996

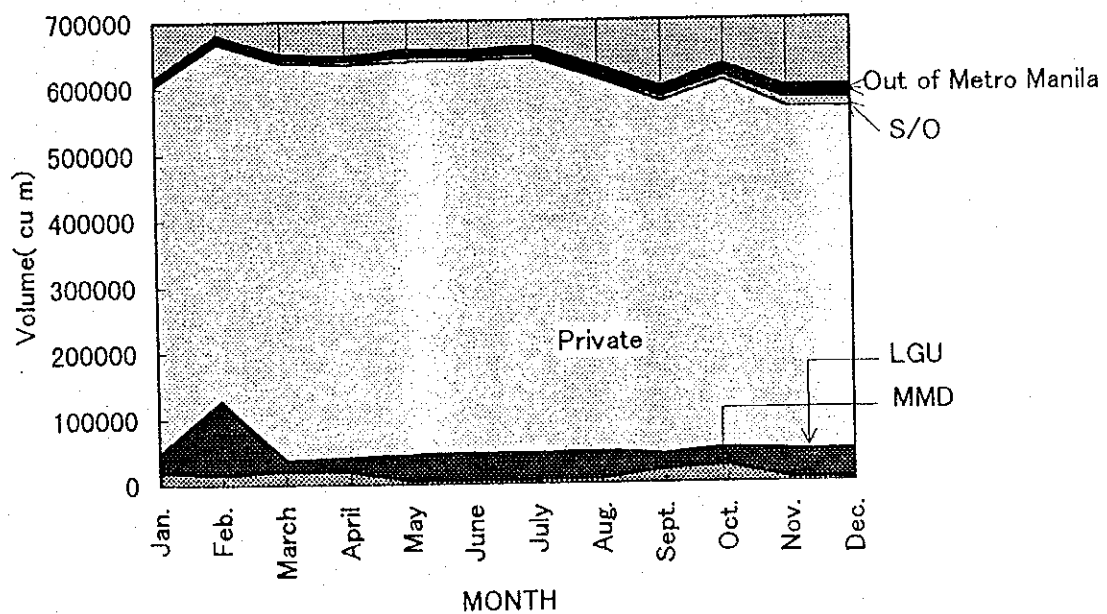


Figure 3.3 Waste Haulage Amount by Collection Organization

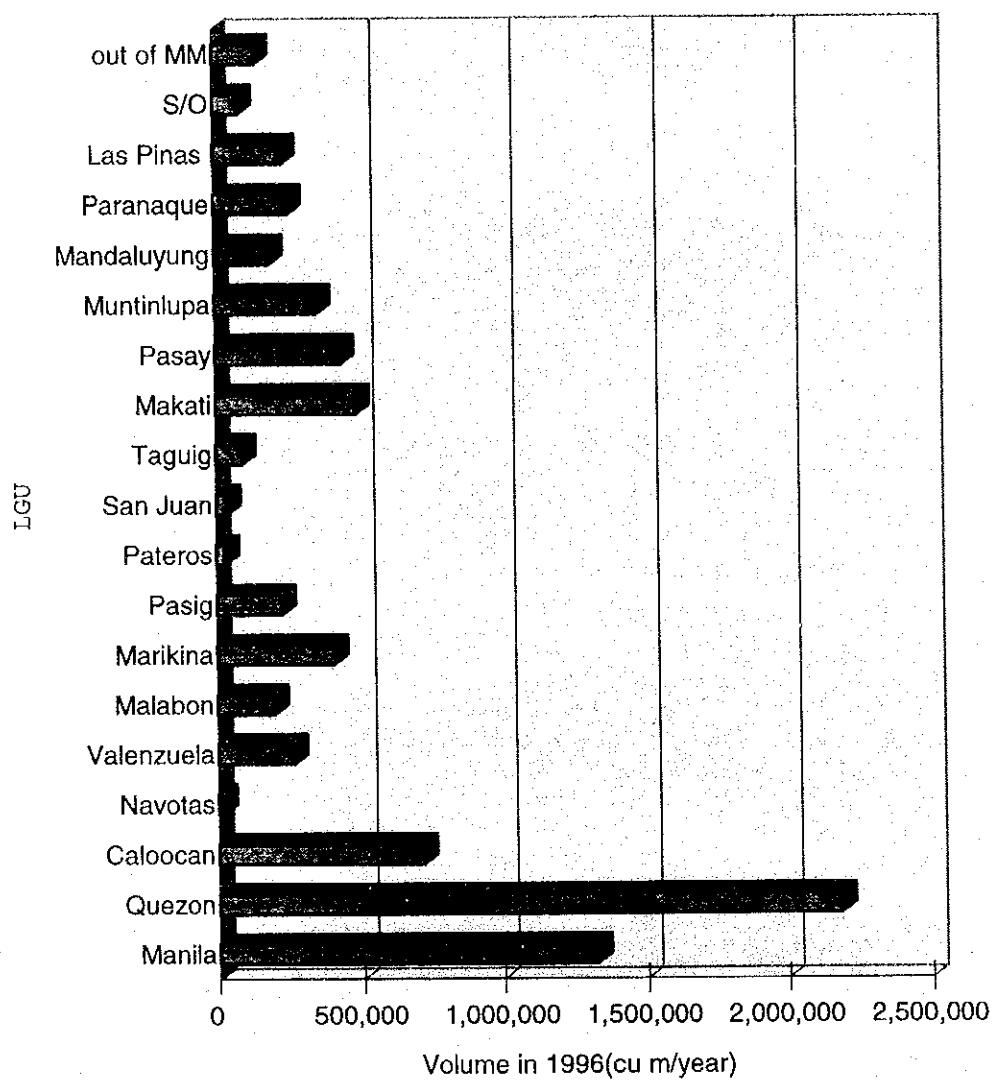


Figure 3.4 Waste Haulage Amount by LGU

3.3 Incoming Waste Survey

3.3.1 Methodology

Survey Sites

As of May 1997, the total amount of waste generated in Metro Manila is disposed at two sanitary landfill sites and two open dump sites. The study on haulage amount was carried out on the following five areas, including the Las Pinas transfer station:

- San Mateo sanitary landfill site
- Carmona sanitary landfill site
- Payatas open dump site
- Catmon open dump site
- Las Pinas Transfer Station

Survey Period

The Study Team conducted the incoming waste survey for 7 days, from the 1st to the 7th of May 1997.

Method of Survey

The type of waste, haulage organization (MMDA, LGU, private contractor, private sector, e.g. factories, companies), generation source, and incoming waste volume were continuously for 7 days.

Using the truck scale of the private contractor, the compaction rate of collection vehicles was calculated. The results of the calculation were used to convert the final disposal waste volume to the unit of weight.

Table 3.3 Waste Haulage Weight Vehicle

Collection Vehicle	Capacity (m3)	Haulage Weight (ton)	Compaction Ratio
Compactor truck (C8)	8.0	2.760	1.73
		2.060	1.28
		2.560	1.60
(average)	-	-	1.54
Compactor truck (C12)	15.0	4.520	1.51
		5.570	1.86
		4.260	1.42
(average)	-	-	1.60
Dump truck (6 wheel)	9.342	2.810	1.50
		3.030	1.72
		2.610	1.35
(average)	-	-	1.52
Dump truck (10 wheel)	11.925	3.080	1.29
		2.160	1.01
		3.340	1.40
(average)	-	-	1.23
Mini dump truck	5.932	1.590	1.34
		2.360	1.78
		1.950	1.62
(average)	-	-	1.58

3.4 Survey Results

Table 3.4 outline the number of trips taken by haulage vehicles in a week and the disposal volume. The vehicles were found to make an average of 1,070 trips a day: 458 trips/day to San Mateo, 87 trips/day to Carmona, 371 trips/day to Payatas, and 34 trips/day to Catmon. The average amount of waste disposal totals 14,639 m³ a day: 4,787 m³/day to San Mateo, 5,954m³/day to Carmona, 4,638 m³/day to Payatas, and 328 m³/day to Catmon.

Based on the results of the survey, the waste disposal amount shall be converted from volume to the unit of weight. The disposal amount converted to weight is shown in Table 3.5. Daily disposal amount was estimated 3,900 ton/day in Metro Manila. Disposal amount by disposal sites and LGUs are illustrated in Figure 3.5 and 3.6 respectively.

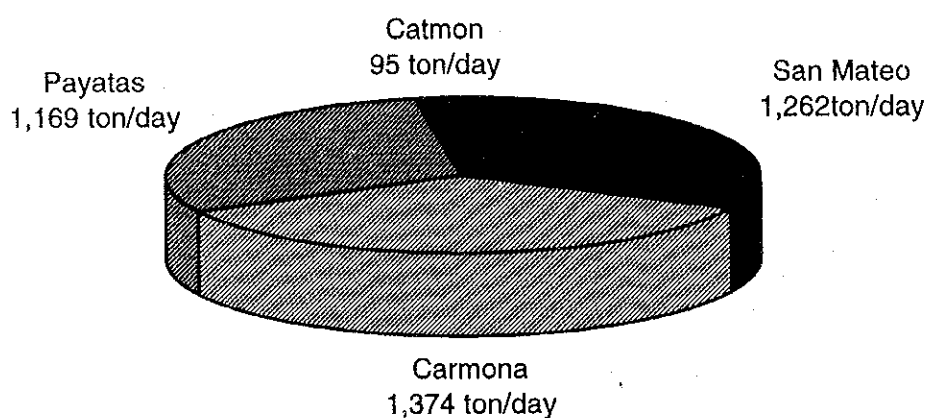


Figure 3.5 Daily Disposal Amount by Disposal Sites

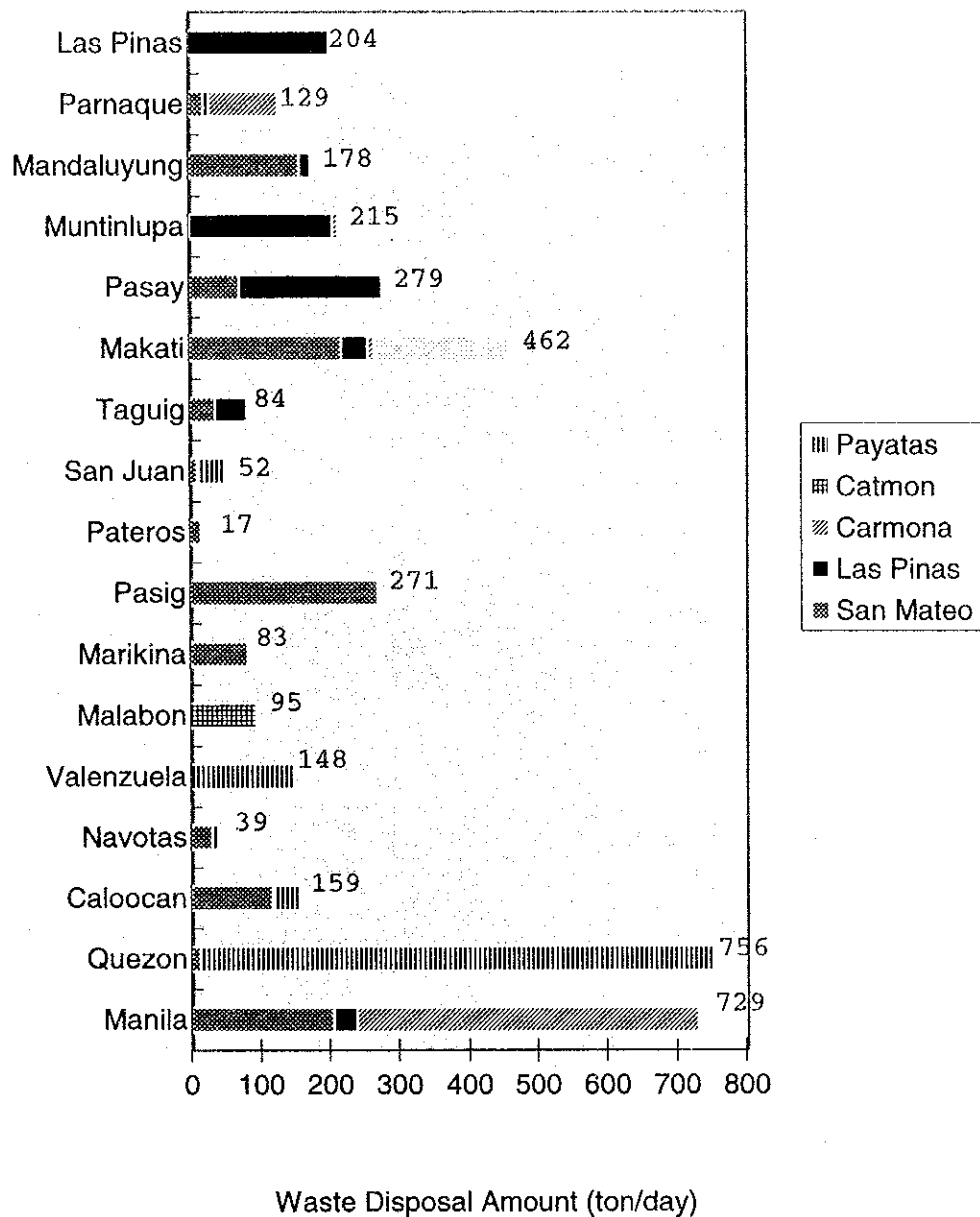


Figure 3.6 Daily Disposal Amount by LGU

Table 3.4 Outline of the Number of Trip and Disposal Volume

		1, May (Thu.)		2, May (Fri.)		3, May (Sat.)		4, May (Sun.)		5, May (Mon.)		6, May (Tue.)		7, May (Wed.)		Average	
		Trip	Volume	Trip	Volume	Trip	Volume	Trip	Volume	Trip	Volume	Trip	Volume	Trip	Volume	Trip	Volume
San Mateo	sub-total	468	4,798	481	5,092	463	4,822	371	3,758	447	4,684	498	5,286	481	5,067	458	4,787
	Manila	54	972	57	1,028	57	1,013	28	504	56	981	70	1,243	68	1,224	56	995
	Quezon	3	59	1	13	3	32	5	59	5	85	8	82	4	46	4	54
	Caloocan	43	436	40	393	40	400	17	170	37	374	50	511	42	425	38	387
	Navotas	8	80	6	60	4	40	6	60	5	50	13	130	24	378	9	114
	Marikina	29	411	33	512	27	410	29	425	24	359	26	391	10	97	25	372
	Pasig	87	844	97	938	92	889	72	695	98	966	98	959	104	1,031	93	903
	Pateros	1	23	6	88	4	62	1	23	5	75	8	107	5	65	4	63
	San Juan	4	32	4	39	6	52	5	52	7	64	3	25	5	32	5	42
	Taguig	14	128	17	160	13	118	11	102	13	118	13	121	11	104	13	122
	Makati	112	883	101	899	98	797	89	722	90	734	94	775	89	686	96	785
	Pasay	32	331	28	291	28	319	22	256	21	211	20	214	19	223	24	264
	Muntinlupa	0	0	1	13	2	17	0	0	1	13	1	13	1	13	1	10
	Mandaluyong	79	563	88	624	79	565	75	537	79	579	86	608	93	655	83	590
	Paranaque	2	36	2	36	10	108	11	153	6	75	8	107	6	88	6	86
Las Pinas	sub-total	214	3,711	261	3,722	263	3,779	191	3,185	219	3,720	215	3,261	225	3,670	227	3,607
	Manila	6	112	13	264	14	235	11	245	2	48	11	198	5	102	9	172
	Caloocan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Navotas	2	30	3	45	3	45	2	30	2	30	3	40	2	30	2	36
	Taguig	11	213	12	288	10	173	10	240	11	243	13	256	12	238	11	236
	Makati	3	58	14	253	12	199	7	137	10	167	13	192	14	312	10	188
	Pasay	64	1,213	63	966	65	962	44	750	58	1,085	67	971	56	1,022	60	996
	Mandaluyong	7	168	3	71	5	90	2	52	1	24	8	144	8	192	5	106
	Muntinlupa	51	972	63	765	68	1,020	47	872	53	1,068	63	1,001	57	1,032	57	961
	Paranaque	2	48	3	46	4	64	2	42	3	51	1	16	2	31	2	43
	Las Pinas	68	897	87	1,024	82	991	66	817	79	1,004	36	443	69	911	70	870
Carmona	sub-total	72	5,166.8	86	4,841	104	7,962	60	3,878	83	6,089	107	7,352	97	6,369	87	5,954
	Manila	21	2,016	19	1,824	11	1,056	0	0	12	1,152	26	2,496	23	2,208	16	1,536
	Makati	0	0	8	64	4	30	4	36	0	0	6	59	3	34	4	32
	Taguig	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Muntinlupa	2	98	2	16	3	24	2	18	0	0	1	10	4	35	2	29
	Paranaque	18	474	29	520	7	54	13	273	18	366	27	728	32	904	21	474
	Las Pinas T.	30	2,591	28	2,417	79	6,798	41	3,551	53	4,571	47	4,059	35	3,188	45	3,882
Payatas	sub-total	450	5,598	422	5,288	481	6,118	280	3,240	336	4,162	329	4,132	319	3,926	371	4,638
	Quezon	297	3,856	282	3,706	327	4,396	145	1,928	192	2,516	185	2,486	175	2,280	229	3,024
	Caloocan	16	128	16	128	16	128	16	128	16	128	16	128	16	128	16	128
	Valenzuela	71	659	60	529	71	624	43	379	61	548	61	548	61	548	61	548
	San Juan	12	145	12	145	12	145	12	145	12	145	12	145	12	145	12	145
	Makati	54	810	52	780	55	825	44	660	55	825	55	825	55	825	53	793
Calmon	Malabon	34	325	38	363	35	330	28	288	34	342	33	318	33	332	34	328
Total		1,154	16,218	1,208	16,109	1,144	15,388	826	10,138	1,011	13,601	1,080	15,465	1,065	15,551	1,070	14,639
	Manila	81	3,100	89	3,114	82	2,304	39	749	70	2,181	107	3,937	96	3,534	81	2,703
	Quezon	300	3,915	283	3,719	330	4,428	150	1,987	197	2,601	193	2,568	179	2,326	233	3,078
	Caloocan	59	564	56	521	56	528	33	298	53	502	66	639	58	553	54	515
	Navotas	10	110	9	105	30	85	8	90	7	80	16	170	26	408	15	150
	Valenzuela	71	659	60	529	71	624	43	379	61	548	61	548	61	548	61	548
	Malabon	34	325	38	363	35	330	29	288	34	342	33	318	33	332	34	328
	Marikina	29	411	33	512	92	410	29	425	24	359	26	391	10	97	35	372
	Pasig	87	844	97	938	4	889	72	695	98	966	98	959	104	1,031	80	903
	Pateros	1	23	6	88	6	62	1	23	5	75	8	107	5	65	5	63
	San Juan	16	177	16	184	18	197	17	197	19	209	15	170	17	177	17	187
	Taguig	26	349	29	448	23	291	21	342	24	361	26	377	23	342	24	359
	Makati	115	941	123	1,216	44	1,026	100	895	100	901	113	1,026	106	1,032	100	1,005
	Pasay	96	1,544	91	1,257	93	1,281	68	1,006	79	1,296	87	1,185	75	1,245	84	1,259
	Muntinlupa	53	1,070	66	794	73	1,061	49	890	54	1,081	65	1,024	62	1,080	60	1,000
	Mandaluyong	86	731	91	695	84	655	77	589	80	603	94	752	101	847	88	696
	Paranaque	22	558	34	602	21	226	26	468	27	492	36	851	40	1,023	29	603
	Las Pinas	68	897	87	1,024	82	991	66	817	79	1,004	36	443	69	911	70	870

Table 3.5 Daily Disposal Amount Estimated Based on the Incoming Waste Survey

Table 3.3 Daily Disposal Amount Estimated Based on the existing trucks																			
AVERAGE																			
	COMPACTOR										DUMP TRUCK				T-Weight				
	C5		C8		C12		C15		SPECIAL		6 WHEELER		10 WHEELER			MINI DUMP TRUCK			
	Trp	Weight	Trp	Weight	Trp	Weight	Trp	Weight	Trp	Weight	Trp	Weight	Trp	Weight		Trp	Weight		
San Mateo	sub-total	0	0	0	0	13	51	7	32	0	5	188	573	70	261	180	340	1,262	
	Manila	0	0	0	0	0	1	0	0	0	0	1	2	55	202	0	1	206	
	Quezon	0	0	0	0	0	1	1	5	0	0	2	5	0	0	1	2	13	
	Calocan	0	0	0	0	3	10	0	0	0	0	34	104	0	0	2	3	117	
	Navotas	0	0	0	0	0	0	0	0	0	0	7	22	2	8	0	0	30	
	Marikina	0	0	0	0	0	0	0	0	0	0	11	33	12	46	2	4	83	
	Pasig	0	0	0	0	0	0	2	9	0	0	78	238	0	1	12	23	271	
	Pateros	0	0	0	0	3	13	1	4	0	0	0	0	0	0	0	0	17	
	San Juan	0	0	0	0	0	0	0	0	0	0	2	5	0	0	3	6	11	
	Taguig	0	0	0	0	0	0	0	0	0	0	10	30	0	0	3	7	37	
	Makati	0	0	0	0	2	7	0	0	4	0	27	82	0	0	67	127	220	
	Pasay	0	0	0	0	3	12	2	9	0	1	12	36	0	2	7	13	73	
	Muntinlupa	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
	Mandaluyong	0	0	0	0	1	3	0	0	0	0	1	3	0	1	81	153	160	
Panorque	0	0	0	0	1	3	1	5	0	0	4	12	0	1	1	1	22		
Las Pinas	sub-total	3	4	37	90	14	54	0	0	0	0	34	104	138	514	1	1	767	
	Manila	0	0	0	0	0	0	0	0	0	0	1	2	8	31	0	0	33	
	Calocan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Navotas	0	0	0	0	0	0	0	0	0	0	0	1	2	8	0	0	9	
	Taguig	0	0	0	0	0	0	0	0	0	0	0	0	11	47	0	0	47	
	Makati	0	0	0	0	0	0	0	0	0	0	1	3	9	35	0	0	38	
	Pasay	1	2	1	2	0	0	0	0	0	0	11	34	45	167	1	1	206	
	Mandaluyong	0	0	0	0	0	0	0	0	0	0	0	0	5	16	0	0	16	
	Muntinlupa	0	0	0	0	0	0	0	0	0	0	9	27	49	179	0	0	206	
	Panorque	0	0	0	0	0	0	0	0	0	0	0	0	2	8	0	0	8	
	Las Pinas	1	2	36	88	14	54	0	0	0	0	12	37	6	23	0	0	204	
	sub-total	0	0	0	0	0	0	0	0	67	1,412	12	38	0	2	7	14	1,456	
	Manila	0	0	0	0	0	0	0	0	16	492	0	0	0	0	0	0	492	
	Makati	0	0	0	0	0	0	0	0	0	0	1	4	0	1	2	4	9	
Taguig	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Muntinlupa	0	0	0	0	0	0	0	0	0	3	1	2	0	0	1	2	7		
Panorque	0	0	0	0	0	0	0	0	6	58	10	32	0	1	4	8	99		
Las Pinas I.S.	0	0	0	0	0	0	0	0	45	859	0	0	0	0	0	0	859		
Payatas	sub-total	0	0	0	0	0	0	0	0	0	0	56	170	189	698	59	112	1,169	
	Quezon	0	0	0	0	0	0	0	0	0	0	56	170	136	503	37	70	743	
	Calocan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	42	42	
	Valenzuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148	
	Makati	0	0	0	0	0	0	0	0	0	0	0	0	53	195	0	0	195	
	San Juan	0	0	0	0	0	0	0	0	0	0	0	0	12	41	0	0	41	
Matmon	6	9	0	0	0	0	0	0	0	0	26	80	2	6	0	0	95		

CHAPTER 4

SOLID WASTE STREAM - PRESENT CONDITIONS

4 SOLID WASTE STREAM - PRESENT CONDITIONS

4.1 Concept of Waste Stream

The waste stream in the Study Area is formulated based on the following surveys:

- WACS (Waste Amount and Composition Survey)
- Interview Survey in sampling points conducted prior to WACS
- Recycling Survey
- Interview Survey of Waste Pickers and Waste Collection Workers on Recycling
- Incoming Waste Survey (Disposal Waste Amount Survey)
- Waste Haulage Amount Survey by Truck Scale

The waste stream concept is illustrated in Figure 4.1. Solid waste from each generation source is classified into three categories, i.e. recycled, discharged and self-disposed waste. Discharged waste is categorized as waste collected by collection services and illegally dumped or littered waste. Collected waste is hauled to the disposal site directly and/or initially taken to the transfer station. Recyclable materials are picked up by collection workers during collection work and by waste pickers at disposal sites. Waste disposed at the disposal site consist of waste collected by LGUs and private companies, and waste hauled directly by private collection and transportation companies individually contracted by factories, hotels and shopping centers.

Only non-hazardous waste is directly hauled, and this waste type is dumped at disposal sites with the permission of sectors managing the said sites. The dumping permit for the use of San Mateo and Carmona disposal sites is issued by MMDA. The dumping permit for Payatas and Catmon are issued by Quezon City and Malabon Municipality, respectively.

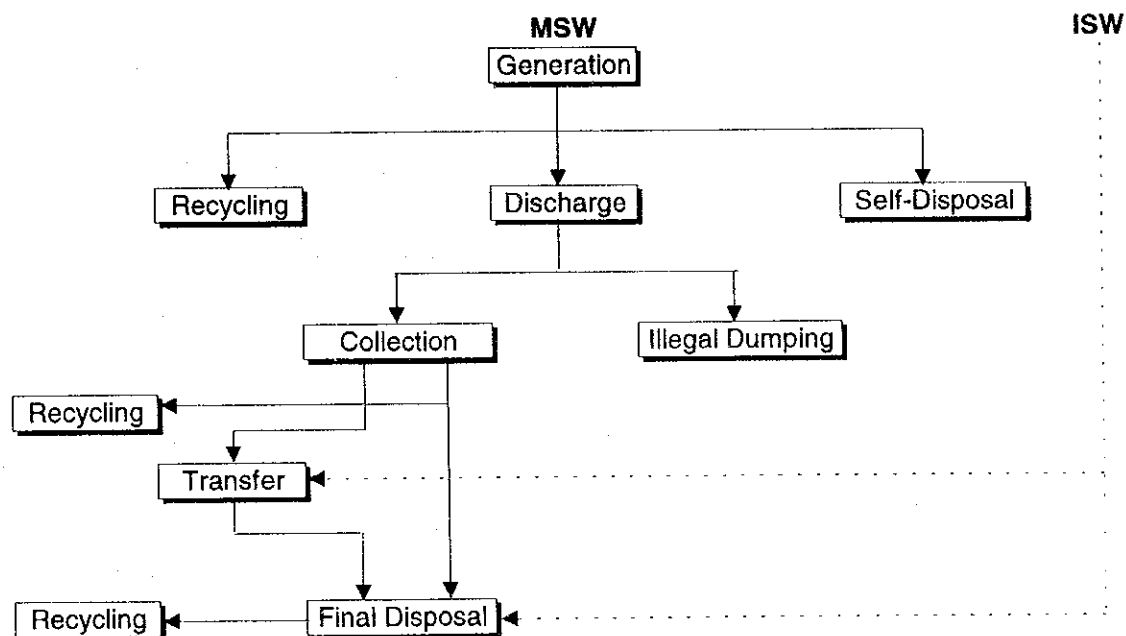


Figure 4.1 Waste Stream Concept

4.2 Generation

4.2.1 Generation

Generation Sources

The MSW generation sources in the Study Area are classified as follows:

- . Residence (household waste)
- . Restaurants (commercial waste)
- . Other Shops (commercial waste)
- . Markets (market waste)
- . Offices (institutional waste)
- . Streets (street sweeping waste)
- . Rivers (river cleansing waste)

Table 4.2 shows the unit number of generation sources.

Generation Rate

The waste amount generated by the above sources in the dry season was obtained through the WACS and is shown below:

- | | | |
|-------------------|---|-------------------|
| . Household | : | 419 g/person/day |
| . Restaurants | : | 21,318 g/shop/day |
| . Shops | : | 1,818 g/shop/day |
| . Markets | : | 7,261 g/shop/day |
| . Institution | : | 72 g/person/day |
| . Street Sweeping | : | 10,702 g/km/day |
| . River Cleansing | : | 18,062 g/km/day |

Generation Amount (G)

The total waste generation amount is estimated at 5,345 tons/day using the formula below.

$$G = (\text{generation rate}) \times (\text{unit number of generation sources})$$

Waste generation amount by LGU and generation source is shown in Table 4.3.

Table 4.2 Unit Number of Generation Sources (1997)

	Population (person)	Shops/Stores		No. of Stalls in the Market			No. of Employees			Length of Streets for Sweeping Services (Km)	Length of River for Cleansing Services (Km)
		Restaurant	Others	Public	Private	Talipapa	Total	Government Employees	Municipal Employees		
		(shop)	(shop)	(shop)	(shop)	(shop)	(shop)	(employee)	(employee)	(employee)	
Manila	1,654,761	9,514	121,015	10,044	2,238	796	13,078	113,995	13,605	127,600	39.0
Quezon	1,989,419	699	58,810	3,348	4,933	132	8,413	275,540	6,594	282,134	108.2
Caloocan	1,023,159	948	9,366	480	1,901	239	2,620	7,702	4,111	11,813	10.0
Navotas	229,039	506	1,293	0	150	348	498	0	660	660	5.0
Valenzuela	437,165	228	7,029	1,309	420	255	1,984	4,237	1,268	5,505	15.0
Malabon	347,484	511	5,649	308	382	68	758	0	1,246	1,246	20.0
Marikina	357,231	371	8,560	921	592	209	1,722	70	1,270	1,340	5.0
Pasig	471,075	566	7,291	3,000	110	403	3,513	13,828	884	14,712	11.3
Pateros	55,286	85	1,338	0	12	0	12	0	208	208	0.7
San Juan	124,187	332	6,177	1,200	25	0	1,225	748	630	1,378	8.0
Taguig	381,350	103	1,286	274	320	182	776	2,710	1,053	3,763	10.0
Makati	484,176	2,765	23,400	546	1,073	161	1,780	49,401	7,418	56,819	5.0
Pasay	408,610	522	5,614	795	1,180	50	2,025	20,673	3,087	23,760	27.5
Muntinlupa	399,846	901	12,634	1,119	246	33	1,398	4,238	2,020	6,258	13.8
Mandaluyong	286,870	1,585	10,951	955	1,364	145	2,464	4,713	2,895	7,608	2.2
Paranaque	391,305	701	14,196	340	932	239	1,511	4,194	4,783	8,977	4.0
Las Pinas	413,086	169	6,591	840	375	175	1,390	0	1,936	1,936	52.0
Total	9,454,049	20,506	301,200	25,479	16,253	3,435	45,167	502,049	53,668	555,717	336.7

Sources:

* Population: 1995 National Statistic Office(NSO)

*No. of Shops/stores: LGU's Business Permits & Licensing Office, City/Mun. Planning & Dev. Office; Manila's Computer Services

*No. of Stalls in the Market: Public Market - LGU's Market Administration, Business Permits & Lic. Office & Makati's Office of Coun. Javier Public and Talipapa - counted by JICA study team based on the market list.

*No. of employees: Field Office Coordination Center, Civil Service Commission- National Capital Region (December 1996 Data)

*Length of Streets for Sweeping Services : Manila's Dep. of Public Services, Navotas Planning Office, Environmental Sanitation Office of other LGUs

*Length of River for Cleansing Services : Manila's Dept of Public Services, Navotas Planning Office, Mandaluyong City's

Environmental Sanitation Office

Table 4.3 Generation Amount (1997)

	Household Waste	Commercial Waste		Market Waste	Institutional Waste	Street Sweeping Waste	River Cleansing Waste	Total
		Restaurant	Other Shops					
Manila	693.76	202.82	220.01	94.96	9.19	2.80	0.70	1,224.24
Quezon	834.06	14.90	106.92	61.09	20.31	2.57	1.95	1,041.80
Caloocan	428.96	20.21	17.03	19.02	0.85	4.69	0.18	490.94
Navotas	96.02	10.79	2.35	3.62	0.05	0.34	0.09	113.26
Valenzuela	183.28	4.86	12.78	14.41	0.40	0.11	0.27	216.11
Malabon	145.68	10.89	10.27	5.50	0.09	0.12	0.36	172.91
Marikina	149.77	7.91	15.56	12.50	0.10	1.07	0.09	187.00
Pasig	197.50	12.07	13.26	25.51	1.06	2.79	0.20	252.39
Pateros	23.18	1.81	2.43	0.09	0.01	0.12	0.01	27.65
San Juan	52.07	7.08	11.23	8.89	0.10	1.15	0.14	80.66
Taguig	159.88	2.20	2.34	5.63	0.27	0.42	0.18	170.92
Makati	202.99	58.94	42.54	12.92	4.09	2.75	0.09	324.32
Pasay	171.31	11.13	10.21	14.70	1.71	0.35	0.50	209.91
Muntinlupa	167.64	19.21	22.97	10.15	0.45	0.46	0.25	221.13
Mandaluyong	120.27	33.79	19.91	17.89	0.55	0.80	0.04	193.25
Paranaque	164.05	14.94	25.81	10.97	0.65	1.07	0.07	217.56
Las Pinas	173.19	3.60	11.98	10.09	0.14	1.02	0.94	200.96
Total	3,963.61	437.15	547.60	327.94	40.02	22.63	6.06	5,345.01

4.2.2 Recycling in Generation Sources

Prior to the conduct of WACS, an interview was done in the sampling area to understand waste discharge conditions in generation sources and to estimate the recycling amount and self disposal amount.

Recycling Ratio

According to the results of the interview, 54% of the households recycle their waste. The amount of recyclable materials, i.e. food waste, cans, papers, bottles, plastics, is estimated at 12.1 g/person/day.

Recycling Amount in Generation Sources (RGS)

Using the formula below, the recycling amount in generation sources is estimated at approximately 200 tons/day, which is equivalent to 4% of the amount of waste generated in Metro Manila.

$$RGS = 12.1 \text{ (g/person/day)} \times \text{population}$$

4.2.3 Self-Disposal

The self-disposal amount was also estimated based on the results of the interview.

Self-Disposal Ratio

According to the results of the interview, 18% of the households independently dispose their waste by burning, burying, or composting. The self-disposed waste amount per person is estimated at 23.3 g/person/day.

Self-Disposal Amount (SD)

Using the formula below, the self-disposal amount in generation sources is estimated at approximately 340 tons/day, which is equivalent to 6% of the amount of waste generated in Metro Manila.

$$RGS = 23.3 \text{ (g/person/day)} \times \text{population}$$

4.3 Discharge (D)

After recycling and self-disposal in generation sources, the remaining amount of waste generated is discharged. Using the formula below, the amount discharged is estimated at approximately 4,800 tons/day, which is equivalent to 90% of the amount of waste generated in Metro Manila:

$$D = G - (RGS + SD)$$

4.4 Collection

Discharged waste is collected by ordinary collection services. On the other hand, waste discharged into rivers, creeks, open spaces, and other areas not designated for disposal or collection is referred to as illegally dumped waste. Recyclable materials are collected by collection workers.

4.4.1 Collection (C)

Collection amount refers to the disposal amount obtained through a survey on incoming waste and the recyclable amount estimated by interviewing collection workers. Using the formula below, the total collection amount is estimated at approximately 3,500 tons/day, which is equivalent to 65% of the amount of waste generated in Metro Manila.

$$C = D + RCW$$

4.4.2 Illegal Dumping (ID)

Using the formula below, the amount of illegally dumped waste is estimated at 1,355 tons/day, which is equivalent to 25% of the amount of waste generated in Metro Manila.

$$ID = D - C$$

4.4.3 Recycling by Collection Workers (RCW)

Collection workers and waste pickers were interviewed to determine the recyclable waste amount. The results show that the amount of waste recycled by collection workers totals 12,000 g/person/day. There are approximately 4,688 collection workers.

Table 4.4 Number of Collection Workers by LGU

LGU	No. of Collectors
Manila	699
Quezon	1,452
Caloocan	202
Navotas	52
Valenzuela	90
Malabon	68
Marikina	150
Pasig	398
Pateros	21
San Juan	64
Taguig	57
Makati	607
Pasay	125
Muntinlupa	64
Mandaluyong	324
Parañaque	231
Las Piñas	84
Total	4,688

Using the formula below, the amount recycled by collection workers is estimated at approximately 56 tons/day, which is equivalent to 1% of the amount of waste generated in Metro Manila.

$$RCW = 12,000 \text{ (g/collector/day)} \times (\text{number of collection workers})$$

4.5 Disposal

4.5.1 Final Disposal (FD)

The final disposal amount was obtained based on the incoming waste survey conducted for 7 days (May,1 to 7, 1997) at the disposal sites in San Mateo, Carmona, Payatas and Catmon, and the Las Piñas transfer station.

The amount of waste disposed in Metro Manila totals 3,900 tons/day, of which 88 % (3,440 tons/day) is MSW and 12 % (460 tons/day) ISW.

4.5.2 Recycling by Waste Pickers (RWP)

The amount of waste recycled by waste pickers is estimated at 59,180 g/person/day based on the results of the interview.

There are approximately 1,200 waste pickers in Payatas and Catmon.

- There are 350 waste pickers in the Catmon disposal site only used by the Navotas Municipality.
- There are 850 waste pickers in the Payatas disposal site used by Caloocan, Venezuela, Makati and Quezon.
- The distribution of waste pickers was determined based on the waste generation rate of the 4 LGUs.

<i>LGU</i>	<i>Generation Amt. (ton/day)</i>	<i>Generation Rate (%)</i>	<i>Waste Pickers</i>
Quezon	1,080.03	50%	425
Valenzuela	223.97	10%	85
Caloocan	506.83	24%	204
Makati	329.03	15%	128
Total	2,139.86	100%	850

Using the formula below, the amount of waste recycled by waste pickers is estimated at approximately 70 tons/day, which is equivalent to 1% of the amount of waste generated in Metro Manila.

$$RWP = 59,180 \text{ (g/person/day)} \times (\text{number of waste pickers})$$

4.6 Collection Coverage (CC)

The coverage of the waste collection services is defined as follows:

$$(CC) = C / D = C / (FD + RCW)$$

The coverage of the waste collection services in the Study Area is summarized in Table 4.5. The collection coverage is approximately 72.8% in Metro Manila.

Table 4.5 Collection Coverage

	<i>Discharge Amount</i>	<i>Collection Amount</i>	<i>Collection Coverage</i>
Manila	1,129.58	706.39	62.54
Quezon	928.00	773.42	83.34
Caloocan	432.41	161.42	37.33
Navotas	100.16	39.62	39.56
Valenzuela	191.11	149.08	78.01
Malabon	153.04	95.82	62.61
Marikina	166.56	84.80	50.91
Pasig	225.44	215.78	95.72
Pateros	24.48	17.25	70.47
San Juan	73.56	52.77	71.74
Taguig	149.10	84.68	56.79
Makati	186.54	290.28	97.86
Pasay	198.26	179.50	96.23
Muntinlupa	176.84	186.77	94.20
Mandaluyong	195.17	17.89	97.20
Parañaque	177.33	131.77	67.52
Las Piñas	184.94	155.01	87.41
Metro Manila	4,804.20	3,496.25	72.77

4.7 Waste Stream

The present waste stream in Metro Manila and in the LGUs was estimated by the Study Team and is shown in Table 4.6 and Figure 4.2.

Table 4.6 Waste Stream 1997

	Generation Amount	Self Disposal Amount	Recycling Amount at Generation Stage	Discharge Amount	Collection Amount	Illegally Dumped Amount	Transfer Amount			Amount Recycled by Collector	Amount Recycled by Waste Picker
							Las Pinas Transfer Station	LGU Transfer Station/System	Total		
Manila	1,224.24	59.74	34.92	1,129.58	706.39	423.19	31.00	698.00	729.00	8.39	-
Quezon	1,041.80	71.82	41.98	928.00	773.42	154.58	0.00	756.00	756.00	17.42	25.15
Caloocan	460.94	36.94	21.59	432.41	161.42	270.99	0.00	0.00	0.00	2.42	12.07
Navotas	113.26	8.27	4.83	100.16	39.62	60.54	9.00	39.00	48.00	0.62	-
Valenzuela	216.11	15.78	9.22	191.11	149.08	42.03	0.00	148.00	148.00	1.08	5.03
Malabon	172.91	12.54	7.33	153.04	95.82	57.22	0.00	0.00	0.00	0.82	20.71
Marikina	187.00	12.90	7.54	166.56	84.80	81.76	0.00	83.00	83.00	1.80	-
Pasig	252.39	17.01	9.94	225.44	215.78	9.66	0.00	211.00	211.00	4.78	-
Pateros	27.85	2.00	1.17	24.48	17.25	7.23	0.00	0.00	0.00	0.25	-
San Juan	80.66	4.48	2.62	73.56	52.77	20.79	0.00	0.00	0.00	0.77	-
Taguig	170.92	13.77	8.05	149.10	84.88	64.42	47.00	0.00	47.00	0.68	-
Makati	324.32	17.48	10.22	296.62	290.28	6.34	38.00	0.00	38.00	7.28	8.05
Pasay	209.91	14.75	8.62	186.54	179.50	7.04	126.00	0.00	126.00	1.50	-
Muntinlupa	221.13	14.43	8.44	198.26	186.77	11.49	186.00	0.00	186.00	0.77	-
Mandaluyong	193.25	10.36	6.05	176.84	171.89	4.95	18.00	0.00	18.00	3.89	-
Paranaque	217.56	14.13	8.26	195.17	131.77	63.40	8.00	0.00	8.00	2.77	-
Las Pinas	200.96	14.91	8.72	177.33	155.01	22.32	204.00	0.00	204.00	1.01	-
Total	5,345.01	341.31	199.50	4,804.20	3,496.25	1,307.95	667.00	1,935.00	2,602.00	56.25	71.01

	Disposal Amount														
	Municipal Solid Waste					Industrial Solid Waste(Directly Hauled Waste)					Total				
	San Mateo	Carmona	Payatas	Catmon	Sub-Total	San Mateo	Carmona	Payatas	Catmon	Sub-Total	San Mateo	Carmona	Payatas	Catmon	Sub-Total
Manila	206.00	492.00	0.00	0.00	698.00	0.00	31.00	0.00	0.00	31.00	206.00	523.00	0.00	0.00	729.00
Quezon	13.00	0.00	743.00	0.00	756.00	0.00	0.00	0.00	0.00	0.00	13.00	0.00	743.00	0.00	756.00
Calocan	117.00	0.00	42.00	0.00	159.00	0.00	0.00	0.00	0.00	0.00	117.00	0.00	42.00	0.00	159.00
Navotas	30.00	9.00	0.00	0.00	39.00	0.00	0.00	0.00	0.00	0.00	30.00	9.00	0.00	0.00	39.00
Valenzuela	0.00	0.00	148.00	0.00	148.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	148.00	0.00	148.00
Malabon	0.00	0.00	0.00	95.00	95.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	95.00	95.00
Marikina	83.00	0.00	0.00	0.00	83.00	0.00	0.00	0.00	0.00	0.00	83.00	0.00	0.00	0.00	83.00
Pasig	211.00	0.00	0.00	0.00	211.00	60.00	0.00	0.00	0.00	60.00	271.00	0.00	0.00	0.00	271.00
Pateros	17.00	0.00	0.00	0.00	17.00	0.00	0.00	0.00	0.00	0.00	17.00	0.00	0.00	0.00	17.00
San Juan	11.00	0.00	41.00	0.00	52.00	0.00	0.00	0.00	0.00	0.00	11.00	0.00	41.00	0.00	52.00
Taguig	37.00	47.00	0.00	0.00	84.00	0.00	0.00	0.00	0.00	0.00	37.00	47.00	0.00	0.00	84.00
Makati	88.00	0.00	195.00	0.00	283.00	132.00	47.00	0.00	0.00	179.00	220.00	47.00	195.00	0.00	462.00
Pasay	52.00	126.00	0.00	0.00	178.00	21.00	80.00	0.00	0.00	101.00	73.00	206.00	0.00	0.00	279.00
Muntinlupa	0.00	186.00	0.00	0.00	186.00	2.00	27.00	0.00	0.00	29.00	2.00	213.00	0.00	0.00	215.00
Mandaluyong	150.00	18.00	0.00	0.00	168.00	10.00	0.00	0.00	0.00	10.00	160.00	18.00	0.00	0.00	178.00
Paranaque	22.00	107.00	0.00	0.00	129.00	0.00	0.00	0.00	0.00	0.00	22.00	107.00	0.00	0.00	129.00
Las Pinas	0.00	154.00	0.00	0.00	154.00	0.00	50.00	0.00	0.00	50.00	0.00	204.00	0.00	0.00	204.00
Total	1,037.00	1,139.00	1,169.00	95.00	3,440.00	225.00	235.00	0.00	0.00	460.00	1,262.00	1,374.00	1,169.00	95.00	3,900.00

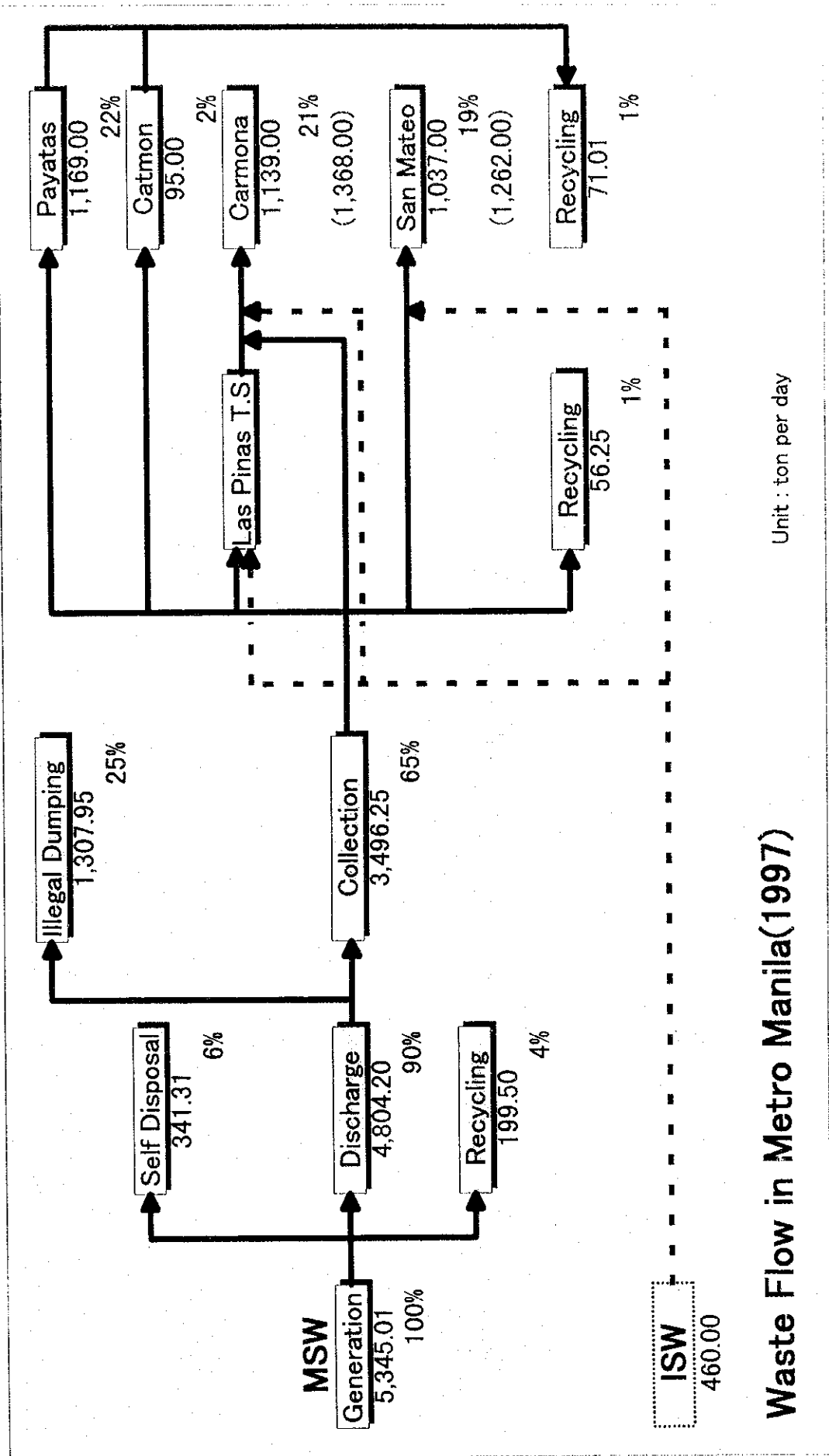


Figure 4.2-a Waste Flow in Manila (1997)

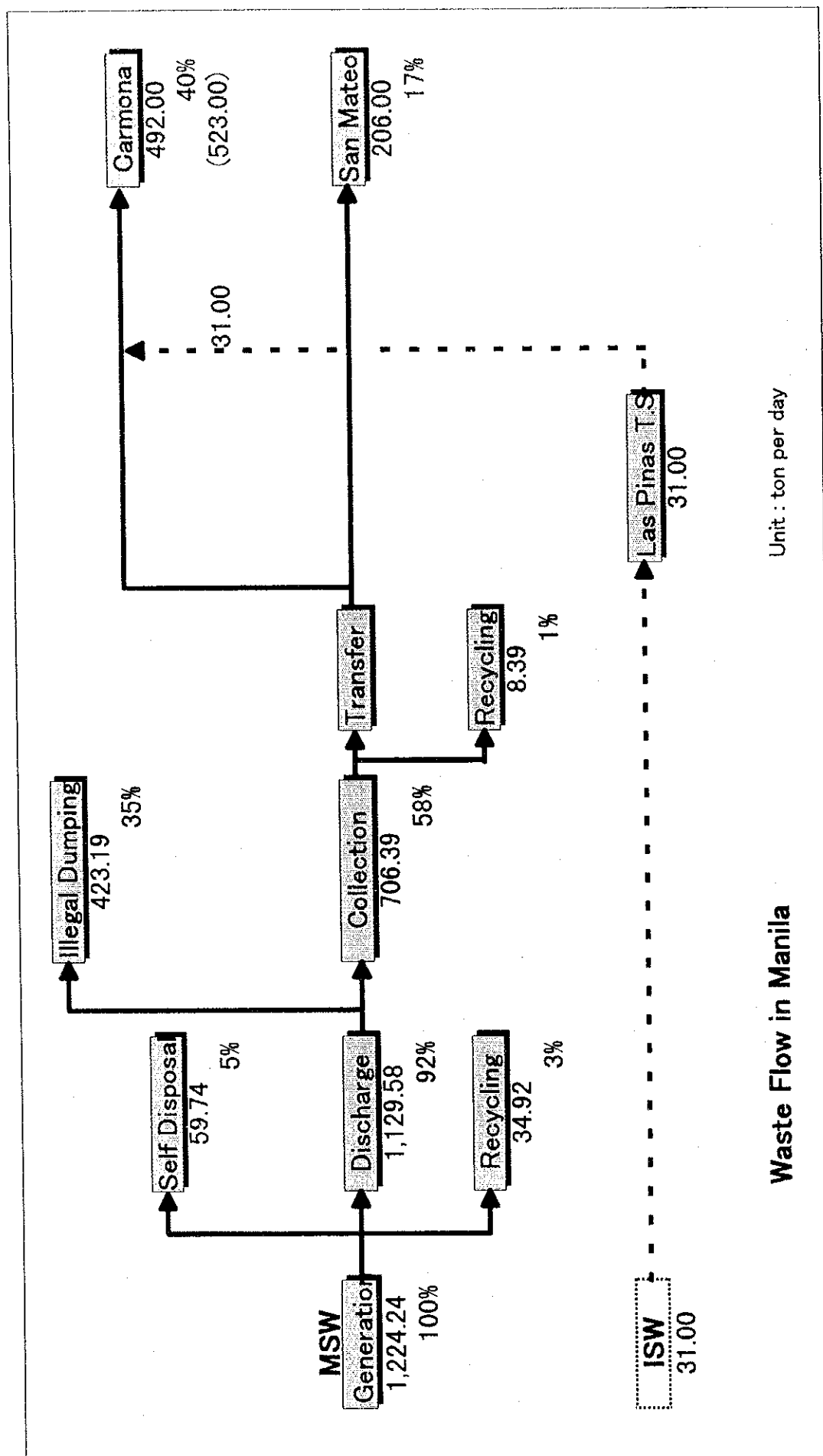


Figure 4.2-b Waste Flow in Manila (1997)

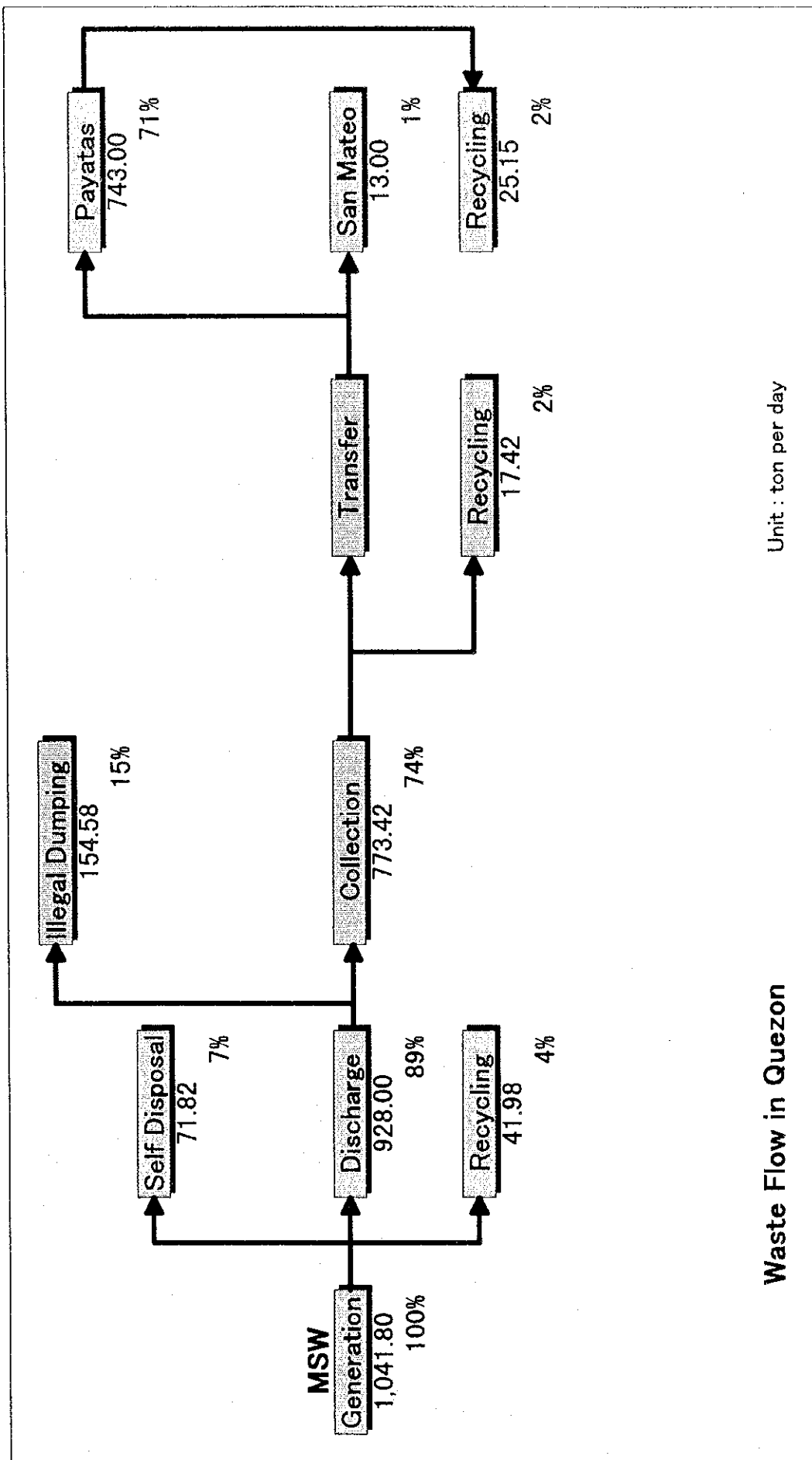


Figure 4.2-c Waste Flow in Manila (1997)

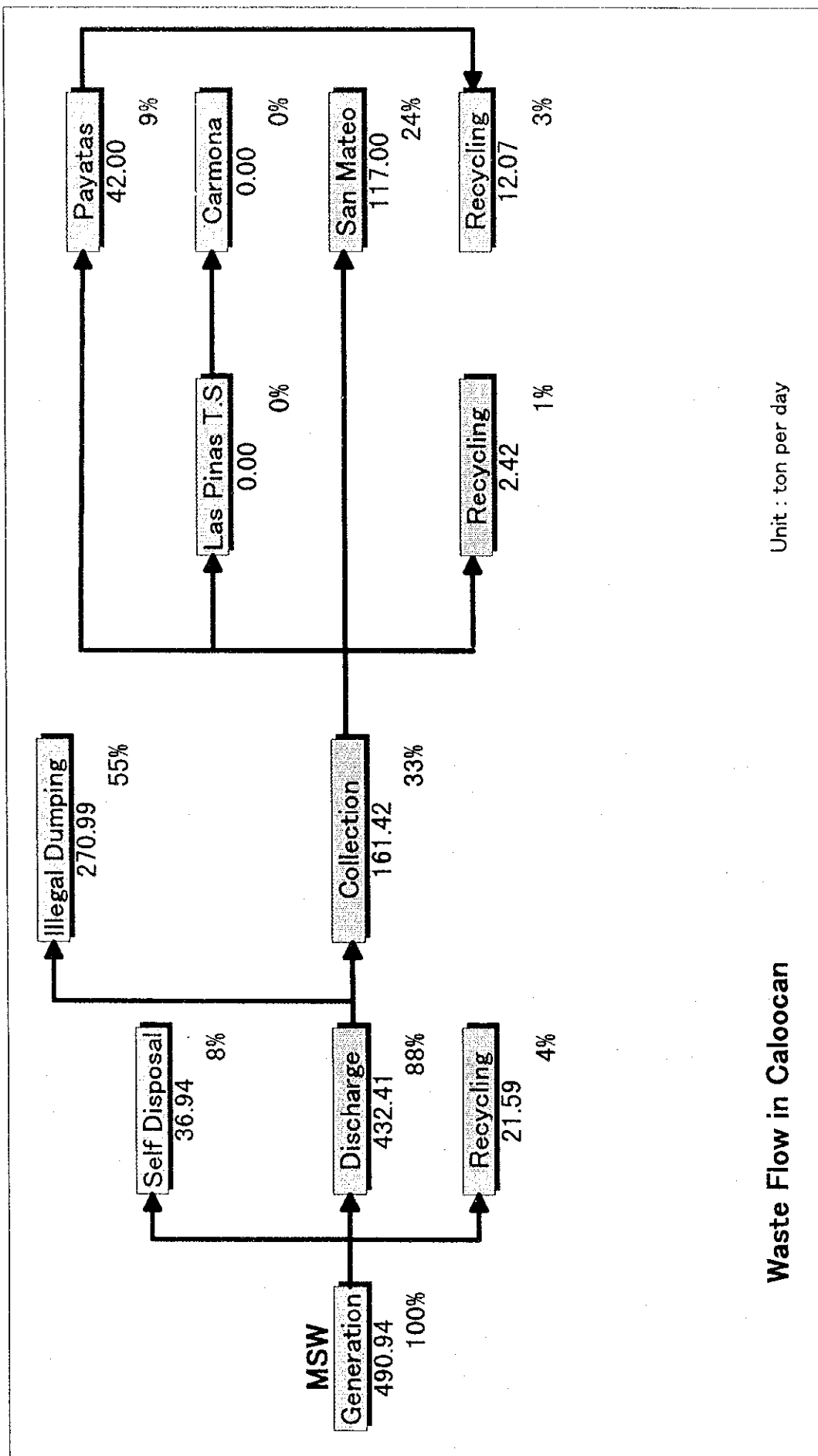


Figure 4.2-d Waste Flow in Manila (1997)

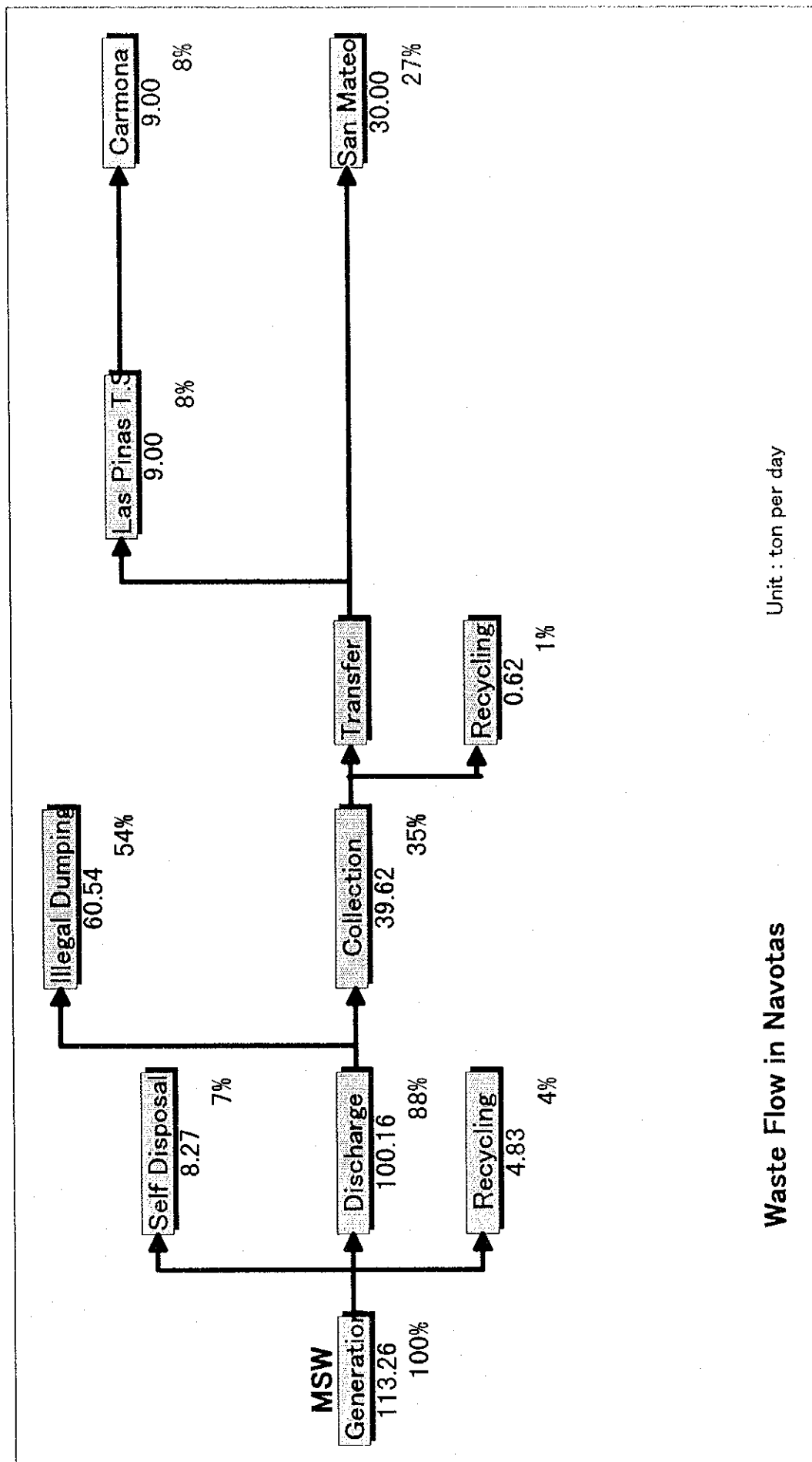
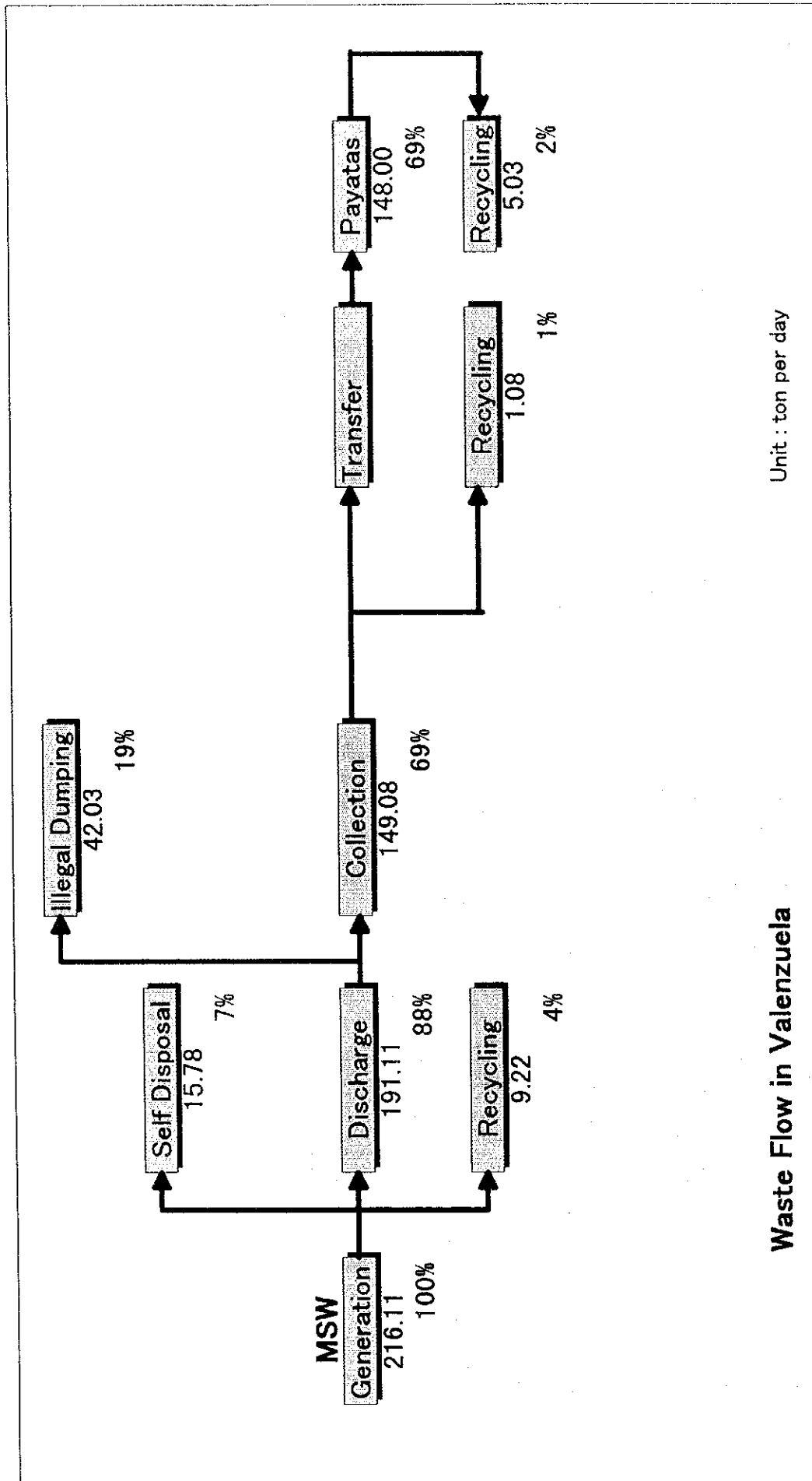


Figure 4.2-e Waste Flow in Manila (1997)



Waste Flow in Valenzuela

Figure 4.2-f Waste Flow in Manila (1997)

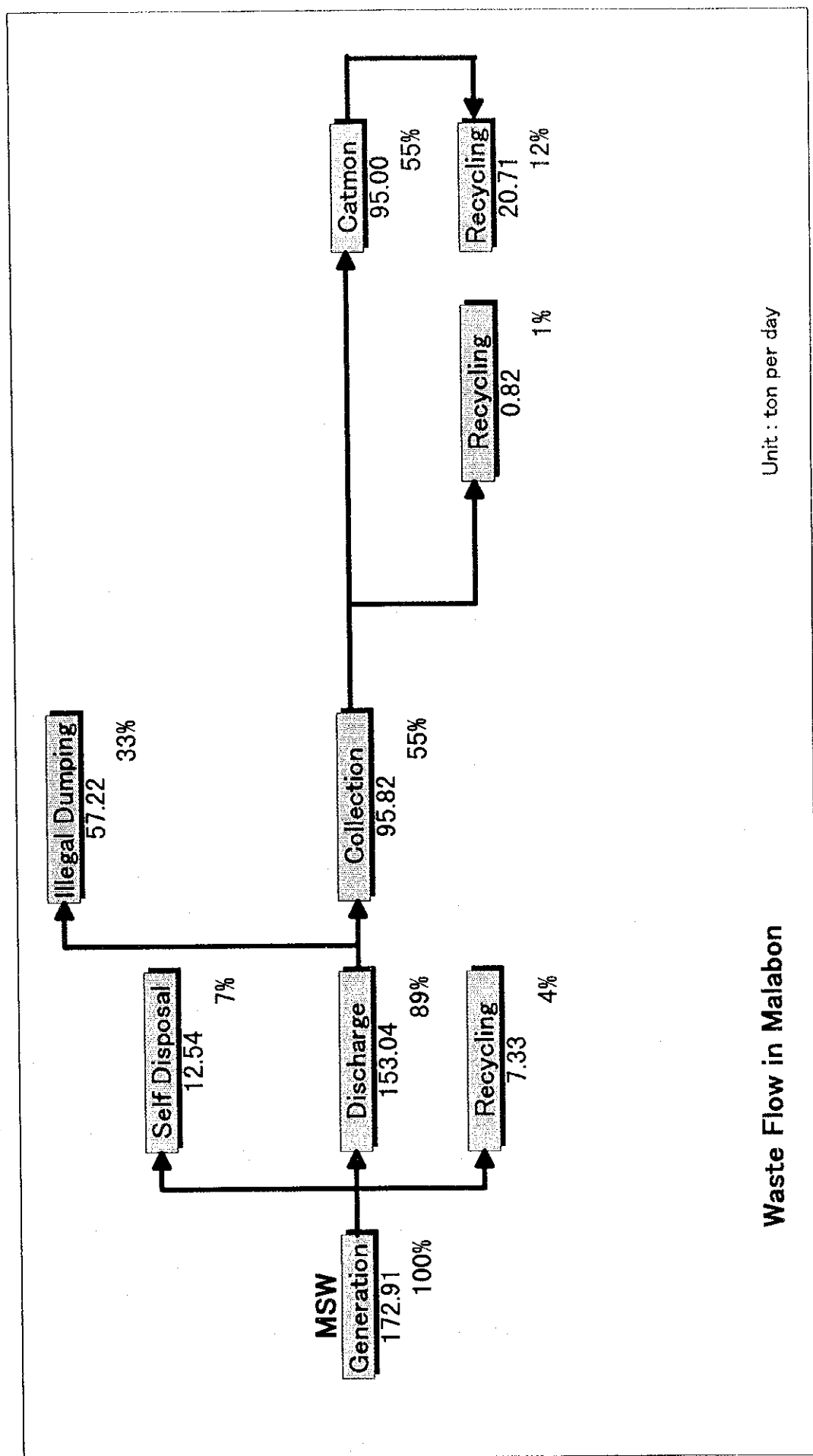


Figure 4.2-g Waste Flow in Manila (1997)

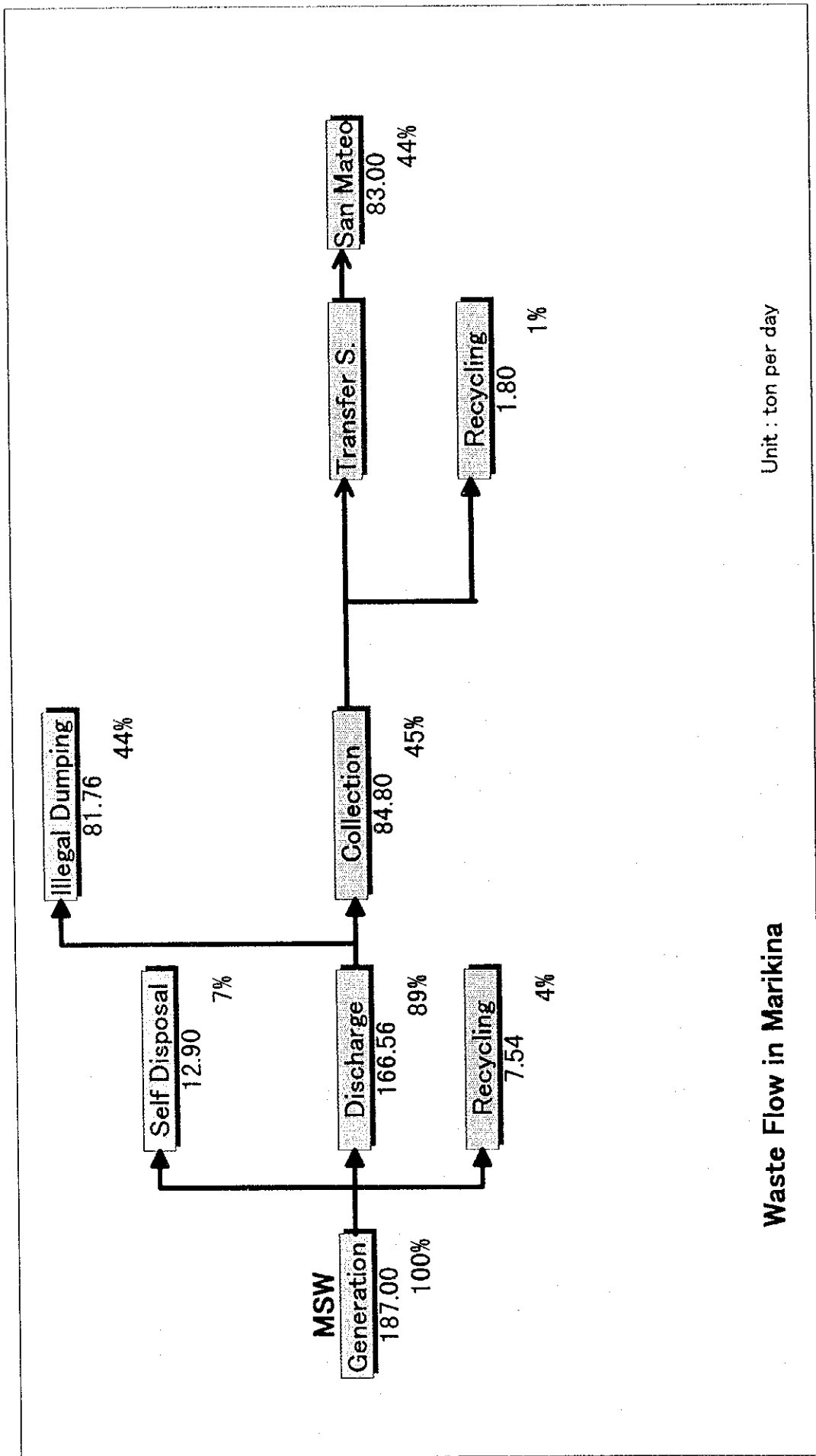


Figure 4.2-h Waste Flow in Marikina (1997)

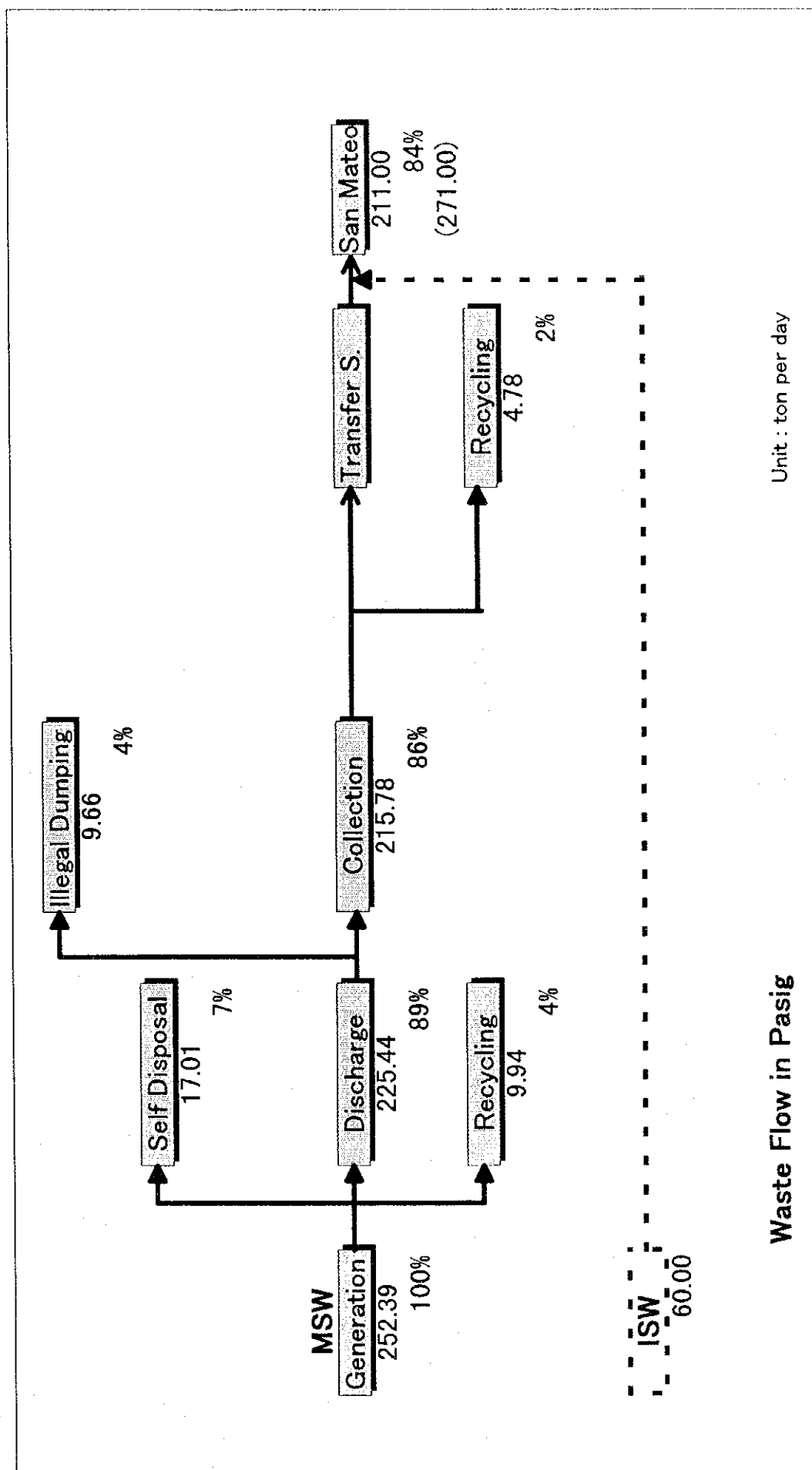


Figure 4.2-i Waste Flow in Manila (1997)

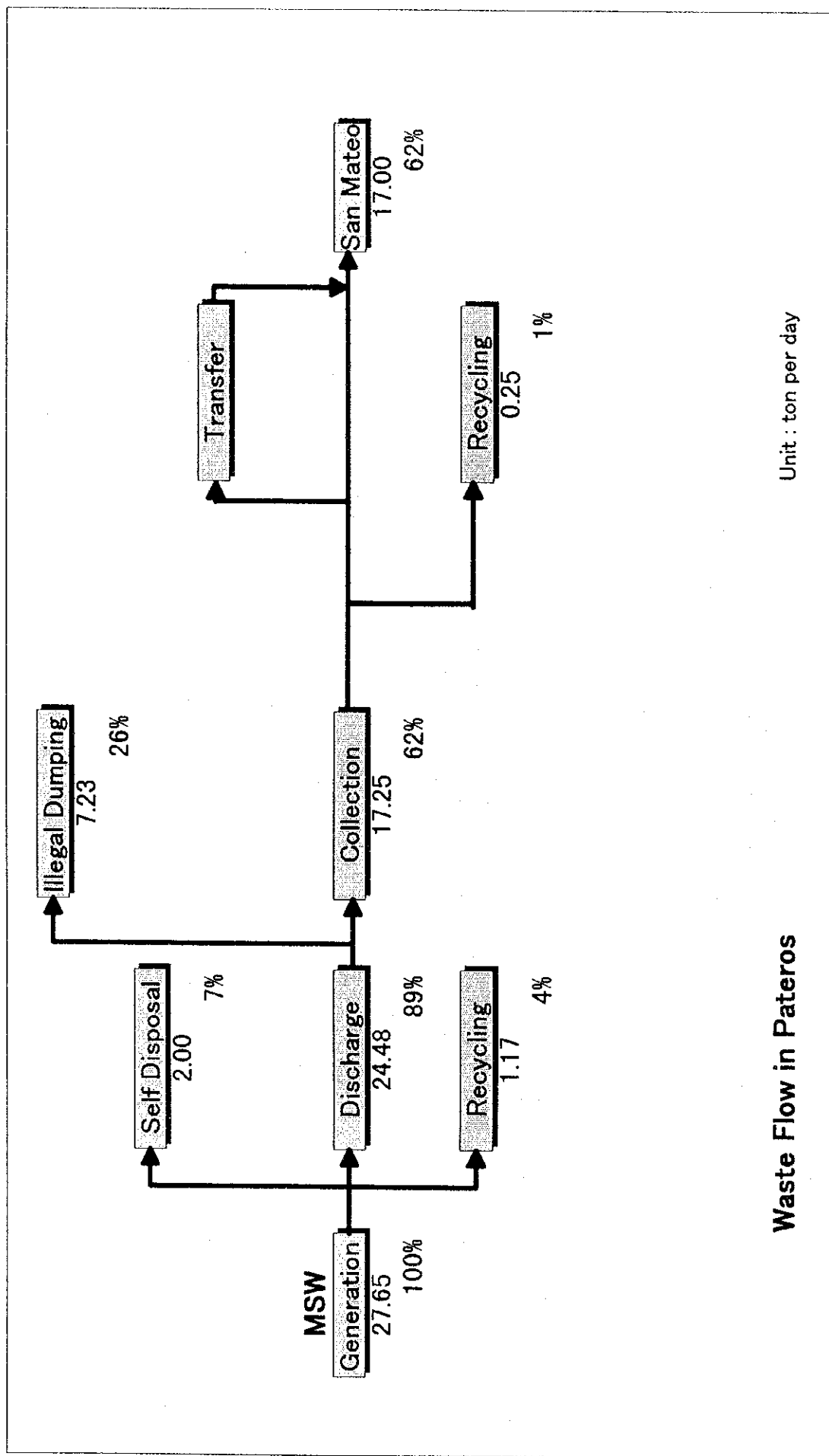
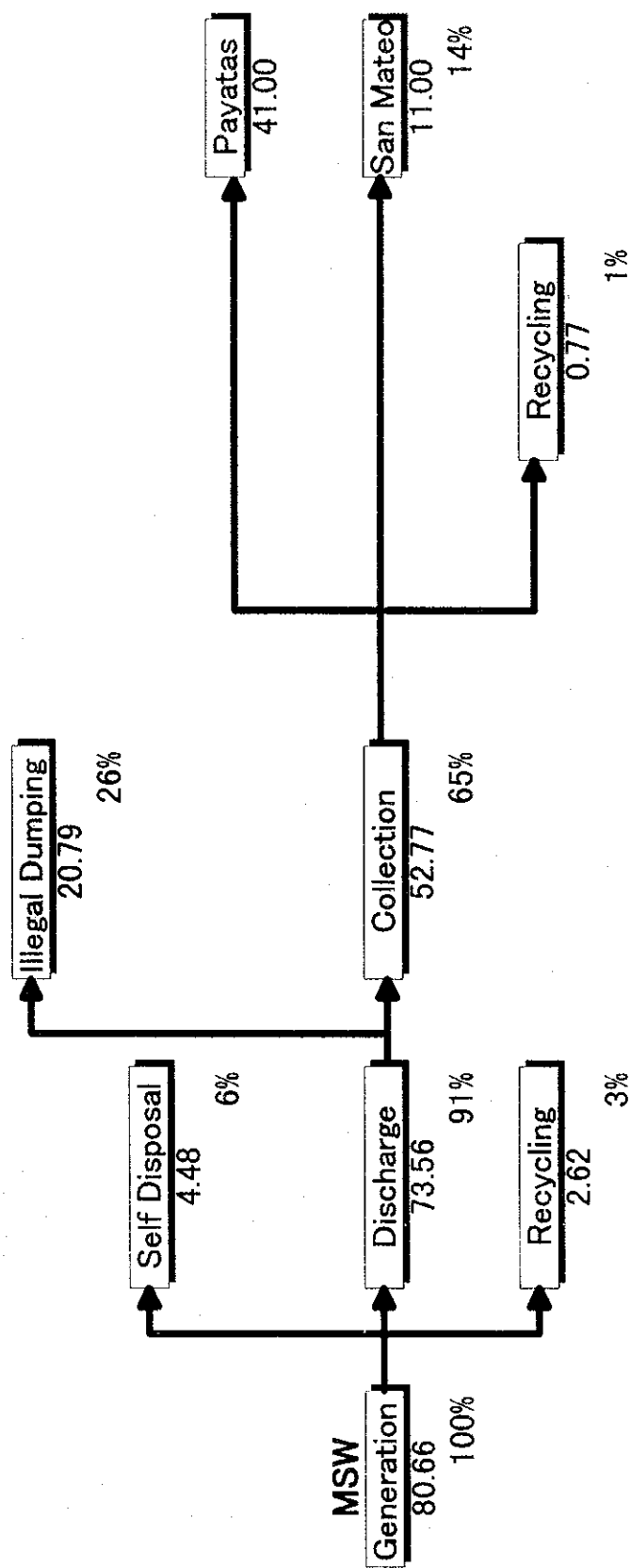


Figure 4.2-j Waste Flow in Manila (1997)



Waste Flow in San Juan

Unit : ton per day

Figure 4.2-k Waste Flow in San Juan (1997)

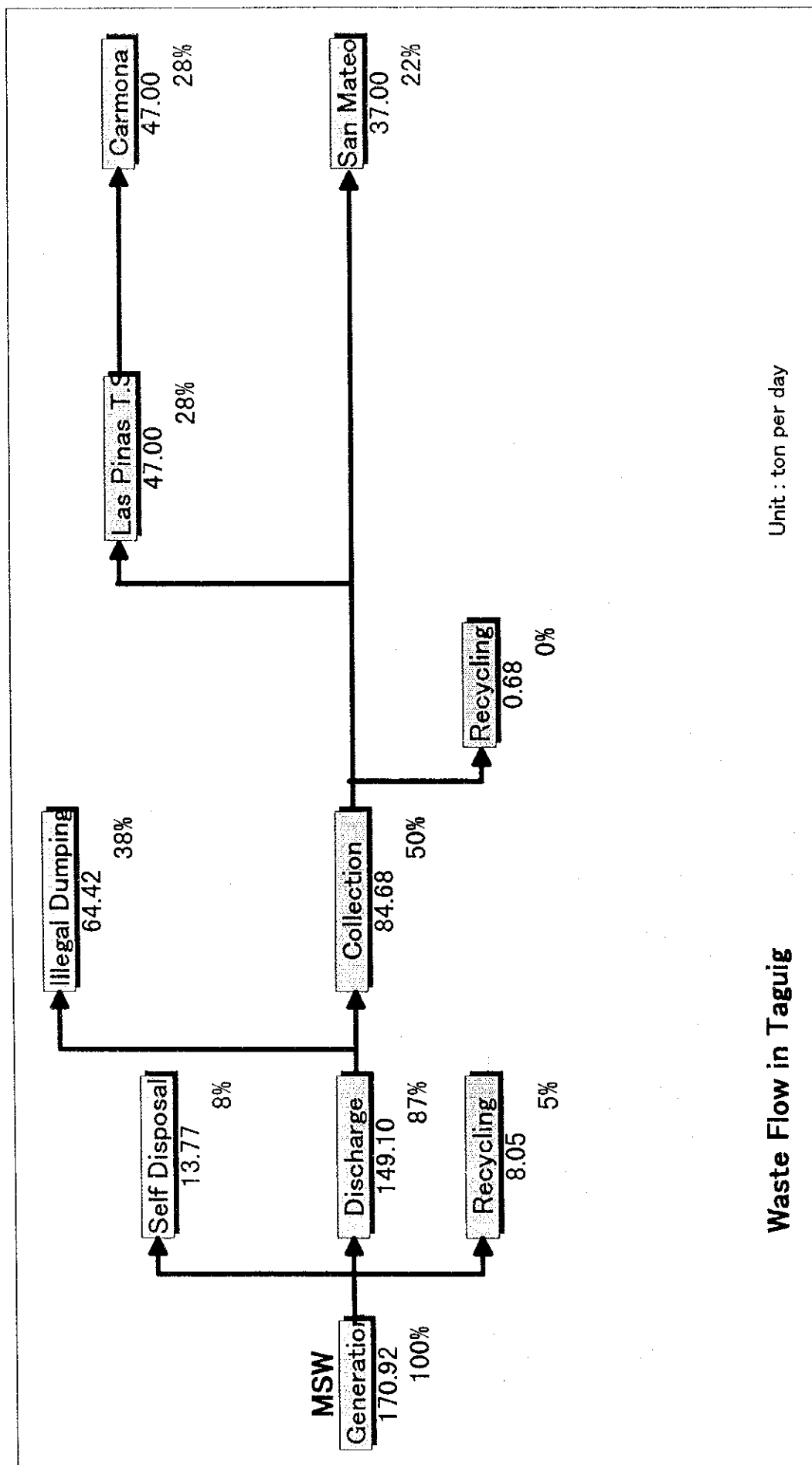


Figure 4.2-1 Waste Flow in Taguig (1997)

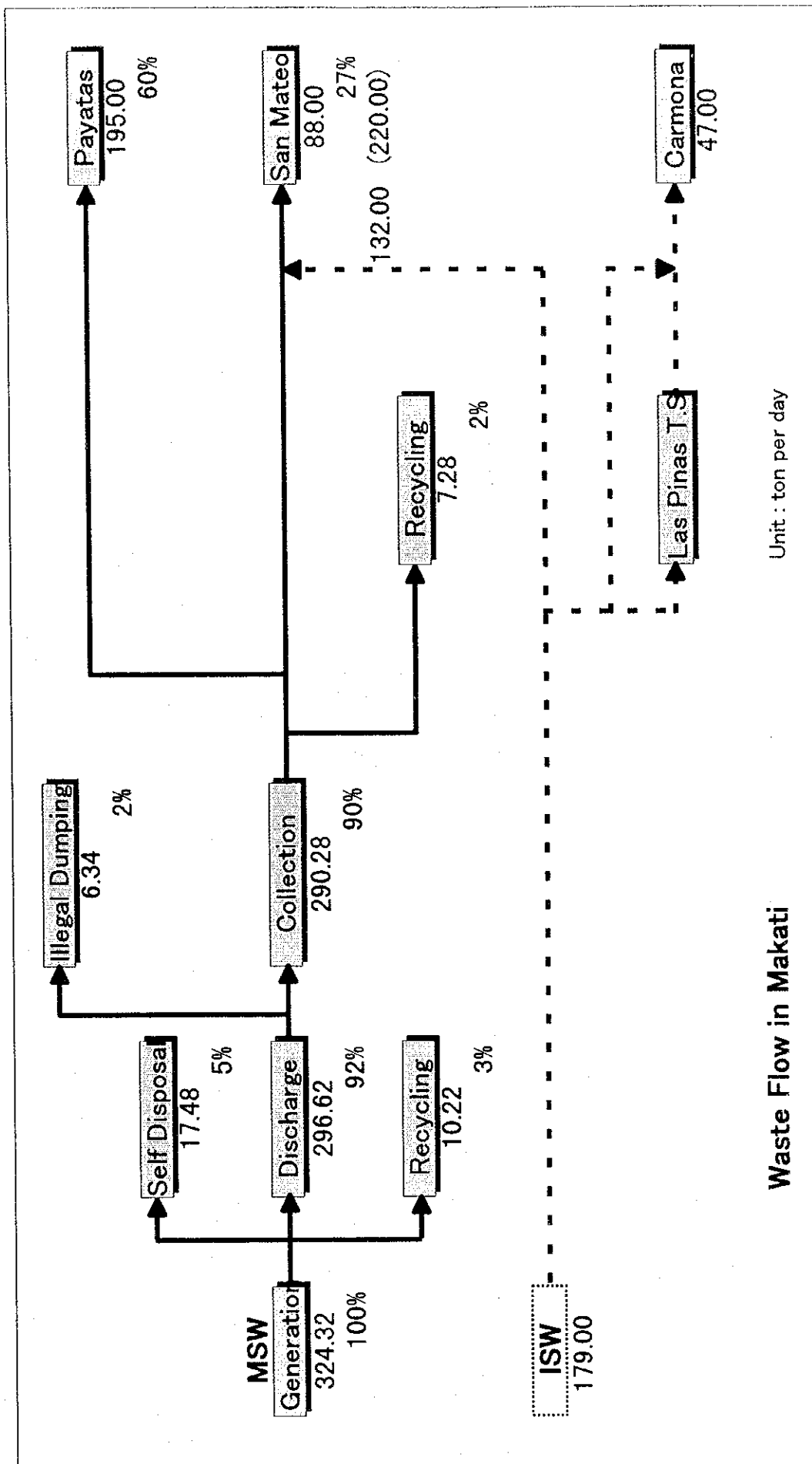


Figure 4.2-m Waste Flow in Makati (1997)

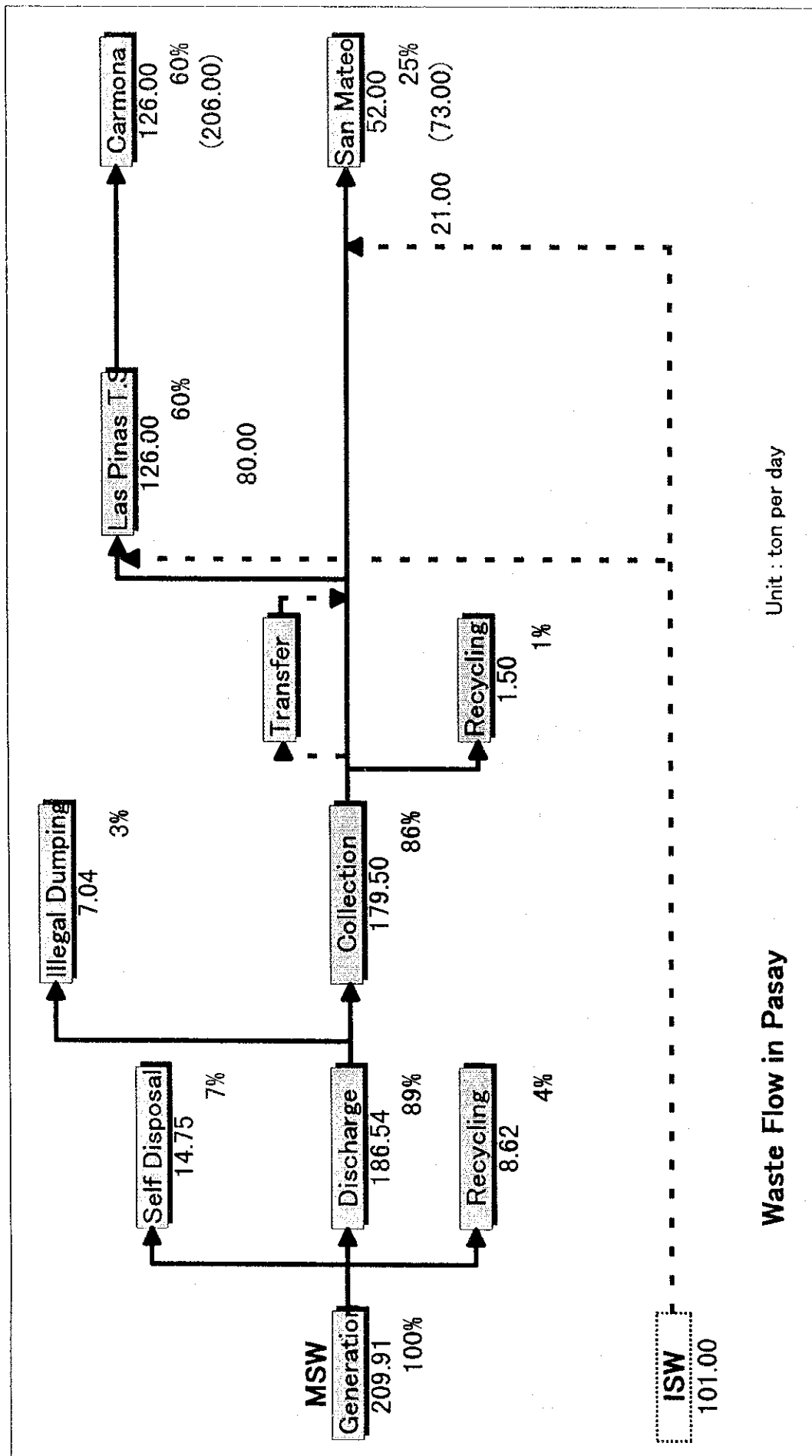


Figure 4.2-n Waste Flow in Pasay (1997)

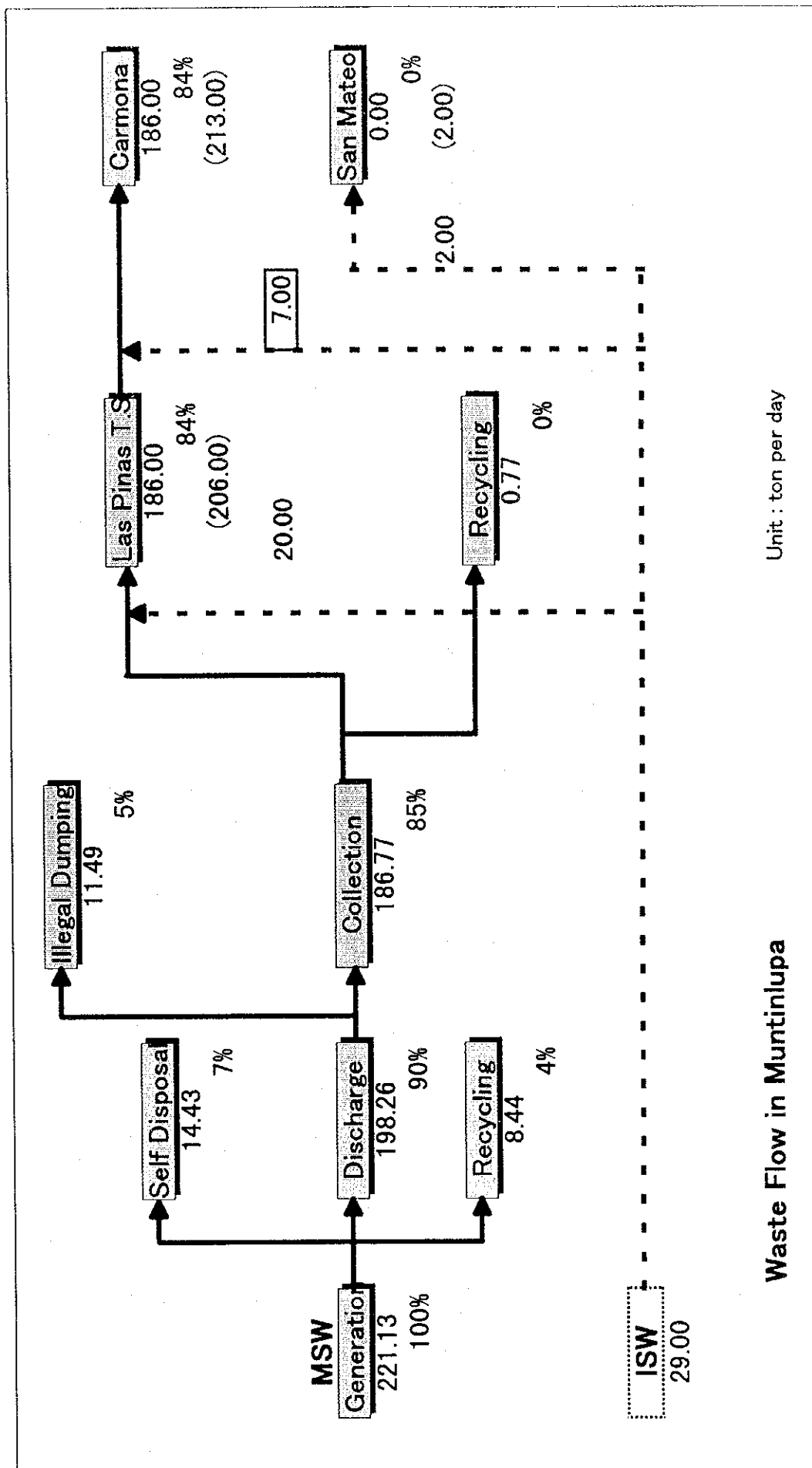


Figure 4.2-o Waste Flow in Muntinlupa (1997)

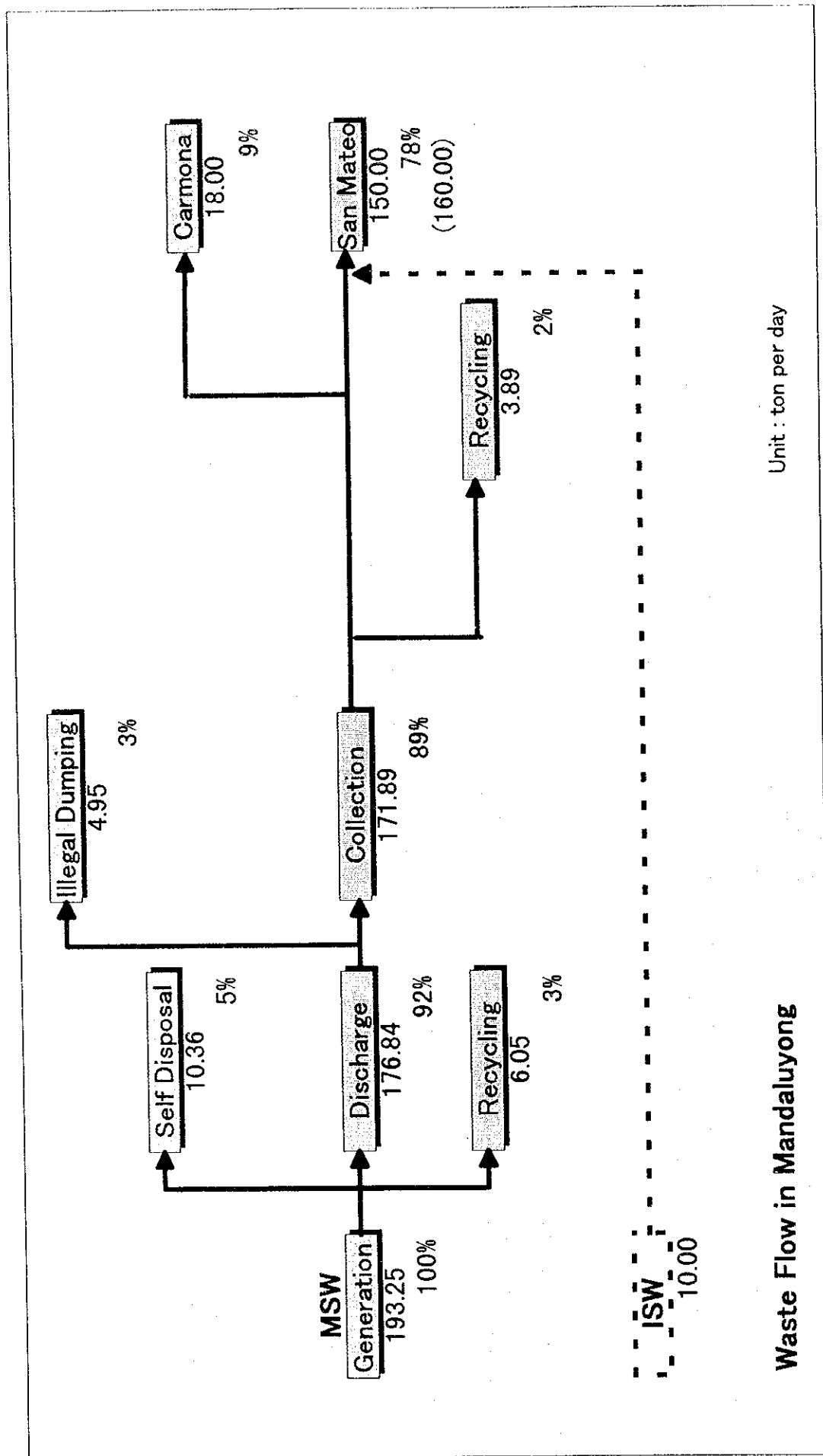


Figure 4.2-p Waste Flow in Mandaluyong (1997)

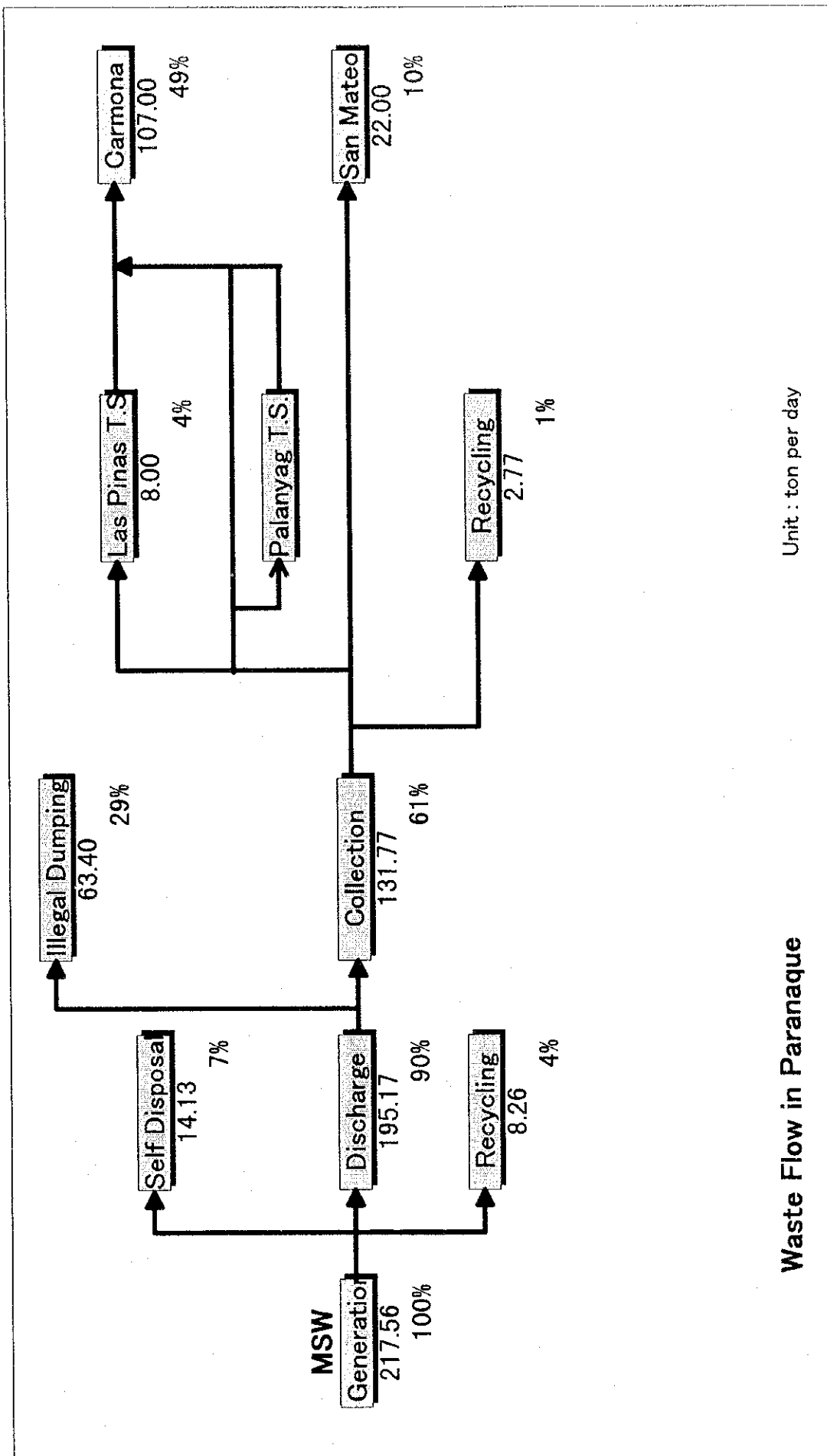


Figure 4.2-q Waste Flow in Paranaque (1997)

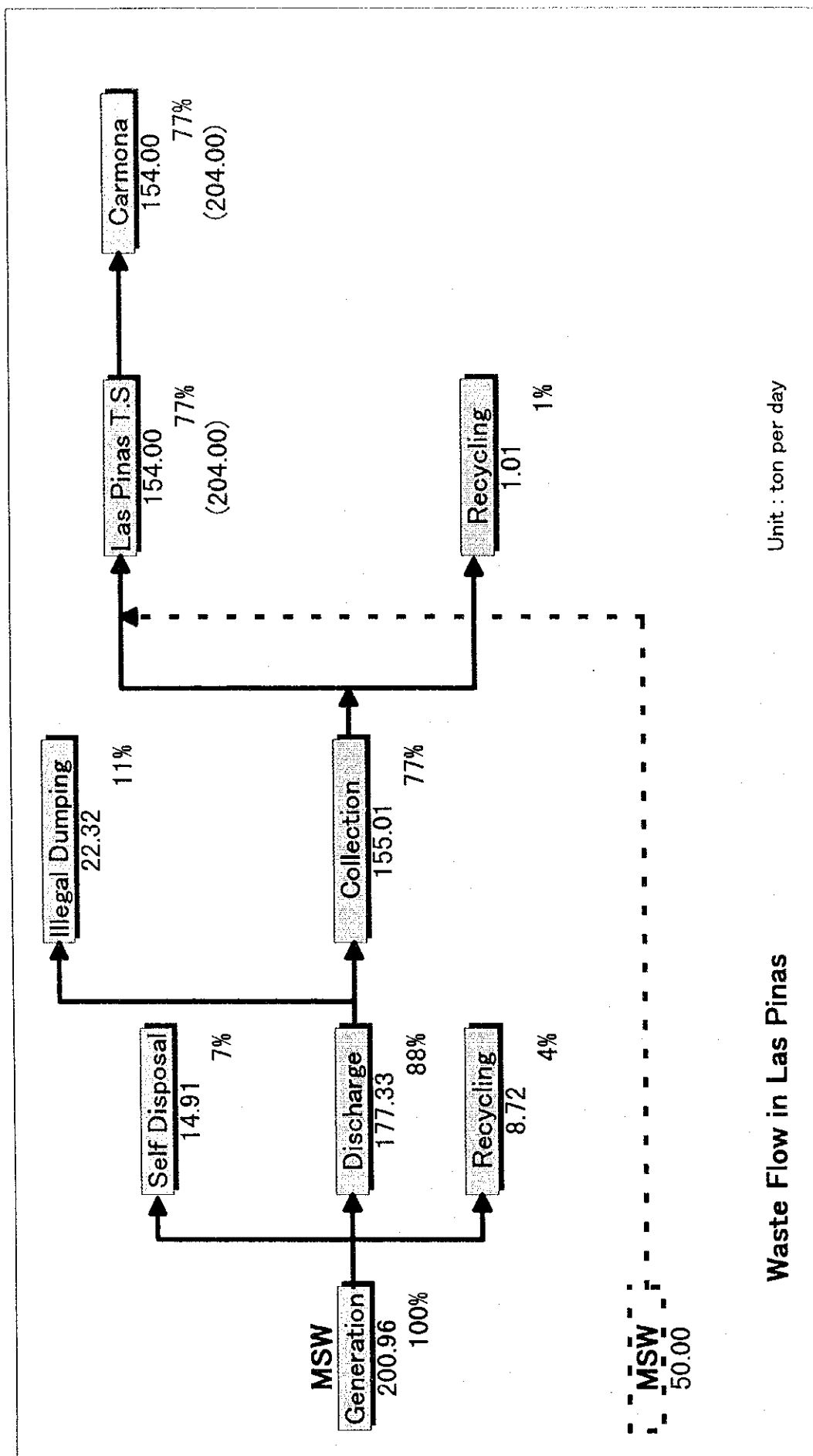


Figure 4.2-r Waste Flow in Las Piñas (1997)

Table 9-16 (1) Garbage Collection Equipment Inventory (By Type & Loading Capacity, in cu.m.)
(Operational Units only)

	C-5		C-8		C-12		C-16		Sp.Comp		6-W DT		10-W		MDT		TOTALS	
	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.
LGU	2	16.0									2	20	1	17.0			5	53.0
Pvt. Contractors	7	56.0	24	330.0					60	2,412	5	50	122	2,122.0			218	4,970.0
MANILA	9	72.0	24	330.0	0	0.0	0	0.0	60	2,412	7	70	123	2,139.0	0	0.0	223	5,023.0
LGU			5	55.6											1	6.0	6	61.6
Pvt. Contractors	3	24.0	2	24.0	2	32.0			15	1,078	59	592	182	2,912.0	11	88.0	274	4,750.4
QUEZON	3	24.0	7	79.6	2	32.0	0	0.0	15	1,078	59	592	182	2,912.0	12	94.0	280	4,812.0
LGU			2	25.6			1	24.0									3	49.6
Pvt. Contractors			1	8.0							65	712	90	1,386.0			156	2,106.0
MAKATI	0	0.0	3	33.6	0	0.0	1	24.0	0	-	65	712	90	1,386.0	0	0.0	159	2,155.6
LGU	4	20.0	2	16.0													6	36.0
Pvt. Contractors											28	335	15	304.5			43	639.1
PASAY	4	20.0	2	16.0	0	0.0	0	0.0	0	-	28	335	15	304.5	0	0.0	49	675.1
LGU	1	5.0	2	25.6													3	30.6
Pvt. Contractors											29	435					29	435.0
MUNTINLUPA	1	5.0	2	25.6	0	0.0	0	0.0	0	-	29	435	0	-	0	0.0	32	465.6
LGU			2	24.0							5	56					7	80.0
Pvt. Contractors											24	281	54	744.8			78	1,025.6
MANDALUYONG	0	0.0	2	24.0	0	0.0	0	0.0	0	-	29	337	54	744.8	0	0.0	85	1,105.6
LGU													6	90.0	2	12.0	8	102.0
Pvt. Contractors									8	579			20	300.0			28	878.6
PARANAQUE	0	0.0	0	0.0	0	0.0	0	0.0	8	579	0	-	26	390.0	2	12.0	36	980.6
LGU	10	60.0	20	240.0													30	300.0
Pvt. Contractors																	0	-
LAS PINAS	10	60.0	20	240.0	0	0.0	0	0.0	0	-	0	-	0	-	0	0.0	30	300.0
LGU	13	69.0	2	24.0													15	93.0
Pvt. Contractors																	0	-
MARIKINA	13	69.0	2	24.0	0	0.0	0	0.0	0	-	0	-	0	-	0	0.0	15	93.0
LGU	6	30.0					4	88.0					19	323.0	11	55.0	40	496.0
Pvt. Contractors									4	290			55	969.0			59	1,259.4
PASIG	6	30.0	0	0.0	0	0.0	4	88.0	4	290	0	-	74	1,292.0	11	55.0	99	1,755.4

Table 9-16 (2) Garbage Collection Equipment Inventory (By Type & Loading Capacity, in cu.m.)
(Operational Units only)

	C-5		C-8		C-12		C-15		Sp.Comp		6-W DT		10-W		MDT		TOTALS	
	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.	No. Units	Cap. cu.m.
LGU/MMDA	3	18.0	3	36.0			1	24.0							2	5.0	9	83.0
Pvt. Contractors																	0	-
PATEROS	3	18.0	3	36.0	0	0.0	1	24.0	0	-	0	-	0	-	2	5.0	9	83.0
LGU											1	10			6	36.0	7	46.0
Pvt. Contractors									15	1,078			12	228.0			27	1,306.4
SAN JUAN	0	0.0	0	0.0	0	0.0	0	0.0	15	1,078	1	10	12	228.0	6	36.0	34	1,352.4
LGU					1	20.0					1	10			1	6.0	3	36.0
Pvt. Contractors													18	270.0			18	270.0
TAGUIG	0	0.0	0	0.0	1	20.0	0	0.0	0	-	1	10	18	270.0	1	6.0	21	306.0
LGU							2	30.0									2	30.0
Pvt. Contractors											5	50	54	906.0	45	360.0	104	1,316.0
CALOOCAN	0	0.0	0	0.0	0	0.0	2	30.0	0	-	5	50	54	906.0	45	360.0	106	1,346.0
LGU											4	32	1	16.0	2	10.0	7	58.0
Pvt. Contractors	1	5.0	3	25.0							20	200					24	230.0
MALABON	1	5.0	3	25.0	0	0.0	0	0.0	0	-	24	232	1	16.0	2	10.0	31	288.0
LGU											3	30	1	16.0	10	35.0	14	81.0
Pvt. Contractors													8	128.0			8	128.0
NAVOTAS	0	0.0	0	0.0	0	0.0	0	0.0	0	-	3	30	9	144.0	10	35.0	22	209.0
LGU																	0	-
Pvt. Contractors													7	105.0	18	144.0	25	249.0
VALENZUELA	0	0.0	0	0.0	0	0.0	0	0.0	0	-	0	-	7	105.0	18	144.0	25	249.0
LGU	7	42.0	22	281.6			13	312.0	1	20			4	60.0			47	715.6
Pvt. Contractors																	0	-
MMDA	7	42.0	22	281.6	0	0.0	13	312.0	1	20	0	-	4	60.0	0	0.0	47	715.6
LGU	46	260.0	60	728.4	1	20.0	21	478.0	1	20	16	158	32	522.0	35	165.0	212	2,351.4
Pvt. Contractors	11	85.0	30	387.0	2	32.0	0	0.0	102	5,438	235	2,654	637	10,375.3	74	592.0	1091	19,563.5
TOTAL	57	345.0	90	1,115.4	3	52.0	21	478.0	103	5,458	251	2,812	669	10,897.3	109	767.0	1303	21,914.9

Form 9-17(1) Garbage Collection Equipment Inventory (By Model and Condition)

	Condition							Model (Year When Manufactured)							Status When Acquired				
	Engine			Body				A	B	C	D	E	F	S	R	N			
	G	Min	Maj	NS	G	Body													
						F	P												
LGU	5				5				3	2				5					
Pvt. Contractors	205	13	10		143	81	4	133	50	37	8			48	26	154			
MANILA	210	13	10	0	148	81	4	133	53	39	8	0	0	53	26	154			
LGU	6				6			1	2				3	2	3	1			
Pvt. Contractors	236	38	4		221	46	11	27					251	40	210	28			
QUEZON	242	38	4	0	227	46	11	28	2	0	0	0	254	42	213	29			
LGU	3		3	1	1	2	4		7					7					
Pvt. Contractors	145	11	2		106	51	1	45	32	7	7	31	36	72	77	9			
MAKATI	148	11	5	1	107	53	5	45	39	7	7	31	36	79	77	9			
LGU	5	1			6				6						4	2			
Pvt. Contractors	39	4			43					43				34	9				
PASAY	44	5	0	0	49	0	0	0	6	43	0	0	0	34	13	2			
LGU	3	0		7	4	0	6	2	8					8	0	2			
Pvt. Contractors	26	3			29			3	26					9		20			
MUNTINLUPA	29	3	0	7	33	0	6	5	34	0	0	0	0	17	0	22			
LGU	2	5	4		2	9		11								11			
Pvt. Contractors	78				78								78	35	43				
MANDALUYONG	80	5	4	0	80	9	0	11	0	0	0	0	78	35	43	11			
LGU	8		2		8		2		10				0	2	8				
Pvt. Contractors	28				28			28								28			
PARANAQUE	36	0	2	0	36	0	2	28	10	0	0	0	0	2	8	28			
LGU	30				30			30							30				
Pvt. Contractors																			
LAS PINAS	30	0	0	0	30	0	0	30	0	0	0	0	0	0	30	0			
LGU	12	3	24	1	17	23		21					19		35	5			
Pvt. Contractors																			
MARIKINA	12	3	24	1	17	23	0	21	0	0	0	0	19	0	35	5			
LGU	25	15	6	3	36	10	3	40					9		35	14			
Pvt. Contractors	51	8			57	1	1	8	5	4	3		39	24	28	7			
PASIG	76	23	6	3	93	11	4	48	5	4	3	0	48	24	63	21			

Form 9-17 (2) Garbage Collection Equipment Inventory (By Model and Condition)

	Condition						Model (Year When Manufactured)										Status When Acquired				
	Engine			Body			A	B	C	D	E	F	S	R	N						
	G	Min	Maj	NS	G	F	P														
LGU/MMDA	5	4		1	3	6	1	6	4												10
Pvt. Contractors																					
PATEROS	5	4	0	1	3	6	1	6	4	0	0	0	0	0	0						10
LGU	7		1		8			8													8
Pvt. Contractors	24	3	2		25	3	1	16	9	4											15
SAN JUAN	31	3	3	0	33	3	1	24	9	4	0	0	0	0	0						23
LGU		3		3		3	3	6													5
Pvt. Contractors	18				18																18
TAGUIG	18	3	0	3	18	3	3	6	0	0	0	0	0	0	0						5
LGU	2			1	2		1		3												
Pvt. Contractors	104				68	36		37	35	15	7	5	5	5	5						82
CALOOCAN	106	0	0	1	70	36	1	37	38	15	7	5	5	5	5						0
LGU	7				7																
Pvt. Contractors	22	2	1		5	19	1	7		1											3
MALABON	29	2	1	0	12	19	1	7	0	1	0	0	0	0	0						3
LGU	14				14			10													10
Pvt. Contractors	7	1	2			8	2	2													2
NAVOTAS	21	1	2	0	14	8	2	12	0	0	0	0	0	0	0						12
LGU																					
Pvt. Contractors	25				25			25													25
VALENZUELA	25	0	0	0	25	0	0	25	0	0	0	0	0	0	0						0
LGU	36	11	15	7		50	19	6	62	1											69
Pvt. Contractors																					
MMDA	36	11	15	7	0	50	19	6	62	1	0	0	0	0	0						69
LGU	170	42	55	24	149	103	39	141	105	3	0	0	0	0	0						137
Pvt. Contractors	1008	83	21	0	846	245	21	331	157	111	25	36	452	314	532						266
TOTAL	1178	125	76	24	995	348	60	472	262	114	25	36	494	343	657						403

Table 9-18 (1) Transfer, Disposal and Other Equipment Inventory (By Type & Loading Capacity, in cu.m.)

	TRANSFER										DISPOSAL										OTHER EQUIPMENT					
	TRAILER VAN		EQUIPMENT (# of Units)								EQUIPMENT (# of Units)										Mech S/S		EQUIPMENT (# of Units)			
	No.	Capacity	BD	PL	BH	PM	WT	Oth	T	BD	PL	TC	BH	WT	DT	Oth	T	No.	Capacity	SJ	WT	TB	Oth	T		
LGU									0								0							0		
Pvt. Contractors	32	3072.0		6	3		1	1	11								0	7	21.0					2	2	
MANILA	32	3072.0	0	6	3	0	1	1	43	0	0	0	0	0	0	0	0	7	21.0	0	0	0	0	2	9	
LGU									0								0	2	5.0	1	2		2	5		
Pvt. Contractors									0	9	1	3	1				14							0		
QUEZON	0	0.0	0	0	0	0	0	0	0	9	1	3	1	0	0	0	14	2	5.0	1	2	0	0	5		
LGU									0								0							0		
Pvt. Contractors									0								0							0		
MAKATI	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		
LGU									0								0							0		
Pvt. Contractors				2					2								0							0		
PASAY	0	0.0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		
LGU									0								0					1		1		
Pvt. Contractors									0								0							0		
MUNTINLUPA	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	1	0	0	1		
LGU									0								0							0		
Pvt. Contractors									0								0							0		
MANDALUYONG	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		
LGU			1	2	2				5								0							0		
Pvt. Contractors	5	375.0		1					1								0					200		200		
PARANAQUE	5	375.0	1	3	2	0	0	0	11	0	0	0	0	0	0	0	0	0	0.0	0	0	200	0	200		
LGU									0								0							0		
Pvt. Contractors									0								0							0		
LAS PINAS	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		
LGU									0								0							0		
Pvt. Contractors									0								0							0		
MARIKINA	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		
LGU				3					3								0							0		
Pvt. Contractors									0								0							0		
PASIG	0	0.0	0	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0		

Table 9-18 (2) Transfer, Disposal and Other Equipment Inventory (By Type & Loading Capacity, in cu.m.)

	TRANSFER										DISPOSAL										OTHER EQUIPMENT				
	TRAILER VAN		EQUIPMENT (# of Units)								EQUIPMENT (# of Units)										Mech S/S		EQUIPMENT (# of Units)		
	No.	Capacity	BD	PL	BH	PM	WT	Oth	T	BD	PL	TC	BH	WT	DT	Oth	T	No.	apaci	SJ	WT	TB	Oth	T	
LGU/MMDA									0															0	
Pvt. Contractors									0															0	
PATEROS	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	
LGU									0															0	
Pvt. Contractors				1					1															0	
SAN JUAN	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	
LGU				1	1				2													2		2	
Pvt. Contractors									0															0	
TAGUIG	0	0.0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.0	0	2	0	2	
LGU									0											3	9.0			0	
Pvt. Contractors			3	7					10															0	
CALOOCAN	0	0.0	3	7	0	0	0	0	10	0	0	0	0	0	0	0	0	0	3	9.0	0	0	0	3	
LGU				1					1															0	
Pvt. Contractors									0															0	
MALABON	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	
LGU				1					1															0	
Pvt. Contractors									0															0	
NAVOTAS	0	0.0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	
LGU									0															0	
Pvt. Contractors			1	1					2															0	
VALENZUELA	0	0.0	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	
MMDA	15	1275.0	1	1		15			17		1						1	1						0	
Pvt. Contrs									0								0							0	
Las Pinas TS	15	1275.0	1	1	0	15	0	0	32	0	1	0	0	0	0	0	1	1	0	0.0	0	0	0	0	
MMDA									0															0	
Pvt. Contrs									0															0	
MMDA Sn Mateo	0	0	0	0	0	0	0	0	0	7	1	2	0	1	0	3	14	0	0.0	0	0	0	0	0	
LGU									0	2	1	2		1		2	8							0	
MMDA Carmona									0	5														0	
MMDA Carmona	0	0	0	0	0	0	0	0	0	7	1	2	1	1	1	4	3	19	0	0.0	0	0	0	0	
TOTAL	52		6	27	6	15	1	1	108	23	4	7	2	2	4	6	48	12		1	5	200	2	220	

Table 9-19 (1) LGUs' Facilities Inventory (Depot or Garage and Maintenance Shops)

LGU	No.	Type	Garage/Mshop/TS			Equipment Maintenance Capability						
			Land Area (in sq.m.)	Ownership		Engine			Body			Maj
				O	R	None	Min	Maj	None	Min	Maj	
MANILA	1					1			1			
QUEZON	1	Garage	16,000.00	1			1					1
	1	Motorpool	320.00	1						1		
MAKATI	1	Depot	3,000.00	1			1			1		
PASAY	1	Motorpool	300.00	1			1			1		
MUNTINLUPA	1	Garage	200.00		1			1				1
MANDALUYONG	1	Depot	300.00	1			1			1		
PARANAQUE	1	Garage	3,000.00	1			1			1		
LAS PINAS	1	Garage		1			1			1		
MARIKINA	1	Depot/TS	13,550.00	1			1			1		1
PASIG	1	Mpool/TS	8,000.00	1				1				1
PATEROS	1	Garage	1,500.00		1			1		1		
SAN JUAN	1	Garage	1,000.00	1			1			1		
TAGUIG	1	Garage		1			1			1		
CALOOCAN	1	Garage	5,000.00		1			1				1
MALABON							1			1		
NAVOTAS	1	Garage		1			1			1		
VALENZUELA							1			1		
MMDA 103	1	Garage/Mpool	700.00	1				1				1
MMDA 107	1	Mpool	500.00	1				1				1
METRO MANILA	17		52,870.00	13	3	13	5	1	14	5		1

Table 9-19 (2) Private Contractors' Facilities Inventory (Depot or Garage and Maintenance Shops)

Company	SERVICE AREAS	No.	Garage/Mshop/TS			Maintenance Capability					
			Type	Land Area (in sq. m.)	Ownership		Engine			Body	
					O	R	None	Min	Maj	None	Min
Leone!	Manila	1	WS/Depot	13,680.00		1			1		1
Greenline	QC, Prque, Pasig, Sn Juan	1	WS/Depot	1,000.00		1			1		1
REN	QC, Makati	3	WS/Garage	60,000.00	1	2	1		2	1	2
Transtar	QC										
Halrey	QC, Kalookan, Valenzuela	2	WS/G	12,500.00	1	1	1		1	1	1
LRP	QC	1	WS/Garage	250.00	1			1			1
NIDC	QC	1	WS	1,000.00	1			1			1
CARC	QC										
Unicorn	QC										
RTM	Makati										
ACY	Makati										
NJ Bautista	Makati										
JSDG	Makati										
LEG	Pasay City	2	WS/TS	1,100.00	1	1	1		1	1	1
Red Fox	Muntinlupa, Pasig, Taguig	3	WS/Depot	1,000.00	1	2		2	1		2
RMMS	Mandaluyong	2	WS/Depot	20,000.00	1	1		1	1		1
EJR	Paranaque	1	Garage	2,000.00		1		1			1
Hinterland	Paranaque	1	Garage			1	1			1	
EER	Pasig	1	Garage	700.00	1		1			1	
JRD	Pasig	1	Garage	350.00	1		1			1	
SVR	Pasig										
Metrowide	Pasig, San Juan	1	Depot	1,000.00		1		1			1
Tuazon	Pasig	2	MP/Garage	2,000.00	1	1	1	1		1	1
BBal	Pasig	1	Garage	500.00		1	1			1	
RB Yap	Pasig		none								
IPM	Pasig	1	Motorpool	4,000.00	1				1		1
Mudregal	Kalookan	2	Garage/MP	4,400.00	1	1	1		1	1	1
LDM	Kalookan	1	MP/TS	300.00		1		1			1
R&F	Kalookan	1	TS	1,000.00		1	1			1	
ETS	Kalookan	1	Depot/TS	15,000.00		1			1		1
EDC	Kalookan	1	TS	2,000.00		1			1		1
Felgene	Kalookan	2	Garage/TS	15,200.00		2	1	1		1	1
Haulers	Malabon, Navotas	1	Mpool	8,000.00	1				1		1
MPH	Malabon	1	Mpool	500.00		1			1		1
TOTALS		34		167,480.00	13	22	11	10	14	11	7

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Table 9-20 (1) ORGANIZATION (LGUs and MMDA)

LGU/MMDA	ADMINISTRATION						OPERATIONS/REGULAR						COLLECTION			BEUTIFICATION			DEPOT/MAINTENANCE						TRANSFER STN				DUMP	MMDA Backup	SPECIAL PROJ.	TOTAL					
	S	TS	ADS	CS	O	ST	S	O	O	S	M	S	I	O	ST	D	C	ST	SW	O	ST	E	M	H	E	C	D	P					O	ST	OO	E	L
MANILA	4	4	12	11	20	51	2	6	12	14		2	36						189		189		2		1												279
	5	6	14	9	14	48	1	2	26	37	21	11	98	15	15	32	82	114																	94	909	
	3	4	5	7	18	37	1	4	3	22	4	14	48	91	91	243	11	254						1										35	468		
	1						1	3	4	2				9	4	8	12	20			20														42		
	2	1	3	5	8	19	1	2	9					12		9	9	57	16	73		2	4	2											670	791	
MANDALUYONG	1																																			308	
	2	2		6	4	11										12	21	23	272		272														284		
	1	1		14		16										0	42	84	126	565		2													715		
	1		3	2	2	8										38	50	150	200	60	60													310			
	2	1	1	3	2	9										16	38	150	188	420	420													639			
PATEROS	1	1			2	4										5	21	26	33		33														65		
	1		3		4	1										3	7		7	26															40		
	7		3	6	16											30	33	4	12	16	129		1											195			
	2		12			14											6			207														227			
	1						1										4			15														22			
VALENZUELA	1						2									7	8	24	32	41															85		
	2	3				5										5	2				85													147			
																																			44		
																																			324	2740	
																																			11		
MMDA/Carmona																																				5	
																																			8		
																																			31		
																																			72		
																																			1123	8435	

Legend:

S - Supervisor (Office/Asst. Head, Managerial Level)	S - Supervisor	D - Driver	SW - St. Sweeper	E - Engineer	OO - Oprns. Offr.
TS - Technical Staff (Offr. Level Posn.)	OO - Operations Officer	C - Collector	O - Others	M - Mechanic	E - Engineer
ADS - Admin. Staff	OS - Operations Staff	(Paleros, Helper, M. Aide, Laborer)	(Gardener, M. Hardliner, Nurse/ Caretaker)	HCO - Heavy	AS - Admin. Staff
CS - Clerical Staff	MS - Monitoring Staff			Egpt. Opt.	L - Laborer
O - Others (Janitor/Driver/Opr. etc.)	I - Inspector			DP - Dispatcher	O - Others (Guide Crew, etc.)
	O - Others (Foreman, etc.)			O - Others	

Table 9-20 (2) ORGANIZATION (PRIVATE CONTRACTORS)

COMPANY	ADMINISTRATION					OPERATIONS/REGULAR					COLLECTION				BEUTIFICATION			DEPOT/MAINTENANCE						TRANSFER STN				TOTAL			
	S	TS	ADS	CS	O	ST	S	O	O	S	M.S.	I	O	ST	D	C	ST	SW	O	ST	E	M	H.E.C	DP	O	ST	OO		E	L	ST
ACY	1					1	1							1	39	125	164							1		1					167
B. Bai	1					1					2			2	4	16	20														23
EDC				6		6					1			1	27	60	87						2	1		3					97
EER	1					1									3	12	15					2			2						18
EJR	1			2		3	1							1	20	80	100						2		2						106
ETS		1		2		3					1			1	5	12	17					1	2	4	7						28
Felgene	1		3			4									12	43	55														
Greenline E	2	1	23	4	12	42	2	1	3			2		8	66	410	476				2	11	2			15					541
Halley	1		6			7	2							2	55	194	249					2		1	2	5					263
Haulers	2		4	4		10	2	2			4			8	13	40	53					4		6	22	32					103
Hinterland	1					1								1	5	20	25														28
IPM	1					1	1	1						2	10	40	50						1		1						54
JRD	1					1									9	36	45														47
JSDG	1	2		1		4	1	3						4	24	96	120														128
LDM	1					1									18	7	25					3				3					29
LEG H.	5			4		9		3						3	41	117	158					4				4					174
Leonel	4	15	3		7	29		10	24	8				42	240	699	939	250				7	6	42	55	2		2			1317
LRP	1	1				2	1							1	17	59	76					1				1					80
Metrowide E.	1			1		2		1	2	2				5	7	28	35														42
Metrowide M.	1					1									14	56	70														71
MPH	1		2			3									5	15	20					1	1	1	3						26
Mud-regal	1					1						1		1	22	78	100					6				6					108
NIDC	1	3		1		5	1							1	8	24	32					2		2		4					42
NJ Bautista	1	2	1			4		1						1	22	88	110														115
R & F	1		2			3									7	5	12					1				1					16
RB Yap															4	16	20					1				1					21
Redfox	5	5	1	1		12									33	120	153					5				5					170
REN	3	1	4	8		16	2							2	232	1128	1360				4	150	13			167					1545
RMMS															78	312	390														390
RTM	1					1	1							1	24	79	103							1		1					106
SVR	1					1									1	4	5														6
Tuazon	1					1									5	20	25														26
TOTAL	43	31	49	34	19	176	13	25	30	17		3	0	88	1070	4039	5109	250	0	250	6	203	2	39	71	321	2	0	0	2	5887