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JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
Ministry of Home Affairs, Provincial Councils and Local Government
Democratic Socialist Republic of Sri Lanka

THE STUDY ON IMPROVEMENT OF SOLID WASTE MANAGEMENT IN SELECTED CITIES IN SRI LANKA

ACTION PLAN FOR NEGOMBO
FINAL REPORT
Volume V-6A
MAIN REPORT

DECEMBER 2002

NIPPON SANITARY CONSULTANTS

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
Ministry of Home Affairs, Provincial Councils and Local Government
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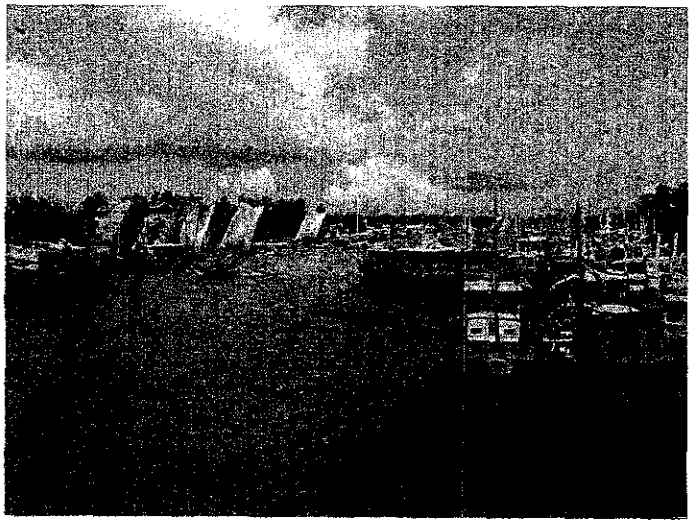
THE STUDY ON IMPROVEMENT OF SOLID WASTE MANAGEMENT IN SECONDARY CITIES IN SRI LANKA

ACTION PLAN FOR NEGOMBO

FINAL REPORT

Volume V-6A

MAIN REPORT



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This is Action Plan for Negombo, Main Report.

In this report, the project cost is estimated using the September 2003 prices and at an exchange rate of 1 US$ = 117.02 Japanese Yen = 95.28 Rupees

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List of Abbreviations

CDA	Community Development Assistant
CDO	Community Development Officer
CEA	Central Environmental Authority
DEO	Divisional Environmental Officer
DF/R	Draft Final Report
EIA	Environmental Impact Assessment
F/S	Feasibility Study
GDP	Gross Domestic Product
IC/R	Inception Report
IDP	Infectious Disease Prevention
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
MOH	Medical Officer of Health
MGTP	Management Plan
M/M	Minutes of Meeting
MOHLG	Ministry of Home Affairs, Provincial Councils and Local Government
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NMA	Negombo Municipal Area
NMC	Negombo Municipal Council
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
PHI	Public Health Inspector
POS	Public Opinion Survey
P/R	Progress Report
SCP	Sustainable Cities Programme
SLILG	Sri Lankan Institute of Local Governance
S/W	Scope of Work
SWM	Solid Waste Management
WTP	Willingness to Pay

Chapter 1 Background Conditions

1.1 Introduction

This plan was prepared by Negombo Municipal Council (NMC) by itself, with JICA's technical assistance. Any decisions in this study were made by NMC.

1.2 Basic Fact Sheet

1.0	**General Data**	
1.1	Province	Western Province
1.2	District	Gampaha District
1.3	Local Authority Status	Municipal Council
1.4	Location	32 km north of Colombo City.
1.5	Description	Very flat, low lying (<10m elevation) coastal city located around a large lagoon.
1.6	Negombo Municipal Area (NMA)	30.8km^2 (approx.) including Thalahena
1.7	No. of Council members	23 (Negombo 12, Kochchikade 10, thalahena and Pitipana 1)
2.0	**Socio-Economic Data**	
2.1	Total Population (2001)	144,551 (2002 estimate = 146,864)
2.2	Daily Floating Population	-12,737
2.3	Average Population Density	72 persons/ha (UDA Development plan)
2.4	Population Growth Rate	1.6% (estimate)
2.5	Number of Households (2001)	32,122
2.6	Family Size	4.5
3.0	**Overall Negombo Muncipal Council (NMC) Data**	
3.1	Total Cadre (2002)	687
3.2	Total Budget Expenditure (2002)	98,814,000
4.0	**Solid Waste Management (SWM)**	
4.1	Collection Amount (2002)	53.2tonnes/d (19,418 tonnes/year)
4.2	Budget SWM Expenditure (2002)	20,607,000
4.3	Cadre for SWM works (2002)	184
4.4	Ratio of SWM workers to all employees	28.0%
4.5	Ratio of SWM to total expenditure	20.9%
4.6	SWM expenditure per capita	140 Rs/person.year
4.7	SWM expenditure per tonne waste	1,061 Rs/tonne

1.3 Natural and Social Conditions

Negombo is a coastal city developed around the Negombo lagoon. It was declared a Municipal Council in 1949 and its administrative area was expanded in 1987 with the addition of Kochchikade Town Council area and Katana Village Council area, and again in 2002 with the addition of Thalahena. Negombo is important for several reasons:

- It is a major commercial and service centre for a large catchment area, just 6km away from the Katunayake International airport, Katunayake Free Trade Zone and with direct road connections to other district town centres such as Puttalam, Kurunegala, Gampaha and Ja-Ela.
- It functions as a sub-regional growth centre of Colombo, being identified as one of five second order towns in the Colombo region[1].

[1] Colombo Regional Structure Plan, UDA, 1999

- *It has a strong tourist industry, being the entry and exit point for most international tourists coming to* Sri Lanka.
- It is one of Sri Lanka's major fishery harbours.

According to the UDA Development Plan, about 30% of the labour force work in the fishing industry, while 80% of the total working population not working in fishing or tourism work outside the city each day. Land use for Negombo and Kochchikade is summarised below:

Classification	Negombo	Kochchikade	Total	%
Residential	710.0	709.5	1,419.5	62.5
Commercial	39.5	31.5	71.0	3.11
Public	51.4	21.3	72.7	3.18
Open Areas	58.7	13.3	72.0	3.15
Cemeteries	4.5	2.2	6.7	0.29
Religious	12.7	4.5	17.2	0.25
Industries	4.7	8.5	13.2	0.57
Marshy land	9.3	15.8	25.1	1.10
Mangroves	24.9	--	24.9	1.09
Coconut cultivation	16.3	163.8	180.1	7.88
Hotels	6.4	11.9	18.3	0.80
Roads	165.7	116.0	281.7	12.33
Paddy cultivation	12.6	11.7	24.3	1.06
Parks and play grounds	13.1	11.4	24.5	1.07
Mixed crops	--	10.7	10.7	0.47
Beaches	5.2	2.1	7.3	0.32
Waterbodies	4.3	11.4	15.7	0.69
Total	**1,139.3**	**1,145.6**	**2,284.9**	**100.00**

Source: Land use survey, UDA (1998); data for Thalahena not available.

1.4 Main Implications to SWM

- SWM service provision needs to be of a high quality due to Negombo being a large city, its commercial/service nature, the large number of tourists passing through it and to protect its lagoon and sea environments.
- The flat nature of Negombo indicates that its drainage system may easily be blocked by garbage, litter and other materials, meaning that regular cleaning is required to avoid nuisance and public health problems.
- The built up and low lying nature of Negombo, means that there are very few suitable places for landfilling within the city limits, other than low lying marshy land. However, before dumping at such places, consideration needs to be given to the possible environmental and social impacts of such activity (e.g. groundwater pollution, increased flooding).
- A lot of garden waste may be generated, due to the large number of trees, home gardens and coconut trees in Negombo, with coconut leaves being used for many purposes (e.g. roofing, fencing) and then thrown away.

Chapter 2 Current SWM Condition

2.1 Current Waste Stream

The "waste stream" refers to the "flow" of waste from generation to final disposal. It describes and quantifies the waste generated by different sources within the scope of this Study and quantifies the amounts of waste collected, recycled and disposed of by different means. Determination of the waste stream is one of the most important tasks to be completed in the formulation of a SWM Plan. Waste stream results (2002) are summarised in this section, with additional waste stream details being given in the supporting report.

2.1.1 Waste Stream Terminology

The terms used in the waste stream model adopted for the NMA are defined below.

Table 2-1 : Waste Stream Terminology

Term	Definition/Explanation
Generation	Production of all waste at source.
On-site disposal	Waste is disposed of by the generator within their property, usually by burial in a pit and/or burning of the waste or sometimes incineration (e.g. hospitals).
On-site composting	Organic waste is composted within the property of the generator itself in order to produce a useful product - compost.
Discharge	Part or all of the waste generated is put out for collection either within the property of the source itself (e.g. hotels, some institutions and industries), outside the property (e.g. in bins or in small piles at the roadside) or at an approved collection point (e.g. concrete bins located around the city).
Direct Haulage	Part or all of the waste generated by different sources is transported directly by them to the official disposal site.
Collection	Waste discharged by a source is collected by NMC for transportation to the final disposal site.
Disposal	Waste collected by NMC is discharged at the final disposal site.
Recycling	Part or all of the waste generated is sold or given to an external person/shop/company, etc. for reuse or recycling. In this context, recycling generally refers to the recovery of inorganic and non-compostable waste materials, particularly plastics/polythene, paper[2], glass, metals and some textile scraps. Recycling may take place at source, following discharge and collection, and from the final disposal site and illegal dumps.
Composting	Readily biodegradable waste (e.g. food/kitchen, garden/yard, paper wastes) is collected and then decomposed aerobically in a controlled manner at a commercial compost facility run by NMC, NGO or the private sector. Composting may be carried out in order to reduce the weight, volume, and polluting strength of waste to be subsequently placed in the landfill and/or to produce a marketable product for sale.
Illegal dumping	Part or all of the generated waste is dumped outside the generator's property in an area where such behaviour is prohibited (e.g. open spaces, drains, canals, etc.).

2.1.2 Waste Sources

The main sources of municipal solid waste (MSW) considered in this Study are households, commercial enterprises, hotels, markets, institutions, industries and "other" (parks, beaches, road and drain cleaning) wastes. Each of these sources is briefly described below.

[2] Many types of paper may readily be composted, while other types are only slowly biodegradable or not suitable for composting (e.g., glossy magazines).

Table 2-2 : Main Waste Generation Sources

Source	Description
Household	Waste generated from domestic activities, including food preparation, cleaning, fuel burning, yard sweeping, gardening and other miscellaneous household wastes (e.g. old clothing, appliances, etc.).
Commercial	Wastes generated by trade, service, processing and production enterprises, excluding hotels, markets and industries (covered separately).
Hotels	Wastes produced by tourist hotels within the city.
Markets	Waste from markets selling a high proportion of vegetables, fruit, meat and/or fish (e.g. Bandula, Dudley Senanayake Central, Lellama markets), including the Polas (daily fairs) held at various locations within NMA.
Institutions	Wastes from schools, other education centres, hospitals, NMC, central and provincial government offices, police, prison and religious institutions. Hospital waste includes some hazardous items as discussed further under hazardous/special waste and later in this report.
Industries	Wastes from Elsuma (electrical circuits manufacturer), sawmills (10) and other industries (128).
Other	Waste from Rajapkasha Udyanaya and Beach Park (public parks). Beach litter collected by the Hotel Association tractor Road/drain cleaning waste, collected by NMC handcart labourers.
Construction and demolition	Wastes originating from construction, rehabilitation and demolition activities, etc. These wastes are not usually handled by NMC but are dealt with by the contractors involved. Typically, they are used as clean fill on other sites or in low-lying areas. Hence, they are not considered further in this Study.
Hazardous (Special)	Hazardous wastes originating from various sources, including household items (e.g. batteries, spray cans, etc.). These are described separately for each category as appropriate. The management of sharps, clinical, body parts and highly infectious wastes from hospitals is a major concern in Negombo.

2.1.3 Waste Generation

2.1.3.1 Waste Generation Rates

Waste generation rates (see table below) were measured or estimated from a combination of quantitative and interview surveys and landfill trip data. Key points are summarised here.

- The average household waste generation rate of 0.62kg/cap.d is slightly less than other Sri Lanka data[3] for municipal councils (0.65 - 0.85kg/cap.d).
- Commercial waste generation is 13.5T/d (9.9% of MSW), with the commercial waste generation rate being moderately high (9.9kg/enterprise.d). These quantities were determined from survey data for a mixture of large and small waste generators within the commercial areas of the city, together with NMC statistics for the total number of business centres. They are considered realistic, being supported by observations of business activities within NMA, with the high value being attributed to the relatively high number of restaurants, local hotels[4] and bakeries in the Negombo and Kochchikade commercial areas.
- Market waste generation (8.7T/d, 6.4% of MSW) is based on estimates for each of the markets and Polas within NMA and equates to a market waste generation rate of 6.7kg/stall.d. This is considered reasonable.

[3] UNEP (2001), State of the Environment Sri Lanka 2001
[4] Local hotels = canteens, small eating places, etc.

- Household and commercial hazardous waste generation is relatively small[5], comprising typical everyday items (e.g. spraycans, batteries, fluorescent tubes and razor blades (hairdressers), etc.) which are disposed with normal garbage.
- Industrial hazardous waste generation is also relatively small, except for Neil Marine Boatyard, which produces about 100kg/d of mainly fibreglass waste, which is collected by a private contractor.
- Significant quantities of hazardous healthcare wastes are produced by the Negombo Base Hospital, with the other four hospitals within NMA producing smaller amounts of such wastes. Total healthcare hazardous waste generation is estimated to be approximately 1.5T/mth of clinical wastes, 0.05T/mth of body parts/placentas, 1.1T/mth of sharps and a small amount of highly infectious wastes.
- Total MSW generation is 136T/d, equivalent to 0.93kg/cap.d. Waste generation by source is shown in Figure 2-1.

Table 2-3: Estimated Waste Generation Quantities (2002)

Source	Waste Generation Data			Waste Generation		
	WGR	WGR Unit	No of Units	Amount (T/d)		%
Residential	0.624	Kg/person.d	146,864	91.58	91.6	67.3
Commercial	9.90	Kg/enterprise.d	1,360	13.47	13.5	9.9
Markets	6.73	Kg/stall.d	1,285	8.65	8.7	6.4
Hotels	2.15	Kg/(guests+staff).d	1,887	4.06	4.1	3.0
Institutions:						
- Schools	0.071	Kg/(students+staff).d	43,633	3.10		
- Other Educational	0.044	Kg/(students+staff).d	4,101	0.18		
- Hospitals	0.356	Kg/(patients+staff).d	2,475	0.88		
- Govt offices/police	0.151	Kg/worker.d	1,966	0.30		
- Prison	1.47	Kg/(worker+inmate).d	365	0.54		
- Religious	1.01	Kg/clergy.d	137	0.14	5.1	3.8
Industries:						
- Elsuma	1.43	Kg/worker.d	750	1.07		
- Sawmills	282	Kg/sawmill.d	10	2.82		
- Other	51.5	Kg/industry.d	128	6.59	10.5	7.7
Other:						
- Parks	0.37	T/d	N/a	0.37		
- Beach litter	0.12	T/d	N/a	0.12		
- Road/drain cleaning	2.28	T/d	N/a	2.28	2.8	2.0
Total	0.93	Kg/person.d	146,864	136.1	136.1	100.0

Notes: N/a = not applicable, WGR = waste generation rate

[5] Except for Browns Beach hotel, who said they discard ~500 bulbs, 40 tubelights and 30 batteries per month.

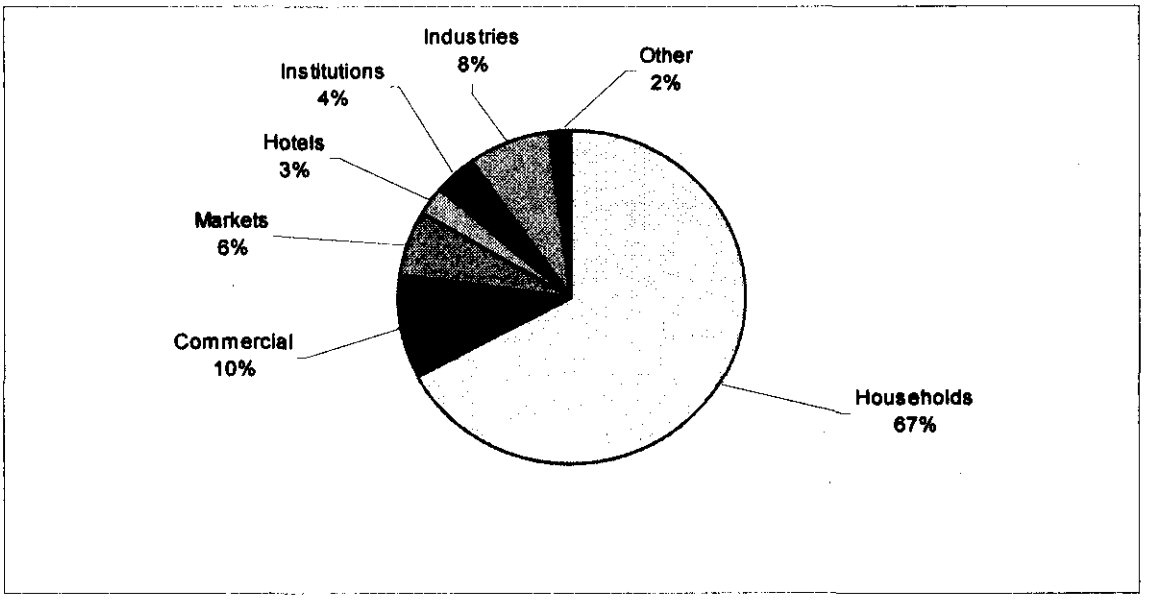


Figure 2-1: NMA Waste Generation by Source

2.1.3.2 Factors Affecting Waste Generation

The main factors affecting waste generation in Negombo are summarised below:

- Waste generation from commercial enterprises, hotels and markets increases approximately 1-3 times during festivals and other special occasions.
- Hotel waste generation also increases by 0.5-2 times during the peak tourist season (Nov/Dec – Apr/May) and for special events (e.g. weddings, parties, conferences).
- Waste generation from the many Christian churches in Negombo increases several times during religious festivals.
- Market waste generation also shows some seasonal and weekly variations, the latter being due to the three Pola which are held on different days of the week - Green Rd night Pola on Saturday, Kamachchodae Pola on Wednesday and Sunday, and Kochchikade Pola on Sunday.
- Seasonal variations, with waste generation increasing during the wet season (April-June and October-November), mainly due to increased garden waste.

2.1.4 Waste Stream Breakdown

2.1.4.1 Field Investigation Results

Field investigation results on the proportions of waste being disposed of on-site, discharged for collection, directly hauled to landfill, composted on-site, recycled at source or illegally dumped are tabulated below.

Table 2-4: Waste Stream Field Investigation Results (2002)

Source	Method (%)	Comments
Households	OSD: 48.9% Discharge: 31.0% ID: 10.7% Compost: 6.0% Recycling: 3.4%	Household public opinion survey results, modified to account for an estimated 75% garbage collection service coverage in Negombo and Kochchikade and allowing for garbage only being collected from the Duwa area of Thalahena (by population).
Commercial	Discharge: 92.1%	Most commercial waste discharged for NMC collection.
	OSD: 4.2%	Some places burn a lot of their waste (mainly paper).
	Recycling: 3.7%	Some recycling – mainly food/kitchen waste from local hotels plus some paper, glass bottles, plastic containers and metals.
Markets	Discharge: 75.5%	Most market waste is collected by NMC and taken to landfill.
	ID: 23.3%	Lellama market dumps 1-3T/d of fish waste into the lagoon, while the fish market (Wella Veediya) discharges ~15kg/d into the sea.
	Recycle: 1.2%	Lellama market recycles 3,000kg/mth of fish waste for crab food. Bandula market: piggery farmer collects ~50kg/mth organic waste.
Hotels	Discharge: 37.1%	Collected by NMC and taken to landfill.
	Recycle: 24.5%	Approx. 890kg/d of food/kitchen waste collected from 12 of 26 surveyed hotels for animal feed, mainly by 6-8 piggeries within NMA. Many hotels recycle plastic containers and glass bottles.
	DH: 25.7%	Hotel Assn. tractor collects ~1T/d of garbage from member hotels.
	OSD: 12.2%	Five hotels burn/bury large proportions of their garbage on-site.
	Compost: 0.5%	Four Hotels compost some garden and food/kitchen waste (small).
Schools	Discharge: 73.1%	Four of six schools surveyed (35% of school population) discharge most-all of their garbage for NMC collection.
	OSD: 22.1%	Three schools burn/bury some-all waste on-site; all schools in Thalahena assumed to do likewise (except Duwa primary school).
	Compost: 4.8%	St Peters College composts some of their waste.
Other Educational	Discharge: 67.4%	Three discharge some-all of their garbage for NMC collection.
	OSD: 27.1%	Six of eight surveyed institutes use OSD for some-all of their waste.
	Recycle: 5.6%	Don Bosco Technical College recycles 300kg/mth of food/kitchen waste for animal feed.
Hospitals	Discharge: 76.7%	Most normal garbage collected by NMC from the two big hospitals (Negombo Base and Ave Maria) and the Manthri Nursing Home.
	OSD: 19.5%	All: Dissanayake Pvt Hospital, Government Central Dispensary. Some: Ave Maria Hospital, Base Hospital (burns ~90kg/d of hazardous healthcare waste (HHCW)); Manthri Nursing Home (burns/buries ~0.6kg/d of HHCW). No hospitals have incinerators.
	Recycling: 3.8%	The Base hospital recycles ~997kg/mth of cardboard, plastics, glass bottles, metals and coconut shells.
Government offices and police	Discharge: 45.5%	NMC collects some-most garbage from 4 of 7 surveyed offices.
	OSD: 52.0%	Six burn some-all of their garbage on-site.
	Recycle: 2.3%	Kochchikade police station gives its food/kitchen waste to piggery.
Prison	Recycle: 100%	All of prison's waste is collected by a farmer.
Religious places	Discharge: 80%	Not surveyed; percentages based on Kandy and Matale data.
	OSD: 20%	
Elsuma	Discharge: 96.0%	Most of Elsuma's waste is collected by NMC.
	Recycle: 3.6%	One lorry load per month of cardboard, (760kg), 400kg/mth food/kitchen wastes for animal feed, small quantities of metals.
	Compost: 0.4%	138kg/mth of garden/other waste.
Sawmills (6 of 7 sawmills surveyed)	Recycling: 64.2%	Six sawmills give away or sell most-all of their sawdust, woodchips and bark wastes, with one sawmill burning some sawdust. The other sawmill burns sawdust, sells woodchips or uses them as furnace fuel for tile making and composts bark.
	OSD: 22.1%	
	DH: 13.7%	
Other Industry (19 of 128 other industries surveyed)	Recycle: 50.0%	11 of the surveyed industries recycle some- all of their garbage.
	OSD: 42.5%	11 industries use on-site disposal for some-all of their garbage.
	Discharge: 5.2%	Five industries use the NMC collection service for some-all waste.
	ID: 2.6%	"Drycast" burns their waste in another place outside their property.
	Compost: 1.8%	Another two industries compost some of their waste
Parks	Discharge: 100%	Assumed collected by NMC ((Rajapaksha Udyanaya, Beach Park).
Beaches	Direct haul: 100%	All beach litter assumed collected by the Hotel Association tractor.
Road/drain cleaning	Discharge: 100%	Assumed to be collected by NMC.

Notes: DH = direct haulage, ID = illegal dumping, OSD = on-site disposal.

2.1.4.2 Recycling at Other Points of the Waste Stream

In addition to recycling at source, recycling occurs at other points of the waste stream. The quantities of recyclable materials collected at these places were estimated as follows:

- **Following discharge**, individuals (scavengers) may sift through discharged waste prior to collection, recovering items of value to them for reuse/recycling. The amount of recyclables recovered in this manner is assumed to be negligible due to the large number of individual collectors collecting recyclables directly from households (60% of surveyed households) and other places (i.e. at source), rather than following discharge, the widespread practice of households taking recyclable materials to shops (28% of surveyed households) and very few people being observed doing this.
- **During collection**, an estimated 42% of NMC workers salvage bottles, paper and metals from the collected waste for sale. About 49kg/d of materials are recovered in this manner, based on survey interviews with 16% of NMC workers.
- **From the central city transfer station,** approximately 20 scavengers collect recyclables from the market collection point, including cardboard, bottles and metals. An estimated 250kg/d of materials are recovered in this manner, based on informal discussions with two of the scavengers.
- **At the disposal site**, neither of the two NMC labourers working there are believed to collect recyclables. One person living in the area collects around 50kg/d of food/kitchen waste for animal feed. There are also about seven adult scavengers from outside the area who collect recyclables at the landfill, none of whom agreed to be interviewed. It is estimated they recycle around 88kg/d (by comparison with the recycling rate at the collection point), giving a total recycling quantity of 138kg/d.
- **From illegal dumping sites**, it is assumed that a similar proportion of materials as at the final disposal site is recovered, amounting to 38 kg/d.

This gives a total quantity of materials recycled at places other than at source of 0.48T/d, equivalent to 0.4% of total waste generation.

Some materials are taken directly to middlemen for recycling by individual collectors and NMC labourers. Based on interviews with 12 middlemen in the city, the total amount of materials recovered in this manner from within NMA is estimated to be 1.9T/d. As the majority of materials purchased by middlemen are obtained from households, it is assumed that this amount has already been accounted for in the household recycling figure of 3.1T/d.

The materials recovered from different points of the waste stream are summarised below.

Table 2-5: Summary of Recycling Data

Material	No of Households (from survey of 150 houses)		Recycling Quantities (kg/d)		
	Give to individual collectors	Take to shop	During collection	At supermarket CP and DS	Collected by middlemen
Organic wastes for animal feed	1	0	0	DS: 50	0
Paper/cardboard	34	8	6.1	CP: 250	187
Plastic	0	1	0	DS: 88	65
Glass	57	38	32.9		532
Metal	24	1	9.6		1007
Battery cases	0	0	0	0	115
Textile	12	0	0	0	0
Tyres	2	0	0	0	0
Total			48.6	388	1,905

Note: CP = collection point, DS = disposal site. Iron is by far the most common type of metal collected, with aluminium, copper and brass being the main other metals.

2.1.4.3 Collection and Disposal Quantities

Current disposal quantities have been determined from NMC records of the number of vehicle trips to the landfill over the five month period: January – May 2002 inclusive and a JICA survey over a continuous seven day period from 13-19 August 2002. This data has been converted to tonnes, as shown below, using measured vehicle capacities (m^3) for tractor trailers, filling factors based on JICA survey observations and typical density data.

Table 2-6: NMC SWM Vehicle Volume and Tonnage Data

Vehicle	Volume (m^3)	Density (kg/m^3)	Fill factor (%)	Tonnage (T)
Handcart	0.43	300	95	0.12
NMC 4WT Trailer	4.65 (range = 3.41 – 6.36)	320	106 (75 – 117)	1.60 (1.18 – 2.36)
Works Trailer	2.10	320	108	0.73
Hotel Association Tractor	4.98	320	100	1.60

Notes:
1. Actual vehicle dimensions are given in the supporting report.
2. NMC's trailers vary considerably in size, as shown by the range tabulated above.
3. Density data: 300kg/m^3 for handcarts and 320kg/m^3 for NMC trailers, based on WACS survey data for NMC collection vehicles (260kg/m^3), an in-situ waste density of 390kg/m^3 for a large four wheel tractor trailer (6.3m^3), measured by weighbridge in Colombo in Jul-Aug 2002, comparative data from Kandy and Matale, and taking into account the lower average height of NMC trailers, compared with those in Kandy and Matale (i.e. less in-vehicle compression of waste).

The current NMC collection quantity of 53.2T/d was estimated from the NMA disposal amount (52.9T/d), allowing for the small amount of recycling that occurs during collection and at the central city transfer station (0.3T/d), which corresponds to an overall MSW service coverage of 39%[6].

The difference between the amount of waste discharged for collection and the amount actually collected is 3.0T/d, equivalent to about 1.9 tractor loads/d. This amount is assumed to represent waste that is discharged for collection but never collected, or waste that is collected and then disposed of at places other than the official disposal site. It has been added to the illegal dumping amount.

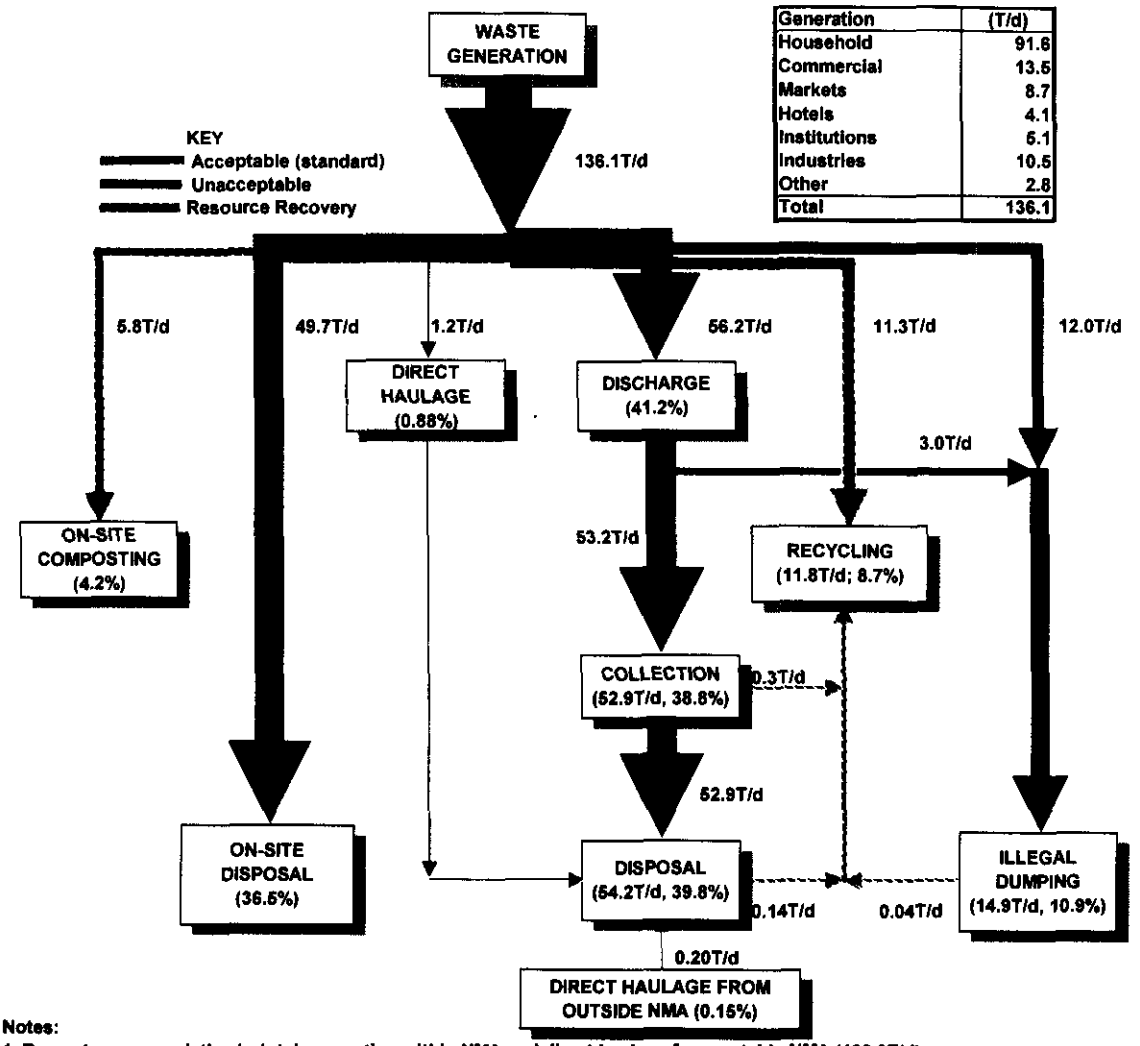
[6] Collected garbage/(generated garbage - direct hauled garbage) within NMA; i.e. 53.2/(136.1-1.2)x100%

2.1.5 Waste Stream

Waste stream data for Negombo is presented below.

Table 2-7: Waste Stream Breakdown (2002)

Source	On-site disposal	On-site Compost	Dis-charge	Recy-cling	Illegal Dump.	Direct Haulage	Gen-eration
Household	44.80	5.47	28.41	3.07	9.82	0.00	91.58
Commercial	0.57	0.00	12.40	0.50	0.00	0.00	13.47
Markets	0.00	0.00	6.53	0.10	2.02	0.00	8.65
Hotels	0.50	0.02	1.51	0.99	0.00	1.04	4.06
Institutions:							
Schools	0.68	0.15	2.27	0.00	0.00	0.00	3.10
Other Educ.	0.05	0.00	0.12	0.01	0.00	0.00	0.18
Hospitals	0.17	0.00	0.68	0.03	0.00	0.00	0.88
Govt offices/police	0.16	0.00	0.14	0.01	0.00	0.00	0.30
Prison	0.00	0.00	0.00	0.54	0.00	0.00	0.54
Religious	0.03	0.00	0.11	0.00	0.00	0.00	0.14
Industries:							
Elsuma	0.00	0.00	1.03	0.04	0.00	0.00	1.07
Sawmills	0.08	0.03	0.00	2.72	0.00	0.00	2.82
Other	2.67	0.12	0.34	3.29	0.17	0.00	6.59
Other:							
Parks	0.00	0.00	0.37	0.00	0.00	0.00	0.37
Beaches	0.00	0.00	0.00	0.00	0.00	0.12	0.12
Roads/drains	0.00	0.00	2.28	0.00	0.00	0.00	2.28
Sub-total	49.70	5.79	56.18	11.30	12.01	1.16	136.13
Collection							
Recycling at discharge			-0.00	+0.00			0.00
Adjust to account for actual collection			-2.95		+2.95		0.00
Recycling at the transfer station			-0.25	+0.25			0.00
Recycling during collection			-0.05	+0.05			0.00
Adjusted sub-totals	49.70	5.79	52.93	11.59	14.96	1.16	136.13
Disposal							
Direct haulage from outside NMA						0.20	0.20
Recycling at disposal site			-0.14	0.14			0.00
Recycling at illegal dumping sites				0.04	-0.04		0.00
Total	49.70	5.79	52.79	11.77	14.92	1.37	136.34
%	36.5	4.2	38.7	8.6	10.9	1.0	100.0



Generation	(T/d)
Household	91.6
Commercial	13.5
Markets	8.7
Hotels	4.1
Institutions	5.1
Industries	10.5
Other	2.8
Total	136.1

Notes:
1. Percentages are relative to total generation within NMA and direct haulage from outside NMA (136.3T/d)
2. Direct haulage is by the Hotel Association tractor, which collects most of its load from hotels and the beach inside NMA plus some garbage/litter from hotels outside NMA.

Figure 2-2: NMA – Current Waste Stream

The waste stream shows us:

- 41% of waste (56T/d) is currently discharged for collection by NMC, with almost all of this (53T/d) being taken to the disposal site. Ideally, more waste should be diverted from final disposal in the future.
- On-site disposal is the second most common disposal method (50T/d, 37%), mainly due to most of Thalahena not being provided with a garbage collection service. This is appropriate in some parts of Negombo (e.g. houses with large properties, institutions), provided the water table is not too high.
- Illegal dumping is also very common (15T/d, 11%). This should be eliminated in the future.
- Resource recovery, via recycling (12T/d, 8.7%) and on-site composting (5.8T/d, 4.2%) are both significant. These should both be promoted further in the future.

2.1.6 Breakdown of Waste Discharge Amount

The amounts of different wastes being disposed of to landfill are tabulated below. This shows:

- The amount of organic materials that can be composted is about 37T/d, excluding paper.
- Higher value recyclables (glass, hard plastic and metal) account for only 2.3% of the waste to disposal (0.4, 0.3 and 0.4T/d respectively), indicating almost all these items are already being recycled.
- Lower value recyclables (paper, textiles, soft plastic) account for 16.4% of the waste to disposal with all three being present in reasonable quantities (1.9-4.7T/d), indicating the recycling rates of these items are lower. Of these materials, paper has the most (but still limited) potential for increased recycling, particularly if it can be sorted at source and collected separately. Otherwise, once mixed with other garbage, it becomes contaminated and is much more difficult and expensive to recycle.

Table 2-8: Amounts of Waste to Disposal (2002)

Waste category	Physical Composition (%)	Disposal amount (T/d)
Kitchen	45.6	24.7
Grass & wood	24.7	13.4
Paper	8.9	4.8
Textile	3.5	1.9
Soft plastic	4.0	2.2
Hard plastic	0.8	0.4
Leather & rubber	0.9	0.5
Metal	0.5	0.2
Glass	0.8	0.4
Ceramic & stone	8.4	4.6
Others	2.0	1.1
Total	100.0	54.2

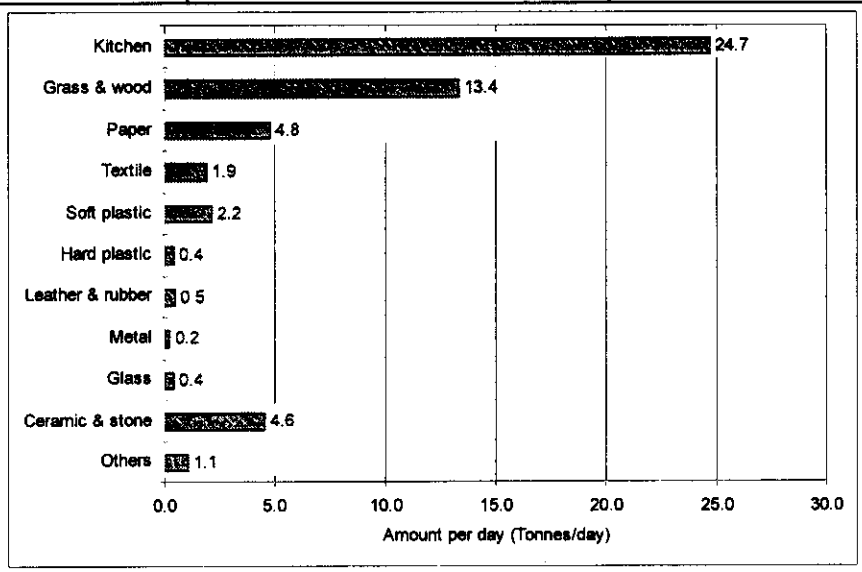


Figure 2-3: Daily Amount to Disposal (2002)

2.2 NMC Waste Management Institutional Setting

The Health Department of NMC is responsible for waste management in Negombo. Specific responsibilities include:

- Collection of MSW within NMA, including the planning of collection routes and daily scheduling of garbage collection vehicles.
- Transportation of the collected MSW to the final disposal site.
- Operation and management of the existing final disposal site at Ovitiyawatta.
- Cleaning and garbage removal from public markets and the public slaughterhouse.
- Septic tank and toilet emptying services.
- Street and drain cleaning[7].
- Collection of any SWM fees levied for the services provided.
- Enforcement of local ordinances and national laws related to SWM.
- Implementation of policies relating to waste minimization, recycling, public education/awareness, etc.

The Works Department is responsible for cleaning and garbage removal from public parks.

2.2.1 Organisational Structure

The current waste management organizational structure (as of September 2003) is illustrated below. The Chief Public Health Inspector (CPHI) has overall responsibility for all of NMC's waste management activities, including SWM. At the next organizational level, there are six Public Health Inspectors (three positions filled, two vacant), each responsible for different waste management activities and areas of the city, as shown in the next table. Beneath them, there are 16 supervisors, 19 drivers and 180 labourers (110 permanent, 70 temporary), who are assigned to different areas. There are also three administrative staff (Chief Clerk and two Clerks).

NMC's allocated cadre for supervisors and labourers is 15 (excluding market supervisors) and 184 respectively.

The Chairman and Health Committee serves as an advisory committee to the Council, dealing with all health issues, including SWM. It comprises six Council members, while the Medical Officer of Health (MOH) and PHIs also usually attend the meeting.

[7] Drain and street cleaning comes under Infectious Disease Prevention (IDP) Services.

Notes:
1. One of the Negombo and the Dalupatha and Thalahena PHI position's are currently vacant and are being looked after by the three other PHIs.
2. 2WT = two wheel tractor, 4WT = four wheel tractor, GS = gully sucker, PHI = Public Health Inspector

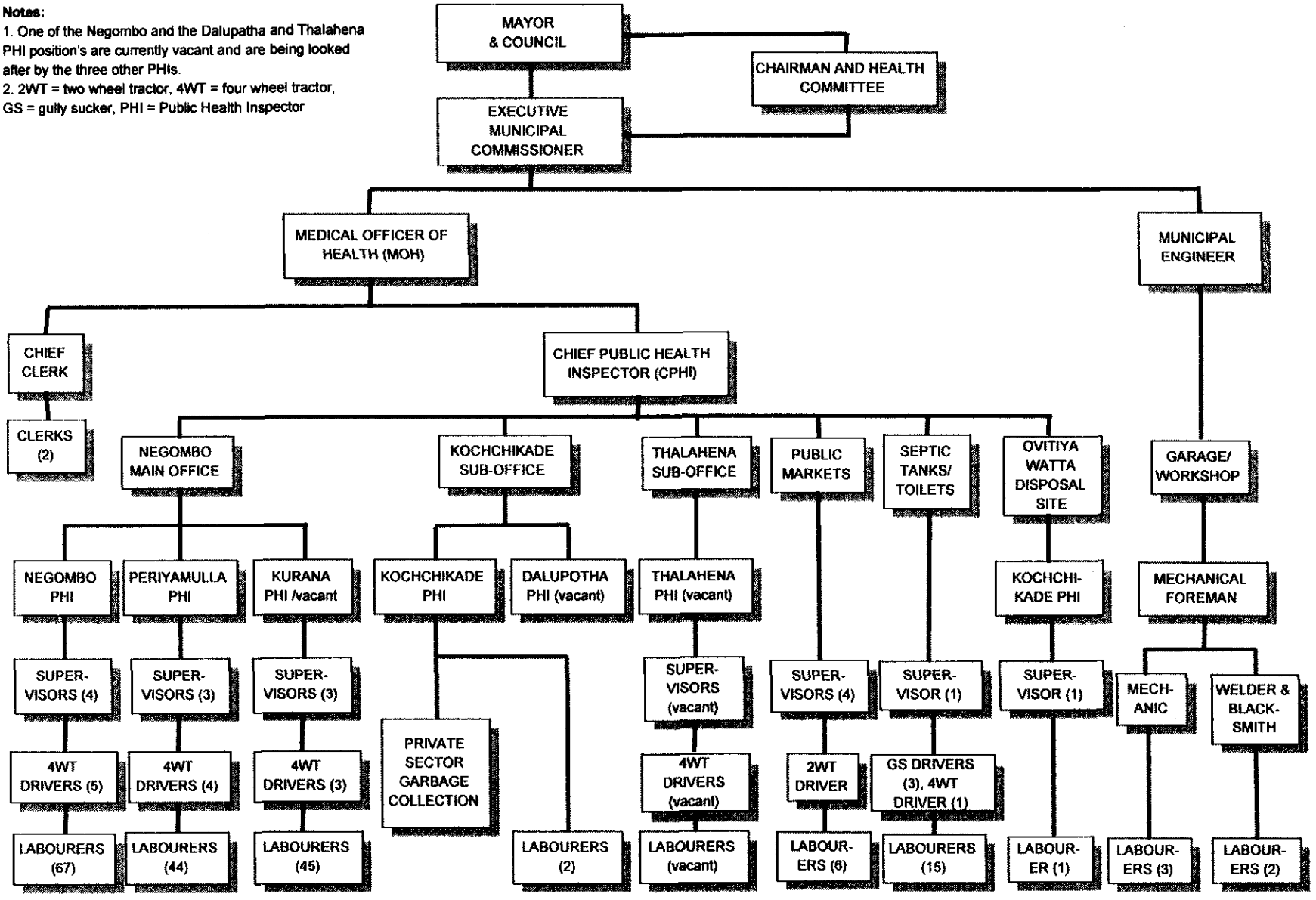


Figure 2-4: NMC Waste Management Organisational Chart

Table 2-9: NMC – Breakdown of Waste Management Staff and Equipment

Area	PHI	Supervisors	Labourers			Collection Points		Hand-carts	Vehicles	Public Toilets
			Permanent	Casual	Total	Permanent	Temporary			
Negombo Main Office										
Bazaar I	2 PHIs (one position vacant)	2	15	12	27	3	0	6	2 x 4WT (4 Tr)	--
Bazaar II		1	10	17	27	6	5	6	2 x 4WT (4 Tr)	--
Munnakkaraya		1	7	6	13	2	0	2	1 x 4WT (2 Tr)	--
Periyamulla I		1	12	6	18	2	0	3	1 x 4WT (2 Tr)	--
Periyamulla II		1	9	3	12	0	7-10	2	1 x 4WT (1 Tr)	--
Kudapaduwa		1	8	6	14	3	5-7	3	2 x 4WT (2 Tr)	--
Kurana I		1	13	5	18	6	0	3	2 x 4WT (2 Tr)	--
Kurana II		1	10	4	14	4	10	3	1 x 4WT (1 Tr)	--
Kadolkale		1	6	7	13	5	6	2	1 x 4WT(2 Tr)	--
Markets	CPHI	4	5	1	6	Included in area bins		0	1 x 2WT	--
Septic tanks/ Toilets	CPHI	1	12	3	15	N/a	N/a	0	3 x GS 1 x 4WT (1 Tr)	10
Kochchikade Sub-Office										
Kochchikade	Kochchikade PHI (Dalupatha PHI position vacant)	0	2	0	2	0	0	0	0	1
Porutota		0	0	0	0	0	0	0	0	--
Dalupatha		0	0	0	0	0	0	0	0	--
Daluwakotuwa		0	0	0	0	0	0	0	0	--
Disposal site		1	1	0	1	N/a	0	0	0	--
Thalahena Sub-Office										
Thalahena	One of Negombo PHIs (Thalahena PHI position vacant)	Vacant	Vacant	Vacant	Vacant	2	0	0	0	0
NMC Total	1 CPHI 3 PHIs (3 positions vacant)	16	110	70	180	35	33-38	30	14 x 4WT (21Tr) 1 x 2WT 3 x GS	11
Allocated cadre		15 (excl. market)			184					

Notes: PHI = Public Health Inspector, GS = gully sucker, 2WT = two wheel tractor, 4WT = four wheel tractor. The three PHIs are covering the vacant positions between them.

2.2.2 Waste Management Equipment

Current waste management vehicle fleet and supporting equipment details are summarized below, together with estimated vehicle lifetimes, based on practical experience of NMC staff.

Table 2-10: Waste Management Vehicle Fleet and Supporting Equipment

Vehicles/ equipment	No	Use (Capacity)	Estimated Life (yrs)
Handcarts	30	SWM collection, road and drain cleaning (0.42m^3, 0.12T)	3
Two wheel tractor	1	Drain cleanings, including from market	15-20
Four wheel tractors (4WT)	16	14 – SWM collection; 1 - gully sucker/toilets; 1 – out of service	15-20
4WT Trailers	26	21 - SWM collection; 1 – gully sucker/toilets; 3 – out of service (45-8327, 46-3139, 46-4139) (average trailer capacity = 4.7m^3 (range = 3.4 - 6.4m^3) excluding JICA trailers; sometimes, some engineering section trailers may also be used (2.1m^3 capacity)	5-6
Gully suckers	3	Septic tank/public toilets emptying (1 x 3,500L; 2 x 7,000L)	10-12
D4C Bulldozer	1	Final disposal site operations (80hp net)	N/a

2.2.3 NMC Waste Management Services Labour Force and Equipment

2.2.3.1 SWM (Garbage) Collection

NMC's collection labour force and equipment comprises:

- 30 handcarts and 14 four wheel tractors (4WTs).
- 11 Supervisors, 14 drivers and 159 labourers (93 permanent, 66 casual) of whom 20% are tamil and 80% sinhala.

Garbage collection crew and labourer equipment details are summarised in Table 2-11.

Table 2-11: Vehicle Labourer and Equipment Details

Vehicle	Labourers	Equipment
Handcart	2-3	Gloves, rake, basket(s)
2WT	0	Not specified
4WT	3	Gloves, gumboots (1 set), rake, fork, ekel broom, 2 baskets

2.2.3.2 Market and Slaughterhouse

Garbage collection and cleaning of Negombo's public markets and slaughterhouse is administered by the Health Department, with there being four Supervisors and six labourers employed for this purpose. A two wheel tractor (2WT) is also used for collecting drain cleanings in the city, particularly from markets.

2.2.3.3 Street and Drain Cleaning

Street and drain cleaning are normally undertaken by handcart labourers in conjunction with garbage collection services. NMC assigns two labourers per handcart for by-roads and three labourers per handcart for main roads.

2.2.3.4 Septic Tank and Toilet Emptying Services

These services include:

- The management and maintenance of public toilets.
- The provision of gully sucker services within the city and to some areas outside the city on request.

The septic tank/toilet emptying services equipment and labour force comprises:

- 11 public toilets.
- Three gully suckers and one four wheel tractor, used for towing a bowser.
- One supervisor, three gully sucker drivers, one tractor driver and 15 labourers.

2.2.4 SWM Costs

NMC's 2002 budget costs, tabulated below, show that 21% of NMC's budgeted expenditure was allocated to SWM. This is mainly due to the high number of NMC employees engaged in SWM works (28% of total). These results are comparable with other Councils covered by this study, with SWM expenditure accounting for an average of 22.0% (range = 13-35%) of local authority budgeted expenditure and SWM workers an average of 29% (range = 22-37%) of all Council workers, by cadre.

Table 2-12: NMC Budget SWM Costs and Employees (2002)

Item	SWM	NMC Total	SWM as % of Total
Budget Expenditure (million Rs)	20,607,000	98,814,000	20.9
NMC Employees (by cadre)	184	657	28.0

Note: SWM budget expenditure includes estimated SWM workshop related budget.

2.2.5 Waste Collection/Disposal Fees

No waste generators currently pay for garbage collection or disposal (NMC Revenue Clerk).

Citizens should pay 150Rs per tractor load to the NMC Office for the collection of garden waste, upon which they are issued with a receipt, which they then present to NMC labourers, who will then collect their garden waste. Only about 17 people paid this fee during June 2001-May 2002. The vast majority of people do not follow this system, relying instead on political favours (e.g. ringing Mayor directly) to get their garden waste collected.

Gully sucker revenue over the last 12 months amounted to 965,030Rs, ranging from 44,000 –131,000 Rs/mth.

It is worth noting that informal payments to garbage collection workers are relatively common and include:

- 30% of 150 households surveyed pay an average of 112Rs/yr "small allowance" or 150Rs/yr "reward".
- 34 (39%) of 88 commercial/industrial and institutional places surveyed pay an average of 2,539Rs/yr (range = 10 (small shop) to 10,000 (large hotel) Rs/yr).

2.2.6 SWM Bylaws

Standard Sri Lankan SWM by-laws are in place. By-law enforcement is poor with many people following illegal practices.

2.2.7 NMC Workshop

The mechanical workshop is responsible for the maintenance and repair of NMC's vehicle fleet. It also fabricates some trailer bodies, making a 10x6.5x3.5ft trailer (internal volume of ~5.5m^3). The workshop is managed by the Mechanical Foreman. It employs one mechanic, one welder and blacksmith and five labourers. Workshop equipment comprises two welding machines (one gas, one electrical), grease gun, high pressure pump, compressor, drill and grinder.

At least three quotations must be obtained for every spare part over 500Rs, with approval for procurement of the spare parts then being given by different people according to the repair cost:

- For repairs up to 10,000 Rs, the Civil Engineer can give direct approval.
- For repairs from 10,000 to 50,000Rs, the Municipal Commissioner can give direct approval, with the spare parts being ordered through the supply accountant, which involves obtaining quotes from a number of suppliers.
- For repairs from 50,000 to 100,000Rs, the Mayor can give direct approval.
- For repairs over 100,000Rs, these must be approved by the Council and Finance Committee, a process which can take two or more months. However, for very urgent repairs in this category, the Civil Engineer may get prior approval from the Municipal Commissioner and Mayor, enabling them to go ahead and order the necessary spare parts.

NMC estimate that about 65% of total workshop expenditure is spent on the maintenance of SWM vehicles.

2.3 SWM System Components

2.3.1 Discharge, Collection and Transportation

2.3.1.1 SWM Collection Zones

The city is divided into six zones for SWM purposes, with Council offices being located within Negombo (main office), Kochchikade and Thalahena (sub-offices). There is also a zone office in the Bazaar area.

Field investigations and discussions with NMC staff found that the NMC garbage collection service (population basis) covers ~80-90% of Negombo and 60-75% in Kochchikade, while NMC collects garbage from only the Duwa area of Thalahena (14% of Thalahena population). This gives a total NMA service coverage of 69%.

Table 2-13: SWM Collection Zones

Zone	Area	Wards	NMC Offices
Negombo	Bazaar I	4, 8, 10 (part)	Negombo Main Office, Bazaar Zone Office
	Bazaar II	2, 3	
	Munnakkaraya	1	
Periyamulla	Periyamulla I	7	
	Periyamulla II	6	
	Kudapaduwa	5	
Kurana	Kurana I	8, 9	
	Kurana II	11, 12	
	Kadolkale	10 (part)	
Kochchikade	Kochchikade	1-8	Kochchikade Sub-Office
	Porutota	9 and 12 (parts)	
Dalupatha	Dalupatha	12 (part), 13	
	Daluwakotuwa	9 (part), 10, 11	
Thalahena	Thalahena	1-13	Thalahena Sub-Office

Note: Negombo, Kochchikade and Thalahena each have 12, 13 and 13 wards respectively.

2.3.1.2 NMC SWM Discharge System

Most waste generators discharge their mixed garbage by one of the following methods:

- At the roadside for primary collection by handcart followed by transfer to one of around 40 permanent circular or rectangular concrete bins located around the city. A number of stationary trailers are also used in the Bazaar I and II areas which function as discharge/transfer points.
- Directly to these concrete bins/collection points.
- At the road side. Over 60 temporary collection points have been identified where there is no bin, but which are used by residents for garbage discharge.

Often the garbage is discharged directly onto the ground or into the concrete bin, although some residents do use plastic bags or dustbins. A small number of residents and some commercial enterprises give their garbage directly to the collection vehicle, while some cafeterias/hotels, producing a lot of fish and other kitchen/food waste have their garbage collected directly from their premises. More specific details on various garbage discharge methods are given in the supporting report.

These practices result in lots of scattered garbage and mini-dumps, creating poor sanitary conditions, due to animals - goats, cows, cats and dogs - looking amongst the garbage for food, scattering it in the process.

Large amounts of garden waste are produced in the city, and are typically discharged illegally at public collection points for subsequent collection by NMC, or dumped on vacant land. Often, garden waste is burnt at such places, while building waste is also commonly present.

Many drains are full of or blocked with garbage, causing nuisance and health problems.

These observations show that there is an urgent need to improve the current discharge system.

2.3.1.3 NMC SWM Collection System

a. Collection System

Garbage is collected from these informal and formal collection points and directly from the discharger as set out in the supporting report. The collection frequency ranges from daily (e.g. Bazaar I, Bazzar II, main roads) to weekly (e.g many parts of Kochchikade). In the new area, Thalahena, a garbage collection service is currently only provided to Duwa (twice per week).

Garbage collection by vehicle is difficult in many low income and housing scheme areas (e.g. MC Housing scheme) due to access being via small narrow roads, clotheslines and kiosks blocking the roads, etc.

Time and motion studies undertaken by JICA for two tractors in August 2002 found that it took both tractors 173-188min to complete one collection round, with loading making up 46-55% of the total round time, the lower percentage being measured in the Bazaar I area which has a stationary trailer system.

b. NMC Collection Vehicle Unit Costs

NMC collection vehicle unit costs were calculated for handcarts and tractors using actual cost data supplied by NMC, supplemented by information from other sources where necessary. These costs are illustrated below (details in supporting report). This data shows:

- Handcarts are by far the most expensive means of collecting garbage, with unit costs of 1,320-1,945Rs/T with 2-3 labourers for poor performance (3 trips/d) and 792-1,167Rs/T with 2-3 labourers for good performance (5 trips/d).
- Tractor unit costs (418Rs/T) are considered moderately high.

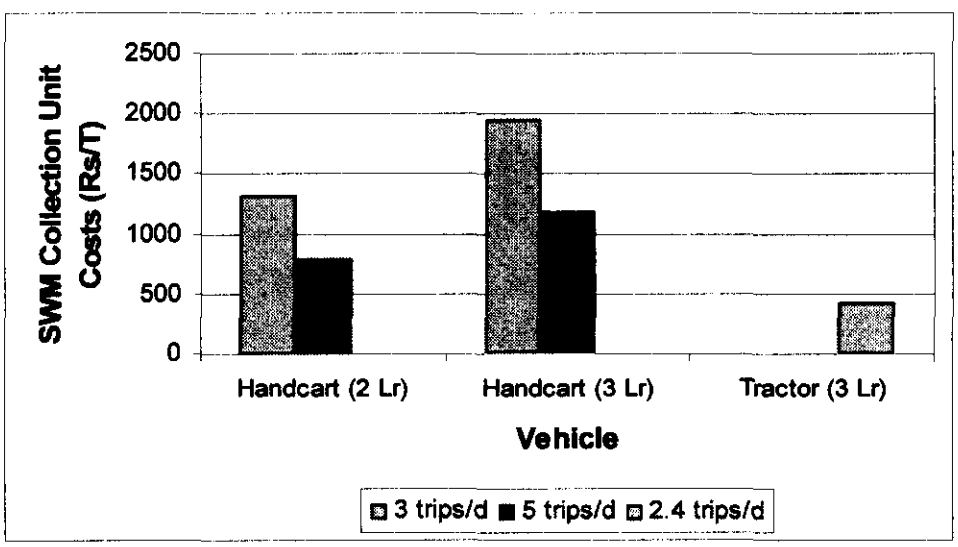


Figure 2-5: NMC Garbage Collection Vehicles – Current Unit Costs

c. Assessment

The present garbage collection system involves a lot of wasted effort. Handcarts undertake primary collection, discharging their loads of garbage to public collection points (concrete bins), from where they are picked up again by tractor labourers and loaded into tractors. Similarly, tractor labourers spend a lot of time loading garbage discharged on the ground or into public bins into vehicles. Many of the public bins are poorly designed. This system results in garbage being double handled and loading taking a long time.

Another major problem is that many of the tractors are getting old (average age: tractors – 6.8years; trailers – 9.0years) and often break down with repairs taking a long time.

These high costs indicate there is considerable potential for reducing handcart and tractor unit costs by decreasing the number of labourers, increasing the number of daily trips, and improving the collection efficiency.

2.3.1.4 Kochchikade Privatisation

NMC awarded a contract for privatisation of SWM services in the Kochichikade area of Negombo in April 2003 to a local company. They are collecting garbage in this area using five tractors and are also responsible for applying cover soil at the final disposal site.

2.3.2 Processing and Treatment

None of the garbage collected by NMC is currently taken for processing/treatment.

2.3.3 Final Disposal

The current disposal site at Ovitiyawatta is situated on private land in Kochchikade, near the Maha Oya, and has been in use since 1985. Until recently, it has been operated primarily as an open dump with a hired bulldozer being used to spread and compact the waste and soil cover sometimes being applied but with no other environmental protection measures being taken. This has resulted in environmental and public nuisance problems including odour, flies, pests, smoke, leachate, etc., with nearby residents being particularly badly affected. Several public protests have taken place concerning this, the most recent one in December 2002.

2.4 Resource Recovery

There are a wide range of ongoing resource recovery initiatives in Negombo, as summarised below.

Table 2-14: Summary of Resource Recovery Initiatives in Negombo

Item	Comments
Reuse	Many shops and micro-enterprises selling items for re-use (e.g. shoes, bicycles, umbrellas, paper bags, etc.).
Recycling at source	Common. 60% of households are visited by someone to collect/buy their reusable/recyclable materials, while 28% of households take some reusable/recyclable items to shops for refund/sale.
Recycling by SWM Labourers	42% of NMC workers involved; collect 49kg/d of glass bottles, paper and metal; earn "tea money" (130 Rs/labourer.mth).
Recycling at Supermarket CP	Approximately 20 scavengers collect about 250kg/d of various recyclables (mainly cardboard).
Recycling at landfill	About seven adults and 4-6 children. Estimated recycling = 88kg/d.
Middlemen	Interview surveys held with 12 middlemen shops found: Established businesses: all in operation for over 3yrs; three over 10yrs old. Creating jobs: employ at least 33 people. Recycling wastes: 2.7T/d, 71% from within NMA (1.9T/d). Generating income: purchases of 890,300Rs/mth; sales of 1,157,390Rs/mth. Mainly buy high value recyclables: clean paper, glass bottles, sacks and plastic containers for reuse; metals, broken glass and battery cases for recycling. Main problems: shortage of recyclables > high land/building rental costs > utilities costs.
Home composting	Home composting barrels have been distributed to various parts of Negombo by NMC and other parties over the last few years, including 100 barrels distributed by Negombo Lions and Lions Orient to residents in Saunders Place, Thaladuwa and Kurana in 2002 at a subsidised price (residents paid 100Rs only). More compost barrels are to be distributed with funding from the Sustainable Cities Programme (SCP) (see compost barrel survey in supporting report and refer Action Plan).
NGOs	Arthacharya Foundation: promoting source separation and home composting in two areas within Munnakkaraya and Siriwardana Place. USIP: resettlement and urban improvement projects in Kadolkale: distribution of plastic dustbins to residents at subsidised prices, provision of six handcarts for garbage collection; construction of recycling storage centre; planning to start source separation and separate collection of recyclables and non-recyclables and home composting. SCP: assisting with USIP project in Kadolkale and providing funding for compost barrels and two biogas facilities (see Action plan).
Animal feed (mainly piggeries)	10-12 piggeries within NMA. Two of the larger piggeries (Dilini Farm, Daluwakotuwa and Mr Kosta's farm, Palungature) collect over 800kg/d of food/kitchen wastes from 10 tourist hotels within Negombo. Piggery wastes are used to make biogas which is used for electricity and cooking. About 0.95T/d in total of food waste collected for animal feed within Negombo.
Speed Pallets	Located on Archbishop Nicholas Fernando Mw, Thaladuwa. In operation since 2001, following an initiative of the former mayor. Owner, manager and 17 workers. Recycles about 15T/month of plastics and polythene waste purchased at around 10-30Rs/kg, mainly from commercial (40%), industry (40%), households (7%), hospitals (7%) and garages (6%), with 75% of the plastic wastes coming from within Negombo. Manufactures 12-15T/mth of plastic flakes and pellets for sale to small-medium scale plastics manufacturers. Main problems = cash flow, lack of capital for process improvements.
Jerod International	Manufacture of charcoal from coconuts.
Silva Land Coir Mill	Coconut fibre processing.

Refer supporting report for further details.

2.5 Social Aspects

2.5.1 Household Surveys and Interviews

2.5.1.1 Household Public Opinion Survey Results

A public opinion survey was conducted in mid-July 2002 within NMA in order to prepare a basic socio-economic profile of Negombo's residents and to gain an appreciation of public attitudes towards the current provision of SWM services, desired improvements to those services and their willingness to pay for improved services. The survey covered 150 households, comprising fifty households from three

high income (Angurukaramulla, Thaladuwa and Udayara Thoppuwa), two middle income (Pallansena and Kattuwa) and two low income (Munnakkaraya and Pathimawatta) areas.

90% of the surveyed population are Sinhalese, 3% Muslim, 6% Tamil and 1% other (Burgher). Data on the average number of people per household and monthly income is set out below.

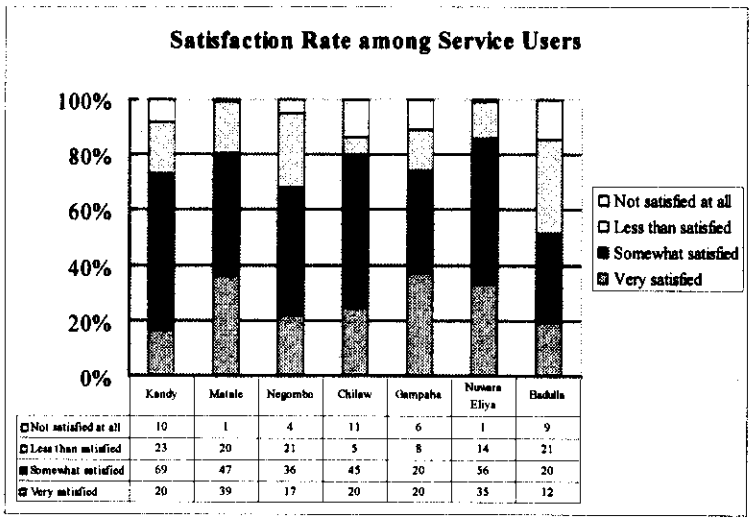
Table 2-15: General Household Data

Item	Low income	Middle income	High income	Overall
Average number of people per household	5.1	4.8	5.0	5.0
Average monthly household income (Rs/household)	5,085	11,869	35,220	
Average monthly income (Rs/person)	997	2,473	7,072	

This household survey shows a considerable difference in income between different income groups, with the low income group figures being very low. This can be explained by the fact that quite a few low income households earn their living by fishing, which is a seasonal trade.

Key survey results related to SWM are summarised here:

- 96% of surveyed households receive a garbage collection service but only 78 (52%) use this service[8]. Only 17 (11%) households are very satisfied with present SWM service provision, while 36 (24%) are somewhat satisfied. Area-wise data shows least satisfaction in middle income areas. The overall satisfaction rate is the second lowest among the seven study towns.



	Kandy	Matale	Negombo	Chilaw	Gampaha	Nuwara Eliya	Badulla
Not satisfied at all	10	1	4	11	6	1	9
Less than satisfied	23	20	21	5	8	14	21
Somewhat satisfied	69	47	36	45	20	56	20
Very satisfied	20	39	17	20	20	35	12

Figure 2-6: Waste Collection Service Users' Satisfaction Rate

- Households' main methods of discharge are shown below. Most people (48%) dispose of their waste by burning or burial within their premises, while only 41% of surveyed households use the NMC garbage collection service, 29% taking their garbage to a collection point and 12% discharging it outside their houses.

[8] Does not quite tally with "main waste discharge" method data, due to some people saying they use the NMC service but then later saying they open dump their waste outside their premises.

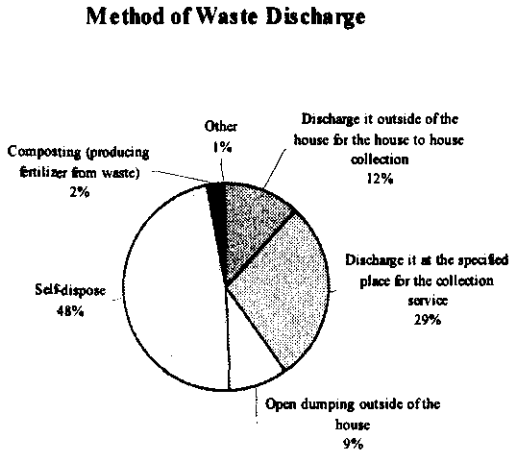


Figure 2-7: Common Waste Discharge Methods

- As for the NMC garbage collection frequency, only 6 (4%) households receive a daily service and only 10 (7%) households receive a service more than four times per week. Collection frequency from once to 2-3 times per week are more common among surveyed households. This contrasts with people's discharge behavior, as 58 households (74% of 78 households using the NMC service) discharge their wastes as soon as they are generated or daily. The discrepancy between these figures explains the large amount of discarded waste present on many streets within Negombo.
- In general, adult female members handle waste in 84% of surveyed households.
- About 82 % of surveyed households are willing to cooperate with source separation for recycling, with the middle income category showing the strongest support. However, about 60% of surveyed households are called on by someone who comes to collect their reusable or recyclable materials (mainly glass and paper, especially newspapers). Although this figure is much lower than other municipal areas, it shows that an informal recycling system is already very active.
- Only 27 households (18%) have ever discussed proper garbage discharge methods at the community level.
- Over 90% of surveyed households appreciate the necessity for SWM awareness programmes.
- The average WTP (willingness to pay) for improved SWM services is 78Rs/month per household.

2.5.1.2 Findings from Interviews with Key People

Two focus group discussions were held to obtain a deeper appreciation of public attitudes to SWM service provision in September 2002 in the Thaladuwa and Wellaweediya low income areas. These discussions revealed that each of these low income communities has specific local problems. For Thaladuwa residents, their main problem is a lack of public toilets. Regarding SWM, they have stopped

using the public bin due to opposition from those living near to it. Instead, they bring their garbage directly to the collection vehicle when it comes to the nearest main road. In Wellaweediya, people consider that an insufficient number of collection bins is one of the major problems, while people also complained about the bad discharge behaviour of neighbours. Both communities also consider the bad condition of the drainage system to be a serious problem. As NMC fails to clean the drains properly, community-based drain cleaning is basically being done monthly by the members of a CBO called "Janashakti" in Thaladuwa. In Wellaweediya however, no community-based improvement efforts have been made.

These observations, together with the household survey results, reveal that although many people dispose of their wastes within their premises in NMA, quite a lot of the people who use the municipal collection service discharge their wastes in any manner, not following any rules, leading to frustration among their communities.

2.5.2 Commercial/Industrial and Institutional Survey Results

Interview surveys were conducted with 88 commercial/industrial and institutional places within NMA during May-July 2002. Key survey results are summarised below:

- 68 (77%) enterprises are provided with a garbage collection service by NMC. 66 (75%) use this service, 16 (24%) of whom are satisfied with it. The main reasons for dissatisfaction relate to the discharge system being poor (36), collection/sweeping is not done properly (33), is irregular (31) or the frequency is too low (29). The Base Hospital is also concerned about the handling and disposal of hazardous healthcare wastes.
- The five most desired improvements to garbage collection and disposal in descending order are an improved discharge system, followed by improved collection frequency, greater recycling/composting, public education and a shorter distance to collection points. Improved hazardous healthcare waste management was also of concern to two hospitals.
- 19 (22%) places supported the introduction of an individual garbage collection fee, while 46 (52%) enterprises indicated an average WTP of 655Rs/mth (range = 50 to 6,000Rs/mth).
- 88 (100%) enterprises believed recycling is necessary, with 69 (78%) enterprises being either very willing (66) or somewhat willing (3) to cooperate in separating their garbage at source, while three are doing this already.
- Nine (10%) enterprises are willing to undertake on-site composting, while seven are doing so already. However, the majority (51, 58%) are not in favour, mainly due to a lack of space on site (41) and it taking too much time (30).
- 87 (99%) enterprises consider a campaign to raise peoples' awareness for maintaining a cleaner city and environment is either somewhat necessary (85) or very necessary (2).

- The most common other comments relate to widespread support for recycling (17), the need for public education/awareness raising (14), polythene should be banned (11) and a proper SWM system should be established (6).

2.5.3 Attitudes of Cleansing Workers

2.5.3.1 Present NMC Labour Force (September 2002)

As of September 2002, there were 209 cleansing workers in NMC (125 permanent and 84 casual). Of these, 30% are Tamil and 70% Sinhalese, while 82% are male. These workers are controlled by so-called "supervisors". In NMC, there were 13 such supervisors as of September 2002, categorized into five different types depending on the system operational at the time of their recruitment, i.e. Health Instructor (Saukiya Upadeshika) (5), Health Field Assistant (Saukiya Setra Sahaeka) (1), Health Labourer (Saukiya Kankaruo) (3), Health Overseer (Saukiya Kangani) (3) or Health Supervisor (Saukiya Paripalaka) (1).

2.5.3.2 Findings from Cleansing Workers Survey

A questionnaire survey was conducted among 30 cleansing workers during late July 2002 in order to obtain a basic socio-economic profile of these workers and an appreciation of their working conditions. Analysis of the survey data shows:

- 20% of the surveyed population is Tamil and 80% Sinhalese.
- The average number of members per household is 4.9 persons.
- The average monthly income is 7,738Rs per household and 1,590Rs per person. This is higher than the average low income figure but less than the average middle income figure found in the household public opinion survey.
- The average number of years of work is 10.1 years.
- Either the mother or father of 33% of surveyed workers also worked as cleansing worker.
- Difficulties and dissatisfaction with their work are as follows.

  First: Insufficient wage
  Second: Not enough tools for collection work
  Third: Improper discharge of waste by people
  Fourth: Lack of protective clothing such as gloves, boots, etc.
  Fifth: Unsanitary waste such as human waste is mixed with other waste
  Sixth: Health problems

  Among these six issues, the second to fifth ones seem to be genuine difficulties directly affecting their work. Addressing these issues may help to improve SWM service provision.
- When work related difficulties arise, all of them talk to the supervisor first. None of the workers directly talk to either the PHI or the MOH.

2.5.3.3 Findings from the Labour Line Survey

A questionnaire survey was conducted among 50 households in the Municipal Labour Line in Thaladuwa[9] in order to obtain a socio-economic profile of its residents who are assumed to be descendants of Tamil immigrant labourers from the colonial period. The survey data shows:

- 49 (98%) of surveyed households are Tamil and 1 (2%) are Sinhala.
- 25 (50%) of surveyed households are Hindu and 25 (50%) are Christian.
- The average number of household members [10] is 5.9 persons, which is higher than the 5.0 persons average figure found in the Negombo public opinion survey of 150 households.
- The average monthly income is 9,430Rs per household and 1,598Rs/person. These are both higher than the average low income figure but less than the average middle income figure found in the Negombo household public opinion survey.
- The average number of people who work in each household is 2.2 persons.
- As many as 33 people (29% of those who have some income source) work as NMC cleansing workers. This is the most common income source among surveyed households, followed by employment in garment factories and the fishery sector.
- 43 (86%) of surveyed households live in single line rooms, 6 (12%) in back-to-back line rooms and 1 (2%) live in a room of one labour line.
- As many as 43 households (86% of surveyed households) have lived there over 20 years.

These findings suggest that although the Labour Line's ethnic makeup indicates that municipal cleansing work had been carried out primarily by Tamil Labourers in the past, such work is no longer dominated by Tamil labourers, which is very different from the situation in Kandy and Matale. It seems that in Negombo, the urban poor have been attracted to cleansing work regardless of their ethnicity. These facts are supported by many children of former and present Tamil cleansing workers resident in Thaladuwa having taken up other employment, taking advantage of Negombo being near the Katunayake Free Trade Zone and Colombo.

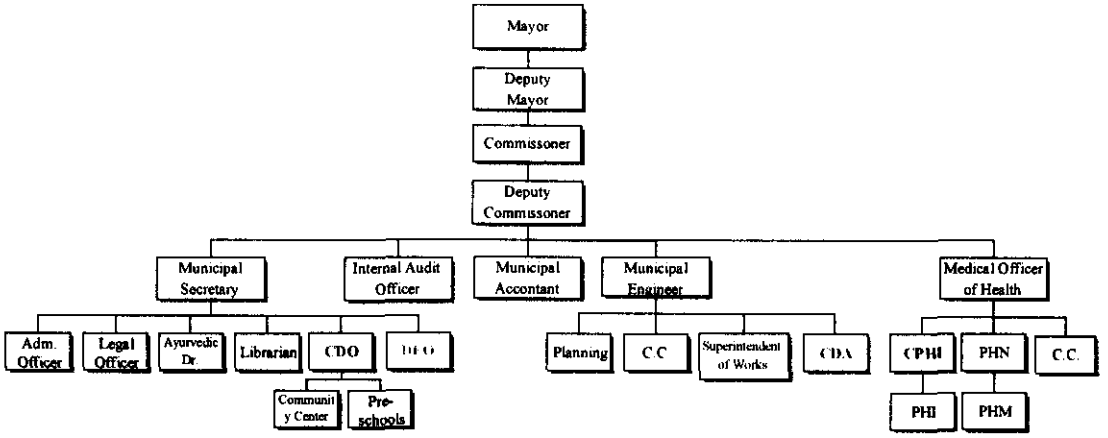
2.5.4 Awareness Programmes and Environmental Education

Several sections of NMC, NGOs and schools currently carry out awareness programmes on environmental issues, including SWM. Additionally, some other programmes with awareness raising components funded by international organisations and other donor agencies have been implemented in cooperation with NMC. Details are given in the supporting report.

2.5.4.1 Involvement of Negombo Municipal Council

NMC's community-based activities, including awareness programmes, are mainly handled by two sections: Health Department and the Environment and Community Development Section.

[9] Data collected by Ms. H. Ogata, JOCV, 2000-02, indicates there are 78 houses (lines) and 101 families.
[10] Household members mean those who live together in one household and share living expenses and doesn't necessarily mean family members.



CDO: Community Development Officer
CDA: Community Development Assistant
DEO: Divisional Environmental Officer
C.C.: Chief Clerk
CPHI: Chief Public Health Inspector
PHI: Public Health Inspector
PHN: Public Health Nurse
PHM: Public Health Midwife

Figure 2-8: NMC Organisational Chart (excluding SWM details)

The public health nurses and midwives in the Health Department are in charge of health activities, and the Divisional Environmental Officer[11] (DEO) and Community Development Officer (CDO)[12] in the Environment and Community Development Section look after environmental issues and community development programmes respectively.

The main community based programmes are taken care of by a CDO, stationed in Negombo since 1999. The CDO is now working for three Community Boards (Praja Mandala) in Thaladuwa, Kadolkale and Wellaweediya and also coordinates the Sustainable Cities Programme (SCP), which began in Negombo in June 2001. The CDO has undertaken very few SWM related awareness programmes. However, usually the Community Boards take necessary steps to improve their living conditions including the SWM situation (e.g. Kadolkale community based recycling programme).

In addition to these programmes, the DEO, stationed here since 1994, organizes school environmental education programmes (see later), and started an Environment Committee in January 2003.

JOCVs have been dispatched since April 2000 to Negombo to carry out community-based programmes concerning health, hygiene and SWM. Mr. N. Nakamoto (community development advisor, batch no. 14-1 (July 2002-July 2004)) is currently involved in several programmes in Negombo including the Kadolkale recycling programme.

NMC also organises special events such as beachside or city centre clean up campaigns in collaboration with other groups (e.g. Negombo Lions Orient Club, Hotel Association).

[11] An officer, dispatched to NMC from the Central Environmental Authority (CEA).
[12] CDAs introduced in the early 1990s to NMC under UNICEF's Urban Basic Service Programme do not work any more in community mobilisation.

2.5.4.2 Involvement of NGOs and Other Organisations

A number of NGOs and other organizations are active in SWM within NMA. One of them is the Arthacharya Foundation, which is working in Munnakkaraya and Siriwardena Place, encouraging households to separate their waste at source and do home composting. USIP's [13] work in Kadolkale includes the provision of plastic dustbins to residents at subsidized rates of 80-100Rs per bin, an environmental poster competition for children living in the Kadolkale area, home composting, source separation of garbage, and the construction of a building for the storage of recyclable materials in collaboration with NMC and SCP. SCP, who works through Sevanatha as facilitator, is also involved in other urban improvement activities, including promoting home composting and biogas (see later).

a. School Environmental Education Programme

Environmental education programmes have been developed by the Central Environmental Authority (CEA) since its establishment in 1980. CEA has introduced two nationwide school programmes, namely the "Environmental Pioneer Brigade (EPB)" programme for secondary schools in 1984 and "Eco Clubs" for primary schools in 2001, with the DEO playing an active role in promoting these programmes.

The EPB programme is voluntary and involves organizing school children into groups of twenty-five. The activities of these groups are based on a five-tier badge system (pioneer, green, silver, gold and presidential). At present, 15 out of 42 schools in NMA have participated in EPB programmes, the most active schools being Newstead Girl's College, Maris Stella Boy's College, Harischandra V., St. Peters College, Bolawalana M.V., Kurana St. Anne V. and Daluwakotuwa St. Anne V. Eco Clubs has been formed in seven primary schools in NMA.

[13] Urban Settlement Improvement Programme (USIP) is funded by JBIC and is implementing water supply, drainage and SWM programmes in 21 areas in the Greater Colombo area, including Kadolkale.

Chapter 3 Main Issues

3.1 Healthy Aspects

3.1.1 Good Performance by NMC in Some Areas

NMC's SWM performance is good in a number of areas, including:

- Good SWM "service coverage" for the Negombo area of NMA of 80-90%, but lower service coverage in other areas, particularly the newly added area of Thalahena.
- 68% of households using the garbage collection service are "somewhat" (46%) or "very satisfied" (22%) with it. However, this satisfaction rate is the second lowest of the seven study towns.
- Reasonable tractor collection performance and costs.
- Privatisation of the Kochchikade area seems reasonably successful.
- Some initiatives are being taken to improve SWM.

3.1.2 Waste Minimisation

Many waste minimisation initiatives are currently in operation within Negombo, many of which are based on traditional values/approaches and represent important social capital. These include:

- "Aparade" is in common use, but requires promotion.
- An excellent traditional recycling system, involving households and other waste generators, individual collectors (Bothal pathara karaya) and middlemen. Most high value recyclables (metals, glass bottles, plastic containers and some paper/cardboard) are recovered via this system, leaving primarily low value recyclables in the garbage taken for final disposal.
- Around 1T/d of food/kitchen waste is collected for use as pig food, primarily from tourist hotels within the city. However, all piggeries located within the city are currently under threat due to non-compliance with a 50m buffer zone requirement to the nearest house.
- Home composting is significant, but with a high dropout rate, primarily due to rusting of the metal barrel containers commonly used by most households for composting.
- Some small scale SWM related initiatives by NGOs and donor agencies (Arthacharya Foundation, USIP Resettlement and Urban Improvement programme, SCP), requiring encouragement and expansion.
- Speed Pallets, a small private company, which recycles around 15T/month of plastics/polythene wastes, primarily from industrial sources in and around Negombo.

3.2 Problems

3.2.1 Very Serious Problems

3.2.1.1 Institutional and Organisational Strengthening Urgently Needed

The main institutional issues related to SWM within Negombo are:

- Current SWM management structure does not reflect the significance of SWM within NMC. It should be much stronger, with more authority being given to the responsible people and adequate human, facilities and financial resources allocated for SWM works because many NMC employees are engaged in SWM works, while NMC spends a lot of its budget on SWM (e.g. 2002 budget: 28% of NMC staff (around 200 employees) working in SWM by cadre; 21M Rs allocated to SWM (21% of total budget)).
- Shortage of senior staff dedicated to SWM works, while the inter-disciplinary nature of SWM makes it difficult for one person to handle SWM alone.
- A lack of short, medium and long term development plans. Goals, objectives and associated measures for improving SWM are not discussed, approved and implemented, resulting in a system where most staff focus on addressing day to day issues and activities are uncoordinated, often leading to confusion and poor motivation.
- Poor labourer management, with absenteeism running at around 15-20%, while some labourers suffer from poor health and/or work under the influence of alcohol.
- Poor cooperation from other departments involved indirectly in SWM (e.g. long delays for vehicle repairs).
- Poor public-LA relations, characterised by a lack of clear instructions to the public detailing citizens' responsibilities, waste discharge rules, fines, etc.; weak enforcement of bylaws; and political interference.
- High SWM expenditure.
- Difficulties in finding out how much money is actually spent on SWM and the SWM cost breakdown (e.g. administration, collection, disposal, etc.)

3.2.1.2 Inadequate Final Disposal and Urgent Need to Find a New Landfill

Proper final disposal is the most important component, required to establish the reliability of SWM works. Current operation of the Ovitiyawatta landfill has improved recently, with soil cover being applied more regularly. However, many further improvements are required to bring operations up to a satisfactory level.

As of mid-2002, the landfill had a reserve volume of about 40,000m^3, equivalent to about 2-3 years further filling. Hence, NMC urgently needs to locate, procure and develop a new landfill site, ideally for use over at least the next 6-10 years.

3.2.1.3 Improvements to Technical System Needed

Current waste discharge and storage is characterised by:

- A lack of public cooperation with many people discharging garbage in any container or none, at any time and place, resulting in lots of garbage discharged at the roadside, or at communal collection points, causing waste scattering and creating mini-dumps.
- Many animals (goats, dogs, cows, crows, etc.) search for food amongst the garbage, creating poor sanitary conditions.
- Many communal bins are poorly designed, being difficult to empty.
- Lots of garden and building waste is discharged at the roadside, collection points or on vacant land. Often, the garden waste is burnt.
- Many drains are full of or blocked with garbage, causing nuisance or health problems.
- The lagoon and sea, valuable assets for Negombo, are being damaged by illegal dumping.

Collection and transportation is inefficient and unreliable, being characterised by many handcarts and collection points, double handling and long loading times, vehicle breakdowns and repair delays, while many trailers are in poor condition and too small in capacity.

These problems, particularly vehicle breakdowns, make it difficult for NMC to keep to scheduled garbage collection times, routes and frequencies.

3.2.2 Serious Problems

3.2.2.1 Processing / Treatment

The main objectives of any processing/treatment technology are to reduce the final amount of waste to disposal. There are currently no centralised garbage processing/treatment (recycling or composting or biogas) facilities within Negombo other than a small private plastics' recycling factory processing polythene waste, primarily from industrial sources. Considering that the composition of Negombo waste is very suitable for composting and that the amount of waste going to the Ovitiyawtta landfill is high, NMC should seriously investigate the feasibility of establishing medium-large scale composting or biogas facilities.

3.2.2.2 Increase Public Cooperation through Education/Awareness

Presently, public cooperation with NMC in SWM activities is poor, with many people still discharging their garbage and litter to public places. NMC is partly to blame for this, primarily due to the collection service being unreliable.

Household surveys/interviews conducted during this study indicate that Negombo's citizens are willing to cooperate with NMC in SWM. They have also realized the importance of public awareness raising and many people are keen on beautifying the town.

Responses from the commercial/institutional and industrial enterprises survey show that there is considerable room for improvement in SWM service provision to these sectors, with stakeholders being willing to cooperate with NMC in this regard, with quite a lot of places indicating a willingness to pay a garbage collection fee.

These observations suggest that the implementation of waste discharge rules together with community based improvement and education/awareness programmes conducted in cooperation with schools, NGOs and other parties should be highly effective both to increase peoples' understanding of the SWM issues facing Negombo and to encourage public participation in SWM.

3.2.3 Less Serious Problems

Less serious problems are listed below.

- Illegal dumping of garbage into the lagoon, especially from households in the Munnakkaraya and Duwa areas and from the Lellama fish market (1-3T/d). Although Lellama market waste is discharged within the tidal zone, meaning it should be regularly flushed from the lagoon to the sea, the Cooperative Society running the market has expressed a desire to change to a better waste disposal system.
- Impact of possible relocation of piggeries outside the city on the recycling of food/kitchen waste from the many hotels and restaurants within Negombo
- Poor hazardous healthcare waste management.
- Outsiders discharging their garbage from vehicles onto vacant land (e.g. Kurana 1, Porutota areas).
- Discharge of human excrement with garbage (e.g. Thakkiya Rd, Jaya Mw).
- Many of NMC's trailers are too small (average size =4.65m^3; ideal is around 6.0-6.5m^3).
- No vehicle trip recording system at final disposal site.
- Lack of a garbage collection service throughout the Thalahena area, other than in Duwa.
- Poor handcart quality, with solid set wheels, making them difficult to push.
- Poor design of many of the public garbage collection bins.
- Waste scattering from collection vehicles during transit.
- Difficulties encountered by middlemen in obtaining sufficient materials for recycling and high land/building and utilities operational costs, together with a general lack of support to the recycling sector from central government. Speed Pallets also identified cash flow and credit problems as serious factors jeopardising the viability of their business.
- High manpower requirement associated with use of the tractor bowser for septic tank/latrine emptying. This system is used in parts of the city not accessible to gully sucker trucks. Typically, 4-5 labourers are used to manually empty the septic tank/latrine using buckets, meaning only about one trips can be completed each day.