3.5 Compost Barrel Survey

Findings from Nuwara Eliya - Compost Barrel Survey

A questionnaire survey was conducted among 80 households who either received or bought a compost barrel in Nuwara Eliya Municipal Areas, in order to gather (a) present situation of composting, and (b) indication to the development of home composting.

Period of survey:	First week of August, 2002
Sample size:	80
Sampling areas:	Nawagangoda, Hawaeliya, in Nuwara Eliya Municipal Area Lists of recipients were obtained from the Community Development Officer in NMC.

Background Information:

Interviewees had received the compost barrels 20 months ago on the average (range from 12 months to 28 months ago), and at present about 40 barrels has been distributed with free of charge in Nawagangoda area.

Survey Results :

Q. Are you still using the compost barrel? Yes/No

		Number	%
a	Yes	18	90%
b	No	2	10%
	Total	20	100%

Q. Average property and garden size

(perches)	Using	Not using	Total
Property area	9.6	8.8	9.5

(perches)	Using	Not using	Total
Garden area	4.2	4.5	4.2

Q. Household Size / Household Expenditure / Per capita expenditure

(person)	Using	Not using	Total
Avg. number of household members	4.7	5.5	4.8

(Rs.)	Using	Not using	Total
Avg. household expenditure	6,833	7,500	6,900

(Rs.)	Using	Not using	Total
Per capita expenditure	1,447	1,364	1,438

Q. Why did you decide to get a compost barrel? *(Multiple answer)*

		Using		Not using		Total	
		Number	%	Number	%	Number	%
a	Compost barrel cost was low	1	2%	1	13%	2	4%
b	Compost barrel appeared easy to use	3	7%	1	13%	4	8%
c	Compost barrel looked like it would not attract pests	0	0%	0	0%	0	0%
d	Compost barrel would not take up much space	5	11%	0	0%	5	9%
e	Council offered education/training in how to use it	2	4%	0	0%	2	4%
f	Compost making is recommended by Municipal Officers/workers	8	18%	0	0%	8	15%
g	Interested in producing compost for use in own garden	15	33%	2	25%	17	32%
h	Hoping to increase income, through making compost for own use/sale	3	7%	1	13%	4	8%
i	Composting is good for the environment – it reuses/recycles waste	7	16%	2	25%	9	17%
j	Other	1	2%	1	13%	2	4%
	Total	45	100%	8	100%	53	100%

Note: Other means "because there is no proper collection points nearby."

Q. Did you receive any education/information on how to use the barrel? Yes/No

		Using		Not using		Total	
		Number	%	Number	%	Number	%
a	Yes	18	100%	1	50%	19	95%
b	No	0	0%	1	50%	1	5%
	Total	18	100%	2	100%	20	100%

Q. If yes, what kind of training / information were you provided with?

		Using		Not using		Total	
		Number	%	Number	%	Number	%
a	Information on waste materials suitable for composting	18	38%	1	33%	19	37%
b	Information on waste materials not suitable for composting	17	35%	1	33%	18	35%
c	Information on how to use barrel	10	21%	1	33%	11	22%
d	Information on how to deal with any problems	1	2%	0	0%	1	2%
e	Information on who to contact for help	2	4%	0	0%	2	4%
f	Others	0	0%	0	0%	0	0%
	Total	48	100%	3	100%	51	100%

Q. What kinds of waste materials did/do you add to the compost bin?

		Using		Not using		Total	
		Number	%	Number	%	Number	%
a	None (i.e. never used)	0	0%	0	0%	0	0%
b	Food or vegetable scraps	18	21%	2	15%	20	20%
c	Fish bones	5	6%	1	8%	6	6%
d	Meat or meat bones	4	5%	2	15%	6	6%
e	Fat, cooking oil or dairy products	1	1%	1	8%	2	2%
f	*Household sweepings (e.g. hair, dust, wood ash)*	16	18%	2	15%	18	18%
g	Plain paper or newspaper	7	8%	1	8%	8	8%
h	Glossy or colored paper	1	1%	0	0%	1	1%
i	Polythene or plastics	0	0%	0	0%	0	0%
j	Metals	0	0%	0	0%	0	0%
k	Leaves or grass	16	18%	2	15%	18	18%
l	Noxious weeds or diseased garden clippings	7	8%	1	8%	8	8%
m	Tree waste (twigs, branches, etc., but not leaves)	2	2%	0	0%	2	2%
n	Soil or dirt	1	1%	1	8%	2	2%
o	Sawdust or wood shaving or hay	1	1%	0	0%	1	1%
p	Chicken manure	0	0%	0	0%	0	0%
q	Albizia leaves	1	1%	0	0%	1	1%
r	Others	7	8%	0	0%	7	7%
	Total	87	100%	13	100%	100	100%

Note : Other means "Cow dung".

Q. If you are not using the compost barrel, how long did you use it for?

		Number	%
a	Never used	0	0%
b	Less than 1 month	0	0%
c	More than 1 month but less than 3 month	0	0%
d	More than 3 month but less than 6 month	2	100%
e	More than 6 month but less than 12 month	0	0%
f	More than 12 month but less than 18 month	0	0%
g	More than 18 month but less than 2 years	0	0%
h	More than 2 years	0	0%
i	Irrelevant	0	0%
	Total	2	100%

Q. If you have never used the compost barrel or have stopped using it, why is this? (*Multiple answer)*

		Not using	
		Number	%
a	Lack of knowledge on how to make compost	1	25%
b	Composting takes too much time	0	0%
c	Not enough space on site	1	25%
d	Too much water gets into the bin	0	0%
e	Odor problems	0	0%
f	Pest problems	0	0%
g	Bin has rusted badly	0	0%
h	Lost interest	1	25%
i	Compost takes too long to make	0	0%
j	Compost product was poor in quality	0	0%
k	Neighbors said something against	0	0%
l	Other	1	25%
	Total	4	100%

Note : Other means " stop using because the barrel smells tar."

Q. During use, how much compost did you produce on average per month?

(Kg.)	Using	Not using	Total
Average production per month	14.6	10.0	14.2

Q. How do you think the Council's home composting programme might be improved? (*Multiple answer)*

		Using		Not using		Total	
		Number	%	Number	%	Number	%
a	Use of non-rusting container	13	33%	0	0%	13	28%
b	Improved design of compost system	11	28%	2	33%	13	28%
c	Improved training / education of household users	5	13%	1	17%	6	13%
d	Council to give container for free	0	0%	1	17%	1	2%
e	Information on who to contact for help / advice	3	8%	1	17%	4	9%
f	Regular inspection by council staff	7	18%	1	17%	8	17%
g	Other	1	3%	0	0%	1	2%
h	Don't know	0	0%	0	0%	0	0%
	Total	40	100%	6	100%	46	100%

Note : Other means "need bigger barrel."

3.6 Other Information

Findings from Labor Line Survey in Nuwara Eliya

A questionnaire survey was conducted among 50 households in Municipal labor line in Nuwara Eliya, in order to gather a Basic socio-economic profile of inhabitants of Municipal labor line.

Period of survey: Third week of October, 2002
Sample size: 50 households in Hawaeliya

Q1 Ethnicity

		Nuwara Eliya	
		Number	%
a	Sinhala	8	16%
b	Muslim	1	2%
c	Tamil	41	82%
d	Other	0	0%
	Total	50	100%

Q2 Religion

		Nuwara Eliya	
		Number	%
a	Buddhist	8	16%
b	Islam	1	2%
c	Hindu	36	72%
d	Christian	5	10%
e	Other	0	0%
	Total	50	100%

Q3 Language Abilities

	Tamil		Sinhala	
	Number	%	Number	%
Can not communicate	1	2%	3	6%
A little bit of daily conversation	0	0%	1	2%
Can speak	17	34%	26	52%
Can speak, read and write a little bit	6	12%	11	22%
Can speak, read and write well	26	52%	9	18%
Total	50	100%	50	100%

Note: Four out of five survey assistants are Sinhala speaker, and the fact itself chooses interviewees who speak better Sinhala.

Q4 Household Size

(person)	Nuwara Eliya
Avg. number of household members	5.6

Q5 Monthly Income and Income Sources

(Rs.)	Avg. household income	Income per person
Nuwara Eliya	8,670	1,559

		Nuwara Eliya	
		Number	%
	Municipal waste collection labor	28	28%
	Government / Municipal Council works other than waste collection	2	2%
	Private sector	14	14%
	Manufacturing, other than the garment industry	0	0%
	Small scale manufacturing	2	2%
	Garment industry	7	7%
	Education	0	0%
	Transport	3	3%
	Security forces	0	0%
	Tourism	2	2%
	Foreign employment	1	1%
	Agriculture / Fishery	10	10%
	Construction	6	6%
	Health	0	0%
	Domestic work	2	2%
	Communications	0	0%
	Pension	4	4%
	Other	19	19%
	Total	100	100%

Note: Other means "wage labors who engage in various kinds of works."

Q6 Housing Quality

		Nuwara Eliya	
		Number	%
a	Separate house	31	62%
b	Single line room	15	30%
c	Back to back line room	4	8%
d	Room of a house	0	0%
e	Other	0	0%
	Total	50	100%

	Floor	Number	%	**Walls**	Number	%	**Roof**	Number	%
1	Cement	41	82%	Brick / concrete	41	82%	Tile	0	0%
2	Floor tiles	0	0%	Sheets	0	0%	Corrugated iron	47	94%
3	Wooden	0	0%	Wattle & daub	3	6%	Asbestos sheet	0	0%
4	Earth	9	18%	Wooden	6	12%	Cadjan (coconut leafs)	0	0%
5	Other	0	0%	Other	0	0%	Other	3	6%
	Total	50	100%	Total	50	100%	Total	50	100%

Note: Other wall means "walls made by cardboard."

Q7 How long has your household lived in this house?

		Nuwara Eliya	
		Number	%
a	Less than 5 years	3	6%
b	5 - 10 years	3	6%
c	10 - 15 years	2	4%
d	15 - 20 years	42	84%
e	More than 20 years	0	0%
	Total	50	100%

Community Focus Group Discussion 1

Name of the Municipality:	Nuwara Eliya Municipal Council
Area name:	Mahinda Mawatha
Date & Time:	2002/10/10, 14:30 – 16:30

Precipitants:
1. Ms. M. Oishi (JICA study team)
2. Ms. Subhashini Seneviratne (JICA study team)
3. Ms. F. Arimizu (JOCV)
4. Ms. Indika Ranasinghe (UCDO Nuwara Eliya Municipal Council)
5. Seven female and one male residents of Mahinda mawatha, Hawa Eliya Nuwara Eliya

1. Present collection system

In this area, the garbage is collected everyday. People discharge their garbage to the collection points. There are 4 concrete dust bins in the area and one dust bin is used by more than 20 families.

Distance to the collection points is about or less than 50 meters. People of this area don't like to keep their garbage within their premises due to the problems of rats and dogs. So, all the wastes are brought to the dust bins directly. And also they do not have enough space to keep garbage as they live in small scale houses. Only one of participants gives garbage directly to the collection hand cart.

2. Problems identified

1. Dogs, cattle and flies.
2. Improper discharge by people. Some people put garbage into the drainage or onto the road sides.
3. Sometimes labourers of municipal council are unable to come for daily collection due to, for example, vehicles breakdown. At that time they can not bear the bad odour of the dust bins.
4. Some drainage is blocked and people discharge their toilet waste in to the drainage.
5. In some area, no drainage system for waste water
6. Drainage water flows to a natural stream and people use it as a bathing place
7. Gully sucker's hose is not long enough to reach some toilet pits.

3 Proposed solutions / suggestions

1. Educating all people to discharge garbage properly.
2. Implementing strict rules for garbage discharging.
3. Daily removing and fixing lids for the collection bins.
4. Construction of more concrete bins.

5. Fixing net (strainer) for outlet of waste water pipes to prevent blocking drainages.
6. Arranging shramadana for drainage cleaning at least once a month
7. Burying grass and tree cuttings within their premises.

Community Focus Group Discussion 2

Name of the Municipality: Nuwara Eliya Municipal Council	
Area name:	Mahagasthota
Date & Time:	2002/10/29, 10:30 – 11:45

Participitants:

1. Ms. Indika Ranasinghe (UCDO in Nuwara Eliya Municipal Council)
2. Ms. M. Oishi (JICA study team)
3. Ms. S. Seneviratne (JICA study team)
4. Two male and thirteen female residents of Mahagasthota Gramaniladhari Division (Vijithapura,Gemunupura and Bakers farm)

1. Opinions about present situation of garbage collection

A) Present condition

Since the area is located a little far away from the main road, there are no collection bins and therefore the collection service in the area. So people dump their wastes illegally to open area in the nearby tea estate or culverts. Only a few people take their garbage to the collection concrete bins located on the main road which is about 300 metres away from their houses.

B) Identified main problems

1. Not enough concrete collection bins or present bins are located too far.
2. Illegal dumping blocks canals and drainage.
3. No proper understanding (knowledge) to make compost.
4. Toilet waste flowing into the drainage
5. Cattle and dogs around collection bins.

C) Proposed solutions / suggestions

1. Constructing concrete bins within 50 metres.
2. Displaying notices (warnings) for illegal dumping.
3. MC should provide instructions to make compost.
4. Fixing lids to avoid animals putting their heads into the collection bins.

2. Opinions about proposed garbage collection

In this community, they prefer bell collection system to the communal bin system, only if collection vehicles come punctually. In addition, they would like to separate their garbage into two categories, namely organic and inorganic wastes, and start making compost by using their organic

wastes. As for inorganic waste, then, the daily collection is not necessary and only a few times per week are enough.

Organizational Information Sheet 1

Interview date : 2002/09/26

Name of the organization: Yovun Gaveshakayo (Youth exploration society of Sri lanka-N'Eliya)
Name of the chairperson: Director, Royal botanical garden , Peradeniya. (HQ). District chief advisor, Mr. Divaka Rathnadurai
Address and contact number: S.O.S. children village, Bambarakeke, Nuwaraeliya.
Year of establishment: 2nd of April, 2000

1. General information

No. of personnel 85 members (including 3 chairmen 1.Active/chief and 2.Common chairman 3 education and project and secretary, vice secretary, treasurer, and vice treasurer and 10 committee members)

Fund resource: membership fee (25/= for each), Provincial ministry of tourism and Municipal council Nuwara eliya

Following business institutes sponsor their programs

L and T cement, S.S color lab, and Kodak.

2. Main activities:

1. Doing research on environment pollution
2. Awareness program for reducing environmental damages
3. Lectures, seminar for school children

They mainly work with school children

Other activities:

- Hiking, camping, exhibition

3. Cooperation with other organizations

Municipal council, Gamini national school Nuwara Eliya

Organizational Information Sheet 2

Interview date : 2002/10/25

Name of the organization: Methodology)	PALM Foundation (Participatory Action & learning
Name of the chairperson:	Team leader, Mr. D.S.K.(Saman) Vijebandara
Address and contact number:	#133, Lady Mc Callum's Drive, Nuwara Eliya, Sri Lanka. Tel/Fax: 052-22839 E –Mail: palm@slt.lk
Year of establishment:	1985 and registered in 1989

1. General information

No. of personnel: 86

Fund resource NOVIB- Netherlands

HELVETAS- Swiss NGO

Individual donors- Stiching PALM

Working area

Agarapathana, Udapussellawa, and Mathurata of Nuwara Eliya district.

2. Main activities

1. The social mobilization program- formation of small groups and CBO, and savings and credit scheme
2. The health, Gender and Educational programs- human rights, gender program, and pre school development
3. Organic agriculture program- natural resource management including home garden development
4. Infrastructure development programs-

3. Cooperation with other organizations

- Member of district development committee
- Member of national level environment net work
- Member of municipal environment committee
- Member of Lanka organic agriculture movement- Helvetas

Activities of Divisional Environmental Officers

Interview date: 2002/11/01

Name of the Municipality:	Nuwara Eliya Divisional Secretary Office
Name of the officer:	Mr. K.B.W. Nimal Ananda
Year of appointment:	February 2000
Address and contact number:	Divisional Secretary Office, Nuwara Eliya.

Presently there is no Divisional Environmental Officer in Nuwara Eliya Municipal Council and the school programs under Nuwara Eliya Municipal Area are looked after by a Divisional Environmental Officer in Nuwara Eliya Divisional Secretary Office.

1. **Organizational information** (which department do you belong to in divisional secretary office)
   - To the deputy director General of Environmental Education and Awareness Division in the Central Environment Authority.
   - To the divisional secretary in the Nuwara Eliya Divisional Secretary Office.

2. Main activities

- School education program, ("Environment Pioneer Brigade" program and "Eco Clubs" program)
- Issuing the environment protection licensee.
- Organizing special programs and conducting lectures on specific days such as the tree planting day, the world environment day, etc.
- Inspection of environmental related problems.

2.1 School Program

There are 9 secondary schools and about 5 primary schools in Nuwara Eliya Municipal Area and only 7 schools are participating in the environment pioneer brigade program. The remaining are Tamil medium schools so he was unable to initiate the program for these schools due to language problem.

Name of the school	EPB/ECO
1. Gamini Central College	EPB
2. Piyatissa Maha Vidyalaya	EPB/ECO
3. Painter Maha Vidyalaya	EPB/ECO
4. Holy Trinity Sinhala Vidyalaya	EPB/ECO
5. Holy Trinity Tamil Vidyalaya	-
6. Good Shepherd Convent School	EPB

7. Vajiragnana Maha Vidyalaya	EPB but inactive
8. Savier Maha Vidyalaya	-
9. Maddumabandara Maha Vidyalaya	EPB/ECO

District Environmental Commissioner is in Good Shepherd Convent School and Deputy Environmental Commissioner is in Painter Maha Vidyalaya.

2.2 Environmental Committee

The DEO is looking after mainly school programs and there is no cooperation regarding the environmental committee meetings in NEMC. NEMC, with an initiative of the Mayor, established its own Environmental Committee and holds regular meetings.

Chapter 4

Nuwara Eliya Waste Stream Analysis

A. Household garbage collection service, garden waste and recycling/composting survey data

2.1&2.2 Garbage coll'n	No	%
Have and use	106	88.3
Have but don't use	9	7.5
Don't have	5	4.2
Total	120	100.0

3.8 Garden waste	No	%
Yes	52	43.3
No	68	56.7
Total	120	100.0

Q4-5 to 4-8Recycling

Qns	Yes	No	Fd/Ki	Paper	Textile	Plastic	Gr/Wd	Le/Ru	Metal	Glass	Ce/St	Tyres	Total
4.5/4.6 Individual collector	102	18	0	12	2	1	0	0	6	57		0	60
4.7/4.8 Take to shop	33	87		5	0	0	0	0	0	29	0	0	33
4.9 Comp ki &/or ga waste	20	100	18				19						20

102 come to collect but only 60 give

Notes:

1. Household questionnaire listed paper and cardboard separately and "metal can" and "other metal" separately, whereas these items were a single category in WACS.
Hence, as more responses were obtained for paper compared with cardboard, it was assumed total paper = paper (not paper + cardboard)
Hence, as more responses obtained for metal can compared with other metal, it was assumed total metal = metal can (not metal can + other)
3. Assume same people are both giving/selling things to collectors and taking things to shops so that total doing some recycling is max no from these 2 questions, not sum
4. In Q4.9, 20 households stated they compost both kitchen & garden waste - this answer assumed more accurate than Q3.9, where 15 households stated they compost their garden waste.

B. Other household survey data and calculation of discharge/behaviour method %s for surveyed area

WACS Collection Vehicle Waste Composition over 8 days - wt %

	Fd/Ki	Paper	Textile	Plastic	Gr/Wd	Le/Ru	Metal	Glass	Ce/St	other	Total
Kandy	58.21	11.95	1.40	7.94	12.31	0.68	0.84	1.13	5.13	0.40	99.99
Matale	61.29	6.40	1.07	4.35	18.14	1.11	0.42	0.36	6.60	0.26	100.00
NE	71.61	11.12	1.22	5.68	5.74	0.14	0.71	0.92	2.56	0.30	100.00

Average Household waste composition over 8 days - wt %

	Fd/Ki	Paper	Textile	Plastic	Gr/Wd	Le/Ru	Metal	Glass	Ce/St	other	Total	
Kandy	69.90	6.93	1.11	5.08	11.70	0.41	0.96	1.07	2.65	0.18	100.00	H'hold wt avg WACS values
Matale	66.50	6.98	1.34	3.59	15.68	0.40	0.37	1.33	3.36	0.46	100.00	H'hold wt avg WACS values
NE	81.84	6.95	1.25	4.16	5.21	0.07	0.72	2.14	1.31	0.33	103.99	See note 1
Adopted	78.71	6.69	1.20	4.00	5.01	0.06	0.69	2.05	1.26	0.32	100.00	

Household survey	Q3.1 garb disp		5.9 others		Weighted no of responses to different methods of waste disposal for different waste types											Wt avg	Rev'd	Rev'd %
(120 respondents)	Main	Other	behaviour															
LA collη	104	10	111		85.2	85.2	85.2	85.2	11	85.2	85.2	85.2	85.2	85.2	777.8	71.2	76.7	75.2
Self-disp (OSD)	7	17	6		9	9	9	9	26	9	9	9	9	9	107	9.7	7.1	7.0
Compost	5	11	0	F/K:Q4-9	18	0	0	0	19	0	0	0	0	0	37	13.9	8.3	8.1
Recycle	0	0	0	Q4-5-8	0	12	2	1	0	0	6	57	0	0	78	1.6	1.4	1.4
Open dump	4	6	18		4.4	4.4	4.4	4.4	0	4.4	4.4	4.4	4.4	4.4	39.6	3.6	8.5	8.3
Total	120	44	135		116.6	110.6	100.6	99.6	56	98.6	104.6	155.6	98.6	98.6	1039.4	100	102.0	100.0
Weight	0.8	0.2							Q3.9									

Notes:

1.Nuwara Eliya household weighted average composition data calculated for each waste type (except paper) as NuwaraEliya VWC x 0.5 x (Kandy HHWC/Kandy VWC + Matale HHWC/Matale VWC) assuming:
a. variations in VWC between towns reflects variations in local conditions; and b. the ratio of town HHWC/town VWC is approximately constant
where VWC = vehicle waste composition and HHWC = household waste composition. The calculated %s are then be adjusted on a pro rata basis to give a total of 100%.
For paper, average of Matale and Kandy data used, as VWC considered to be high for paper, probably due to high proportions of paper contributed by the commercial and institutional sectors.

2. Q5.9 generally supports Q3.1 except for suggesting open dumping is more common. Q3.1 used in prelim analysis, applying weights to main/other answers as shown (results then adjusted in 4-6).
3. For compost and recycle options, use answers from other questions as indicated, rather than 3.1.
a. For those recycling different materials, assumed 90 % of materials generated are recycled - gives revised total shown in last column
b. For those composting food/kitchen and garden waste, calculated 60 % of materials generated are composted (from Q4-9 survey results) - gives revised total in final column
4. LA coll'n % considered too low based on observation, disp site tonnages & Q5.9. Q5.9 LA colln % = 82.2 % - LA % revised to be avg of value in 3rd to last column & this value
5. Self-disposal % considered too high based on observation, disp site tonnages & Q5.9. Q5.9 OSD % = 4.4 % - OSD % revised to be avg of value in 3rd to last column & this value
6. Illegal-disposal % considered too low based on observation, disp site tonnages & Q5.9. Q5.9 ID % = 13.3 % - ID % revised to be avg of value in 3rd to last column & this value

C. Extension of survey results to entire NEMA area

Household waste stream results in final column of above table have been adopted as representative of surveyed areas. This survey was undertaken in areas where 95.8% of households receive a garbage collection service (see Q2.1 & 2.2). Discussions with NEMC Supervisors indicated that the NEMA service coverage is approx. 85 % in Nuwara Eliya (range = 80 - 90 %)
Hence, the survey results were adjusted to account for the different overall service coverage as set out below:

Area (fraction)	Formulae			Survey area			Overall		
	Serviced	Unserviced	Total	Serviced	Unserviced	Total	Serv.	Unserv.	Total
	A	B	1	0.96	0.04	1	0.85	0.15	100
LA collection	X1	0	Z1	78.5	0.0	75.2	78.5	0.0	66.7
Self-disposal	X2	Y2	Z2	6.0	28.0	7.0	6.0	28.0	9.3
Compost	X3	Y3	Z3	7.1	32.8	8.1	7.1	32.8	10.9
Recycle	*X4*	*Y4*	*Z4*	1.2	5.6	1.4	1.2	5.6	1.9
Open dump	X5	Y5	Z5	7.2	33.5	8.3	7.2	33.5	11.2
Total	100	100	100	100.0	100.0	100.0	100.0	100.0	100.0

Notes:
1. In general:
a. X1 = Z1/A
b. X2*A + Y2*B = Z2; X3*A + Y3*B = Z3; etc.
c. Assume for areas not provided with collection service, waste is disposed of by other methods in proportion to %s in serviced areas.
I.e. X2/(X2+X3+X4+X5) = Y2/(Y2+Y3+Y4+Y5) which simplifying becomes X2/(100-X1) = Y2/100 as Y2+Y3+Y4+Y5 = 100;etc. for X3, X4, X5
d. Combining these equations gives Y2*(A*(100-X1)/100+B) = Z2; etc.
Solving these equations gives the relative %s for different disposal methods in serviced and unserviced areas within the survey area.
2. These %s are then assumed applicable to all NEMA:
a. Overall %s calculated as ((% serviced area) x (disposal method % in that area) + (% unserviced area) x (disposal method % in that area))/100%
b. Results in last column used in waste stream.

D. Waste Generation Rate (WGR) data

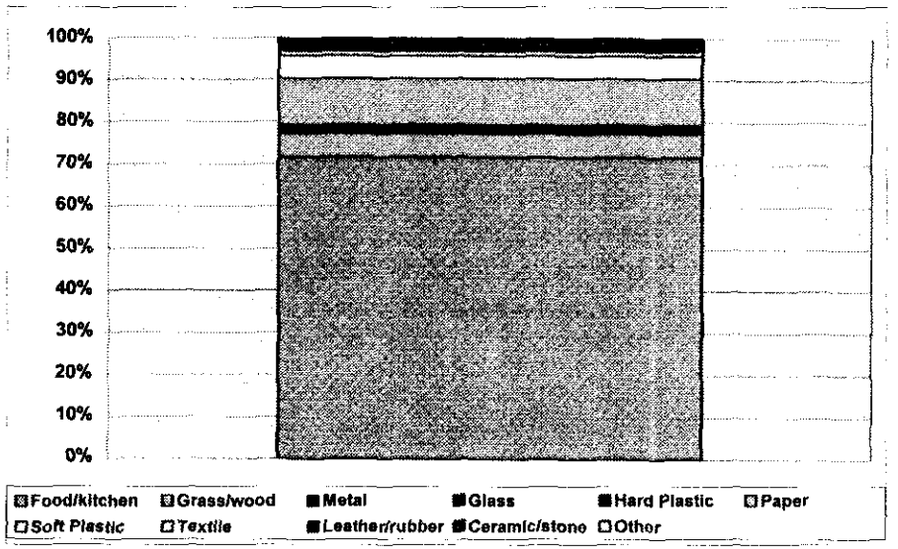
Town/city	Pop'n	WGR (kg/cap.d)	Ga waste Comp (%)
Kandy	110,049	0.545	11.70
Matale	36,331	0.451	18.14
Nuwara Eliya	27,833		5.01

These are estimated WGRs based on measured waste discharge rates in Kandy and Matale.

Adopted Nuwara Eliya WGR = 0.498 kg/cap.d, = average of Kandy and Matale data, as although Nuwara Eliya is a similar sized town to Matale, the waste generation per capita is considered likely to be higher due to the high level of agricultural activity within the town.

Composition data for graphing

Vehicle comp'n	%
Food/kitchen	71.61
Grass/wood	5.74
Metal	0.71
Glass	0.92
Hard Plastic	0.26
Paper	11.12
Soft Plastic	5.42
Textile	1.22
Leather/rubber	0.14
Ceramic/stone	2.56
Other	0.30
Total	100.00



Collection worker recycling (data from collection worker survey)

Item	Total
No of workers collecting items for recycling	9
Total no of workers interviewed	30
Average income(Rs/mth)	171
% of those interviewed collecting recyclables	30
Total no of SWM workers	80
% interviewed/total workers	38
Estimated total no of workers collecting recyclables	24

Notes:

1. Total SWM workers = 90 labourers + 5 drivers - (3 septic tank/toilet + 6 cemetry + 5 disposal site + 1 slaughterhouse) labourers = 80
2. All nine workers indicated they take their recyclables to Nadar Kade (4) or Saraswathie Stores (4) or Ari Stores (1)

Collection worker - recycling quantities

Item	No collecting	Qty	Units	Price	Units	Corrected qty (kg/mth)	Est total kg/mth	Est total kg/d	
Bottles	9	221	kg/mth	0.5 - 5.0	Rs ea	331.7	884.4	29.5	3 don't knows
Iron	2	3	kg/mth	2-3	Rs/kg	6.0	16.0	0.5	1 don't know
Metal can	2	78	kg/mth	1.5-2.0	Rs/kg	78.0	208.0	6.9	
Aluminium	4	4.75	kg/mth	35-50	Rs/kg	4.8	12.7	0.4	
Brass	1		kg/mth	60	Rs/kg	2.0	5.3	0.2	1 don't know; assume 50% of Al
Other metal	2	14	kg/mth	1.5-4.0	Rs/kg	14.0	37.3	1.2	
Total quantity	9	320.85	kg/mth			436.4	1163.7	38.8	
Est. tot. qty collected by all labourers		856	kg/mth			1164			

Notes:

1. Average weight of bottles (mainly beer and arrack) = 0.66 kg ea (average weight, based on measurements of 5 arrack and 5 beer bottles)
2. No of bottles collected per month = 335 bottles/mth, converted to kg/mth using above average weight
3. Corrected quantity accounts for any "don't knows"
4. Overall quantity recycled = 39 kg/d, which is relatively small. However, household survey indicates lot of recyclables collected at discharge + MM survey indicates very few middlemen receive recyclables from collection workers. Assume correct.

Final disposal site - recycling

1. The 5 NEMC labourers working at the final disposal site collect recyclable materials. Estimated quantities of recyclable materials collected by them were obtained by directly asking the labourers and also the landfill supervisor, with the results being summarised below:

Item	Labourers		Supervisor		Adopted		Notes
	Qty	Units	Qty	Units	Qty	Units	
Bottles	10	bottles/d	50	bottles/d	30	bottles/d	
Broken glass	0		50	kg/d	25	kg/d	
Tins	40	kg/d	100	kg/d	70	kg/d	
Coconuts			27.5	25-30 shells/d	27.5	shells/d	
Animal feed			No				
Iron			No				Collected by collection labourers
Aluminium			No				Collected by collection labourers
Total	50		185	kg/d	117	kg/d	

Note: *Total quantities in kg/d based on* *0.66 kg/bottle &* *0.0875 kg/coconut shell*

1. Some other individuals also collect recyclables from the Inco (Interfashion) trailer which comes about 2 times/wk.

a. Textiles are collected by 7 women amounting to 1-2 polysacks/person twice per week, which they use to make bed sheets, pillow covers, etc.
Amount of textiles recycled calculated based on 1 polysack is ~200L and using textile density of 65kg/m3
Qty = 39 kg/d

b. Paper is collected by 2 men, amounting to about 1-2m piles/person twice per week which they transport by bicycles.
Total paper recycled estimated based on 90kg/m3 density, 1.5m high pile by 150mm wide by 300mm long = 3.5 kg/d

c. Inco said that normally 1 Tr/wk goes to the disposal site, but now more loads are going due to their incinerator being out of service.
It is assumed that this recycling is a normal practice.

2. Combining these quantities gives total recycling at final disposal site = 180 kg/d

1. WASTE STREAM HOUSEHOLD, COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL DATA

a. Residential	Permanent		Floating		Notes
	H'holds	People	H'holds	People	
July 2001 census		25049			1
NMC PHI data	7258	27833		7167	2,3
UDA					
Adopted	0	27833	n/a	7167	

Other data:
Area = 15.01 km2 (used by UDA and in NEES study)
No of voters = 16400

Notes:
1. Provisional July 2001 census results; census breakdown into different areas also given based on GSD census data
2. Data from NMC PHI - includes 2,784 estate population, which if subtracted from popn figure gives 25,049 census population
3. Permanent + floating population = 35000 ; floating popn = 7167
Data from Ceylon Transport Board surveys, undertaken every 6 mths (according to reporter); this figure is also widely quoted in many studies.
Note that this floating popn can be regarded as a 7d average, made up of Mon-Fri workers + weekend visitors.
4. H'holds = housing units + collective living quarters
5. NE population growth rate based on the following data:
a. Census data for Nuwara Eliya gives an average compound growth rate of 1.55 % over the period 1981-2001 (refer table).
Inspection of preceding census data shows that the compound growth rate has been maintained within the 1.39-1.70% range since 1963, while the long term compound growth rate relative to 1946 is 1.7%.
b. UDA (2002) base their population projections for NE on minimum and maximum growth rates of 0.7 and 1.1% respectively.
c. 2001 census data shows NE district population increased from 603577 in 1981 to 700083 in 2001 representing *a compound growth rate of 0.74 % - expect NE urban area growth to be higher than this.*
c. Adopted population growth rate = 1.32 %, intermediate between the 1981-2001 measured value and the UDA maximum population projection of 1.1%
d. Hence, Nuwara Eliya population 2002 = 28201

NE Popn data		Cmpd gr rate (%)	
Year	Pop'n	bet census	relative to 1946
1881	1791		
1891	*2726*	4.29	
1901	5226	6.72	
1911	7406	3.55	
1921	7525	0.16	
1931	7823	0.39	
1946	10828	2.19	
1953	14405	4.16	4.16
1963	15482	0.72	2.13
1971	17288	1.39	1.89
1981	20471	1.70	1.84
2001	27833	1.55	1.73

General Notes on Shading
1. Yellow indicates waste generators surveyed/interviewed during this study.
2. Blue relates to specific notes described under relevant items.
3. Purple shows data used in waste stream calculations
4. Brown indicates cells affected by changes in collection tonnages

Abbreviations
1. Waste type codes: F = food/kitchen, G = garden, Gl = glass, Hz = hazardous, In = inert, M = metal, M/F = meat/fish, O = other, P = paper/cardboard, Pl = plastic, R = rubber/leather, Sw = sawdust, T = textile
2. Disposal method codes: A-D= LA collection; E-F = on-site disposal, G = recycling, H = composting, I = illegal dumping, J = other
3. Waste stream codes: OSD = on-site disposal, comp = composting, LA colln = NMC collection, Recy = recycling, ID = illegal dumping, DH = direct haulage
4. Other: WDR = waste discharge rate; WGR = waste generation rate; SW = solid waste

Recycled material weights:

1. Average arrack/beer bottle =	0.66 kg	Measured
2. Other bottle =	0.2 kg	Measured
3. Large plastic container =	0.75 kg	Measured
4. Small plastic cans/containers =	100-125 kg	Measured
5. Polysacks/gunny bag =	0.1 kg	Measured

2. COMMERCIAL & INDUSTRIAL SECTOR - DETAILED INFORMATION

a. General

Cat. Small	Name	Address	Relevant Data: No staff	Type	SW gen (kg/d)	Main 3 wastes	Disposal: Main	other	OSD	Comp	LA coll'n	Recy	ID	Total	Notes
SW1	New Fairline Textile	12,Kandy Rd,NE	3	Textile	1	P>F>Pl	B	G	0.0	0.0	0.9	0.1	0.0	1.0	
SW2	Deens Tailor Shop	53A,Daily Fair,NE	4	Tailoring	2.5	T>Pl>F	B		0.0	0.0	2.5	0.0	0.0	2.5	
SW3	Central Hardware	39A,Lawson St,NE	2	Hardware	3	P>Pl>M	B		0.0	0.0	3.0	0.0	0.0	3.0	
SW5	Sagara Agry Care	9,Kandy Rd,NE	2	Fertilizer	0.5	F>P>Pl	C		0.0	0.0	0.5	0.0	0.0	0.5	
SW6	Kandy Shoe Palace	16,Kandy Rd,NE	2	Retail	1.5	P>Pl	C		0.0	0.0	1.5	0.0	0.0	1.5	
SW7	Shalika Communication	5,Central Market,NE	3	Communication	1	P>F>Pl	B		0.0	0.0	1.0	0.0	0.0	1.0	
SW8	Edmonds Grocery	56,New Bazar,NE	3	Retail	2	P>F>Pl	B		0.0	0.0	2.0	0.0	0.0	2.0	
SW9	Green City Communication	50,Bazar St,NE	4	Communication	0.5	Pa>In>T	B		0.0	0.0	0.5	0.0	0.0	0.5	
SW12	Commercial Bank	36,Park Rd,NE	11	Finance	5	P>F>Pl	B	F	1.3	0.0	3.8	0.0	0.0	5.0	
SW13	Ravina salon	29/25, Lawson St, NE	6	Salon	0.5	O>P>Hz	B		0.0	0.0	0.5	0.0	0.0	0.5	O = hair
SW14	Park Motors	28, Water field drive, NE	6	Garage	5	M>R>Gl	C	G	0.0	0.0	4.0	1.0	0.0	5.0	
LW47	Globe Automobile	71,Queen St, NE	5	Garage	10	M>P>Pl	G	C	0.0	0.0	2.0	8.0	0.0	10.0	
Large				Small	WGR =	2.71	kg/ent.d								
LW1	Cargills	90,Kandy Rd,NE	20	Supermarket	15	F/K>Pa>Ca	B	G	0.0	0.0	14.3	0.7	0.0	15.0	
LW2	CWE	Main St,Regional Office,NE	31	Supermarket	85	F/K>Pa>Ca	C	G	0.0	0.0	47.4	37.6	0.0	85.0	
LW32	Main Post Office	NE	105	Post office	25	P>Pl>F	F	E,G	24.8	0.0	0.0	0.2	0.0	25.0	
SW4	Kalpana Stores	50/1,Lawson St,NE	7	Retail	20	Pa>Ca>Pl	A		0.0	0.0	20.0	0.0	0.0	20.0	
LW8	S.N.S Moter Engineering	25,Queen Elisabeth St.,NE	30	Garage	30	Te>Pa>Me	B		0.0	0.0	30.0	0.0	0.0	30.0	
LW44	Remarko Restaurant	No 70,Main St, NE	30	Local Hotel	60	F/K>Pl>Ca	B	G	0.0	0.0	57.5	2.5	0.0	60.0	
LW45	De Silva Food centre	A/27,Aluth Kada Veediya,NE	30	Local Hotel	50	F/K>Pa>Pl	C	G	0.0	0.0	48.0	2.0	0.0	50.0	
LW46	Hotel Milano	24, Bazaar St	10	Local Hotel	50	F/K>Pa>Pl	C		0.0	0.0	50.0	0.0	0.0	50.0	
SW11	Famina Hotel	3,Model Shop,NE	7	Local Hotel	50	F/K>Pa>Pl	C		0.0	0.0	50.0	0.0	0.0	50.0	
SW10	Green Vilas Hotel	50,Bazaar St,NE	12	Local Hotel	25	F/K>Pa	C		0.0	0.0	25.0	0.0	0.0	25.0	
	Total								26.1	0.0	364.4	52.0	0.0	442.5	
				Large	WGR =	41.0	kg/ent.d	Disp %	5.9	0.0	82.3	11.8	0.0	100.0	

Notes:

1. Additional waste stream generation data:
   - a. Safari hotel generates 4bins @ 40L, 80%full = 38.4 kg/d using waste density of 300 kg/m3, as mainly F/K waste
   - b. Food Lanka generates 4bins @ 40L, 80%full = 38.4 kg/d using waste density of 300 kg/m3, as mainly F/K waste
   - c. Devon generates 5bins@40L, 80% full = 48.0 kg/d using waste density of 300 kg/m3, as mainly F/K waste
   - d. Sulaiman generates 4bins @40L, 80%full = 38.4 kg/d using waste density of 300 kg/m3, as mainly F/K waste

   Combining this data with the JICA LWGS survey data gives large WGR = 40.9 kg/ent.d
   - e. Cargils ground stalls generates 2 HC/d = 240 kg/d using 120 kg/HC
   - f. Kavithas building generates 4 HC/d = 480 kg/d using 120 kg/HC
   - g. Samurdhi stalls generates 2.5 HC/d = 300 kg/d using 120 kg/HC
2. Waste stream breakdown (survey data):
   - a. SW1 recycles 3kg/mth c'board = 0.1 kg/d
   - b. SW14 recycles 10kg of metal, 1kg of battery, 25L of oil /mth = 1.02 kg/d (used oil spec grav =0.8)
   - c. SW12 - assume LA collection = 75 %; residual = OSD
   - d. LW47 recycles 10 small pl cans (assumed wt = 125 g) & 300kg of metal=10.04kg/d, but daily waste generation is 10kg -> assume that 80 % of generated waste is recycled; residual = LA coll'n
   - e. LW13 recycles 20kg/mth c'board = 0.67 kg/d
   - f. LW2 reuses 1200 polysacks/gunny bags + recycles 2,250kg/mth c'board & 5kg/mth paper = 75.2 kg/d (pa/ca recycling only) - too high relative to waste gen & stated disp methods - assume 50 % of this
   - g. LW32 recycles 5kg/mth paper = 0.17 kg/d; other waste goes to OSD
   - h. LW44 recycles 60 large cans & 300bags (assume can wt is 750g & bag wt is 100g) = 2.5 kg/d
   - i. LW45 recycles 60 bottles (0.66kg ea.), 50 polysacks (0.1kg ea), 20 large cans = 1.99 kg/d
3. Waste gen based on estimated actual no of comm enterprises in NEMA= 570 enterprises from NEMC Revenue section less 58 hotels/guesthouses, 5 industries and 3 farms which are considered separately (central mkt stalls assumed to be excluded from comm enterprises), giving a total of 504 commercial enterprises

From NEMC Revenue section, small waste generators =	85 % of total =	428	enterprises with WGR=	2.71 kg/ent.d =	1.16 T/d
From, NEMC Revenue section, large waste generators =	15 % of total =	76	enterprises with WGR=	40.9 kg/ent.d =	3.10 T/d
		504		Total	4.26 T/d or 7.47 kg/ent.d

4. JICA disp site trip count survey data (Sep 12-18th) gives actual Z2 tonnage (no of trips x fill factor x density) = 5.16 T/d, equiv to 3.37 TL/d based on 1.53 T/load (Z2 tractor & trailers)
According to NEMC supervisors, Z2 is *80 % commercial -> zone 2 comm coll'n =* 4.13 T/d. Surveyed trips = 61.3 % of NEMC Sup'r estimates for Z2 trips (5.5 TL/d)
Similar T/d data can not be separated out from JICA survey data for Z1. However, NEMC sup'rs said Z1 trips are ~1 TL/d, which has been adjusted to actual trips, assuming same performance as per Z2, giving
0.97 T/d, based on 1.58 T/load (avg filled Tr load) x 61% of 1 Tr/d. NEMC Sup'rs said Z1 is 90 % comm -> comm waste coll'n= 0.87 T/d
Hence, total comm waste colln = 5.00 T/d (Z1+Z2 coll'n records), which after subtracting mkt waste = 4.22 T/d. From JICA survey data, LA colln = 82.3 % of gen; hence
Comm waste gen = 5.12 T/d
5. The two estimates calculated in notes 3 and 4 are very similar - average value adopted = 4.69 T/d
6. Summary: No of comm enterprises = 504 with waste generation = 4.69 T/d, equiv to 9.31 kg/enterprise/d

b. Markets

ID	Name	No of stalls				Stalls		Total	WD (kg/d)	WDR kg/stall.d	Main wastes	OSD	LA colln	ID	Notes
		Meat/Fish	Veg/Fruit	Goods	Other	Retail	W/sale								
	Fish/meat and vegetable														
	Central market	11	9	15	19			54	780	14.44	F>M/F>	0	780		5 stalls closed/used
	Pola					*Stalls*	*kg/pola.d*	*Eq no*	*Eq WG*		P				as stores
	Sunday					1000	9420	143	1346	9.42		0	1346	0	
								196.6	2125.7			0	2126	0	
											Waste stm %s	0.0	100.0	0.0	

Notes: In this case, F/K = vegetable/fruit waste/leaves, coconut shells, etc. WGR = 10.8 kg/stall.d
1. From NEMC Sup'r survey, central mkt produces 5-6 HC on weekdays & 8-10 HC on weekends = 6.5 avg HC/d @ 120 kg/HC
2. From NEMC Sup'rs survey, Pola has ~1000 stalls and generates 3-5 (say 4)TL+1lorry load = 9.42 T/d, based on 1.58 T/tr & 3.1 T/lorry
3. *Pola is only held once per week - hence waste generation and no of stalls has been converted to an equiv daily average by dividing by 7days/wk.*
4. NEMC Sup'r survey indicated recycling from the market is not significant.
5. JICA field observations suggest some of the pola waste is burnt on-site - however, NEMC labourers said they cant burn because of the moisture content -assume all collected by NEMC

c. Tourist Hotels

No	Hotel	Address	rooms	Avg no of staff	Avg Guests	WG (kg/d)	WGR (kg/G+S.d)	Waste Types	Disposal methods		Waste Stream Data						
									Main	Other	OSD	Comp	LA colln	Recy	ID	DH	Total
LW11	Grand Hotel	Grand Hotel Rd	310	200	100	600	2.00	F>G>GI	C	G,F	39.0	0.0	156.2	404.8	0.0	0.0	600.0
LW14	Hill Club	29,Grand Hotel Rd	71	68	35	250	2.43	F>G>GI	C,F	D,G	54.1	0.0	81.2	114.8	0.0	0.0	250.0
LW16	Windsor Hotel	2 Kandy Rd	105	40	20	100	1.67	F>PI>P	D	G	0.0	0.0	95.1	4.9	0.0	0.0	100.0
LW9	St Andrews Hotel	10 St Andrews Drive	104	93	55	60	0.41	F>G>P	D	F,G,H	11.8	0.2	35.4	12.7	0.0	0.0	60.0
LW21	Galway Forest Lodge	89 Upper Lake Rd	130	87	40	200	1.57	F>G>P=P	G	B	0.0	0.0	118.0	82.0	0.0	0.0	200.0
LW10	Ceybank Rest	Badulla Rd	43	20	20	100	2.50	F>G>GI	F	G,H	73.6	0.2	0.0	26.3	0.0	0.0	100.0
LW12	*Glendower Hotel*	*5 Grand Hotel Rd*	20	24	50	65	0.88	F>P>GI	C	G,E	16.6	0.0	30.8	17.6	0.0	0.0	65.0
LW13	Hotel Tree of Life	2 Wedderburn Rd, off Park Rd	12	4	3	6	0.86	F>G>GI	D	H	0.0	2.0	4.0	0.0	0.0	0.0	6.0
	Total			536	323	1381					195.1	2.4	520.6	662.9	0.0	0.0	1381.0
Notes:		Total guests + staff =		859	Guests+staff/d				waste stream %s		14.1	0.2	37.7	48.0	0.0	0.0	100
T&M = time and motion		Average WGR =		1.61	kg/(guests+staff).d												

1. LW11 recycles 500kg/d F/K waste for animal feed + 150kg/mth plast. + 30kg/mth pa = 506 kg/d, while in T&M study, ~2m3 of waste discharged = 300 kg/d (assuming 2d waste), including a lot of F/K waste
Assume, actual recycling = 80 % of stated figure, while LA coll'n = 80 % of other waste, rest = OSD -this is more consistent with both sets of data
2. According to piggery survey, 500kg/d is fed to pigs at the Grand Hotel (adjusted to 400kg/d above) and the Nazareth Farm collects on average 50kg/hotel of organic material after source separation from Hill Club, Galway Forest Lodge, Ceybank and Glendower with larger quantities being collected from the Hill Club and less from Glendower. According to hotel surveys, F/K waste given for animal feed is Hill Club (200kg/d), Galway (100kg/d (changed from 100kg/mth)), Ceybank (50kg/d) and Glendower (30kg/d) = 380kg/mth. Adopted total from these 4 farms = 210kg/d, which is consistent with Nazareth farm total, this being considered more realistic and confirmed by tel. Individual hotel recycling is taken to be: Hill Club - 100kg/d (50% of survey); Galway = 70kg/d (70%); Ceybank = 25kg/d (50%); Glendower = 15kg/d (50%)).
3. LW14 stated they produce 500kg/d of waste, which seems too high relative to other hotels & T&M study observations - hence 50% of this value (250kg/d) adopted here. They recycle 500bott, 150 large cans (assumed 750g ea.) & 6,000kg/mth F/K (adjusted to 3000kg/mth as per note 2) = 114.8 kg/mth; assume LA colln = 60 % of other waste (based on T&M data), residual = OSD.
4. LW16 recycles 200 bot & 20 large cans/mth = 4.9 kg/d
5. LW9 recycles 50kg/mth metal/paper/plastic & 500 bot/mth = 12.7 kg/d & composts 5kg/mth= 0.17 kg/d;main disp method = D,assume 75 % other waste = LA colln; rest = OSD
6. LW21 recycles 70kg/d F/K waste, 2.9 small cans, 16.7liquor and 3.3 other bottles per day (other bottle=200g, small can=100g) = 82.0 kg/d
7. LW10 recycles 15kg of paper, 750kg F/K & 30 cans(large) = 26.3 kg/d + composts 0.18 kg/d of garden waste; other waste = OSD
8. LW12 recycles 8kg paper,100bot, 35small cans, 450kg of F/K waste per mth = 17.6 kg/d; assume LA colln = 65 % of other waste, residual = OSD
9. LW13 composts 60kg of F/K waste = 2.0 kg/d
10. Total no of tourist hotels = 8
11. Galway Forest Lodge used to be called Nuwara Eliya Lake Inn

d. Guesthouses

No	Guesthouse	Address	Rooms	Avg no of staff	Avg Guests	WG (kg/d)	WGR (kg/G+S.d)	Waste Types	Disposal methods Main	Disposal methods Other	Waste Stream Data OSD	Comp	LA colln	Recy	ID	Total	
LW40	N-Eliya Golf Club	NE	14	85	10	75	0.79	G>F>Pl	E	F,G	74.1	0.0	0.0	0.9	0.0	75.0	
LW17	Avicans	120/2,Badulla Rd, NE	13	4	10	8	0.57	F>P>G	B		0.0	0.0	8.0	0.0	0.0	8.0	
LW37	Grosvenor Hotel	6 Haddon Hill Rd	26	9	4	5	0.38	F>G>Pl	B	G	0.0	0.0	4.6	0.4	0.0	5.0	
LW39	Princes Guest House	12 Wedderburn Rd	14	3	2	6	1.20	F>G>Pl	C	E	1.2	0.0	4.8	0.0	0.0	6.0	
LW20	Victoria Inn	15/4,Park Rd,NE	18	4	7	20	1.82	F>P>G=Pl	B	F,G	3.9	0.0	15.4	0.7	0.0	20.0	
LW15	Sunhill Hotel	18,Unique View Rd,NE	35	16	15	30	0.97	F>M>P	B		0.0	0.0	30.0	0.0	0.0	30.0	
LW18	Rising Lion	3,Sri Piyatissapura, St. Andrew's Dr	26	2	20	2	0.09	F>P>Pl	E		2.0	0.0	0.0	0.0	0.0	2.0	
LW38	Clifton Inn	154 Badulla Rd	25	5	4	14	1.56	F>G>P	C	F,H,G	2.7	6.7	4.0	0.7	0.0	14.0	
LW19	Wattles Inn	17,Sri Jayatilaka St,NE	28	4	4	7	0.88	F>G>P=Pl	B	F,G	1.6	0.0	4.8	0.6	0.0	7.0	
10	Hellenic Holiday Home		10	5	4	5	0.56		A-D		0.0	0.0	5.0	0.0	0.0	5.0	
11	The Rock	49/1 Unique View Rd	10	7	5	6.25	0.52		A-D		0.0	0.0	6.3	0.0	0.0	6.3	6-6.5kg/d
12	Kamal's New Country House	60 Unique View Rd	11	6	10	5	0.31		A-D		0.0	0.0	5.0	0.0	0.0	5.0	LA colln assumed
13	Travel Lodge	Badulla Rd	9	2	2	5	1.25		B		0.0	0.0	5.0	0.0	0.0	5.0	
14	Alpine Hotel	4 Haddon Hill Rd	25	24	15	40	1.03		A-D		0.0	0.0	40.0	0.0	0.0	40.0	
15	Haddon Hill Hotel	8 Haddon Hill Rd	11	4	2	2.75	0.46		A-D		0.0	0.0	2.8	0.0	0.0	2.8	2.5-3.0kg/d
16	Single Tree Hotel	1/8 Haddon Hill Rd	7	2	3	3.25	0.65		A-D		0.0	0.0	3.3	0.0	0.0	3.3	3-3.5kg/d
17	Haddon Hill Lodge	29 Haddon Hill Rd	8	3	2	2.75	0.55		A-D		0.0	0.0	2.8	0.0	0.0	2.8	2.5-3.0kg/d
18	Haddon Hill Rest	Haddon Hill Rd	5	3	15	5	0.28		A-D		0.0	0.0	5.0	0.0	0.0	5.0	
19	Haddon Hill Inn	Haddon Hill Rd	10	3	8	4	0.36		A-D		0.0	0.0	4.0	0.0	0.0	4.0	
20	Maggies Hotel	Haddon Hill Rd	5	2	2	5	1.25		A-D		0.0	0.0	5.0	0.0	0.0	5.0	
21	Oatlands	124 St Andrews Dr	4	4	1	1	0.20		C		0.0	0.0	1.0	0.0	0.0	1.0	
22	Collingwood Inn	112 Badulla Rd	9	3	2	5	1.00		B		0.0	0.0	5.0	0.0	0.0	5.0	
23	Chalet du Lake	Badulla Rd	10	7	2	12.5	1.39		C		0.0	0.0	12.5	0.0	0.0	12.5	5-20kg/d
24	Clifton Hotel		11	5	2	5	0.71		C		0.0	0.0	5.0	0.0	0.0	5.0	
25	Unique View Cottage (Yenisey)		10	8	2	2	0.20		B		0.0	0.0	2.0	0.0	0.0	2.0	
26	Grosvenor		10	8	4	4	0.33		C		0.0	0.0	4.0	0.0	0.0	4.0	
27	Ascot Guest House	120 Badulla Rd	11	3	8	3	0.27		G		0.0	0.0	0.0	3.0	0.0	3.0	Nazareth Farm
28	New Keena Hotel	122 Badulla Rd	9	3	6	10	1.11		G		0.0	0.0	0.0	10.0	0.0	10.0	Nazareth Farm
29	Cooperative Guesthouse		14	5	7	5	0.42		A-D		0.0	0.0	5.0	0.0	0.0	5.0	
30	Seranditae		7	NA	2	5	#VALUE!		A-D		0.0	0.0	5.0	0.0	0.0	5.0	LA colln assumed
31	Green Garden		8	2	2	12	3.00		B		0.0	0.0	12.0	0.0	0.0	12.0	
32	Blue Haven Inn		6	2	1	1	0.33		B		0.0	0.0	1.0	0.0	0.0	1.0	
33	Dushan Rest House		9	3	2	4.25	0.85		A-D		0.0	0.0	4.3	0.0	0.0	4.3	4-4.5kg/d
34	Sampath Rest		5	3	2	2	0.40		A-D		0.0	0.0	2.0	0.0	0.0	2.0	
35	Tharaka Guesthouse		5	1	15	3	0.19		A-D		0.0	0.0	3.0	0.0	0.0	3.0	
36	Rosebank		6	2	2	2	0.50		A-D		0.0	0.0	2.0	0.0	0.0	2.0	
37	Tourist Board Holiday Inn		18	20	60	45	0.56		H		0.0	45.0	0.0	0.0	0.0	45.0	40-50kg/d
38	Glenfells Guesthouse		8	4	20	10	0.42		A-D		0.0	0.0	10.0	0.0	0.0	10.0	
39	Seeyasoon Hotel		7	4	3	7	1.00		A-D		0.0	0.0	7.0	0.0	0.0	7.0	
40	Sunny Dew Rest		6	1	10	4	0.36		A-D		0.0	0.0	4.0	0.0	0.0	4.0	
41	Boathouse		10	7	6	10	0.77		A-D		0.0	0.0	10.0	0.0	0.0	10.0	
42	Summs		7	1	4	2	0.40		A-D		0.0	0.0	2.0	0.0	0.0	2.0	
43	Wedderburn Rest		7	4	3	10	1.43		A-D		0.0	0.0	10.0	0.0	0.0	10.0	
44	Vilann Inn		16	5	2	1.5	0.21		A-D		0.0	0.0	1.5	0.0	0.0	1.5	1-2kg/d
45	Green House		6	2	1	2.5	0.83		C		0.0	0.0	2.5	0.0	0.0	2.5	
46	Deepaloka		6	3	1	2	0.50		C		0.0	0.0	2.0	0.0	0.0	2.0	
47	Link View		4	2	1	2	0.67		H		0.0	2.0	0.0	0.0	0.0	2.0	
48	Little Flower		10	3	7	2	0.20		B		0.0	0.0	2.0	0.0	0.0	2.0	
49	Carnation Rest		6	2	1	1	0.33		C		0.0	0.0	1.0	0.0	0.0	1.0	
50	Milano Inn		4	2	2	2	0.50		A-D		0.0	0.0	2.0	0.0	0.0	2.0	
	Total		559	312	325	428.75	#VALUE!		waste stream %s		85.4	53.7	273.3	16.3	0.0	428.8	
											19.9	12.5	63.8	3.8	0.0	100.0	

Notes:

1. Total no of guesthouses = 50 with **637** Guests+staff/d with avg WGR = **0.673** kg/(guests+staff.d)
Note: Stanas Eve Holiday Resort could not be located; Mr Perera's is temporarily closed; Fellcity is closed; Mount View Tour Inn is closed for renovation; Nuwara Eliya Lake Inn is now Galway Forest Lodge
2. Complete surveys undertaken for nine guesthouses at top of list, giving the following waste stream information:
a. LW40 recycles 20 kg paper + 12 bot /mth = 0.93 kg/d
b. LW37 recycles 12 kg/mth paper = 0.4 kg/d
c. LW39:main method =C - assume LA colln = 80.00 %, residual = OSD
d. LW20 recycles 2kg paper & 30bot /mth = 0.73 kg/d; as main disposal method is B, assume 80 % of other waste is collected by LA; residual = OSD
e. LW38 recycles 3kg paper+25 bot /mth= 0.65 kg/d & composts 6.7 kg/d of ga waste; as main disp method is C, assume LA colln = 60.0 % of other waste; residual = OSD
f. LW19 recycles 6kg paper & 20 bot /mth= 0.64 kg/d; as main disposal method is B, assume LA colln = 75 % of other waste; residual = OSD
Overall waste stream %s based on JICA survey data and additional information obtained from NEMC.

e. Industries

	Surveyed Industries	Address	Type	No of Staff	SW Gen (kg/d)	Main 3 wastes	Waste disposal Main	Other	Waste stream breakdown OSD	Comp	LA colln	Recy	ID	DH	Total
LW7	Birdwear Interfashion	15,Hawaeliya,NE	Garment	1275	350	T>P>Pl	F	G,J	138.7	0.0	0.0	62.0	0.0	149.3	350.0
LW4	Winter World Garment Pvt. Ltd.	Badulla Rd,Magastota	Garment	300	150	T>P	D	F,G	46.7	0.0	70.0	33.3	0.0	0.0	150.0
LW6	S.S. International Pvt. Ltd	Hawaeliya,NE	Eye lashes production	392	320	F>P>G	C	G	0.0	0.0	305.3	15.0	0.0	0.0	320.3
	Eyelashes factory	Kalukale	Eye lashes production	45	140		A		0.0	0.0	140.3	0.0	0.0	0.0	140.3
	Ceylon Brewery Ltd.	HawaEliya	Brewery	closed											
LW5	Robin Polypack Pvt. Ltd.	16/3,Becus farm,Magastota,NE	polythene bags prodn	35	200	Pl>F>G	G	E	150.0	0.0	0.0	50.0	0.0	0.0	200.0
LW3	Pedro Estate	Hawa Eliya	Tea factory	1638	280.5	F>P>Pl	F	I,H	176.9	8.3	0.0	0.0	95.3	0.0	280.5
				3685	1441		Total		512.3	8.3	515.5	160.3	95.3	149.3	1441.0
							Disp method (%)		35.6	0.6	35.8	11.1	6.6	10.4	100.0
		WGR	0.391 kg/worker.d	2047	1161		Revised total		335.4	0.0	515.5	160.3	0.0	149.3	1160.5 excl LW3
		Adopted WGR (excl LW3)	0.567 kg/worker.d				Adopted %		28.9	0.0	44.4	13.8	0.0	12.9	100.0

Notes:
1. LW7 has own incinerator. Normally, they incinerate some of their waste + take 1TL/wk to landfill site. Incinerator is currently out of service - hence, all their waste is going to landfill. Normal condition is used in waste stream calcs; 1 Tr/wk = 149.3 kg/d based on avg filled wt of their 2 trs calc'd from JICA disposal site survey data (1.14T,0.95T) = 1.05 T/load
They also recycle 1,000kg/mth pa/ca, 210kg/mth plastic, 50kg/mth metals and 600kg/mth textiles = 62 kg/d; assume residual = OSD
2. LW4 recycles 1000kg/mth textiles = 33.3 kg/d; as main disposal method = D, assume LA colln = 60 % of other waste; residual = OSD
3. LW6 said they generate 0.5TL/d = 281 kg/d, assuming normal 4WT trailer (as per INCO-2 trailer) = 2.2 m3 vol x 85 % full x 300 kg/m3 (lower density due to P/G wastes being 2nd/3rd most common types). NEMC supr's said they produce 3HC/d @ 120 kg/HC = 360 kg/d . Use average of these two values = 320 kg/d
4. LW6 recycles 450kg/mth of plastics = 15 kg/d
5. Kalukele Eyelashes factory (tel interview) said they generate 0.25TL/d = 140.3 kg/d
6. LW5 recycles 1500kg of polythene/mth = 50 kg/d
7. LW3 generates 0.5TL/d = 280.5 kg/d, based on std trailer as per note 3, 85 % full x 300 kg/m3, as P/Pl are 2nd and 3rd most common waste types.
It composts 250kg/mth of tea wastes for own use = 8.3 kg/d, assume OSD = 65 % for other waste, residual = ID
8. Pedro Tea Estate excluded from waste stream as on the city boundary.

3. INSTITUTIONS - DETAILED INFORMATION

a. Schools

	Schools	Location	Students	Teachers	Total	Hostel	Type	Notes
1	Kalukale Vidyala (sinhala)	Kalukele	53	7	60		2	Govt
2	*Moon Plains TV (tamil)*	*Mahagastota*	133	5	138		primary	govt
3	Zahira Muslim School	Hawa Eliya	24	2	26		primary	govt
4	Mahagastota Madduma Bandara MV	Mahagastota	368	18	386		2	govt
5	Our Ladies	NE	725	34	759			SG, prim
6	Holy Trinity School (Tamil)	Hawa Eliya	1532	45	1577		1AB	Govt
7	Holy Trinity School (sinhala)	Hawa Eliya	655	27	682		2	G, Sec.
8	Good Shepherd Convent (Sinhala)	Nuwara Eliya					1AB	semi-govt; both schools surveyed together with total nos being obtained
9	Good Shepherd Convent (Tamil)	Nuwara Eliya	1386	62	1448		primary	semi-govt
10	Gamini National School	Nuwara Eliya	2200	68	2268		1AB	Govt
11	Republican International School	Mahagastota	400	35	435			Pvt, sec.
12	Little Flower	Waterfield Dr	23	187	210			Pvt, sec.
13	John Knox International School							This school will open in earl 2003
14	Sri Vagiragama School	Hawa Eliya	245	25	270		1C	govt
15	Paynter Memorial College	Nuwara Eliya	827	34	861		1C	Govt
16	St Xavier MV (sinhala)	Nuwara Eliya	750	41	791		1AB	Govt
17	Good Rest Convent	Nuwara Eliya	650	21	671		2	Govt
18	T Piyathissa Vidyalaya	Bamarakele	130	13	143		2	Govt
19	Bamarakele TV	Bamarakele	87	3	90		primary	Govt
	Total		10188	627	10815			

	Survey Results		Students	Staff	St + St	SW (kg/d)	Waste Types	Waste disposal Main	Other	Waste Stream Data OSD	Comp	LA colln	Recy	ID	Total
LW27	Good Shepherd convent	Nuwara Eliya	1386	62	1448	10	P>G>F	C		0.0	0.0	10.0	0.0	0.0	10.0
LW28	Gamini National School	Nuwara Eliya	2200	68	2268	100	P>Pl>F	J	F	100.0	0.0	0.0	0.0	0.0	100.0
LW29	St Xavier MV (sinhala)	Nuwara Eliya	750	41	791	6	P>F>Pl	C		0.0	0.0	6.0	0.0	0.0	6.0
LW30	Holy Trinity Central	Hawa Eliya	1532	45	1577	15	P>G>F	F		15.0	0.0	0.0	0.0	0.0	15.0
LW31	Holy Trinity School (sinhala)	Hawa Eliya	655	27	682	12	P>F>Pl	F	E	12.0	0.0	0.0	0.0	0.0	12.0
	Total		*6523*	*243*	*6766*	*143*				*127*	*0*	*16*	*0*	*0*	*143*
		WGR =	0.021	kg/(students+staff).d				Waste stream %		88.8	0.0	11.2	0.0	0.0	100.0

Notes:
1. LW28 J = disposes in pit on-site (but not buried) - hence OSD = 100%
2. Survey schools staff+students represent 62.6 % of total school population

b. Other Educational Institutes

No	Name	Location	Students	Teachers	Total	Boarders	SW (kg/d)	Waste Types	Waste disposal Main	Other	Waste Stream Data OSD	Comp	LA colln	Recy	ID	Total	Notes
LW36	Forest College	Moon Plains Rd	60	37	97	60	300	G>F>P	E,F		300.0	0.0	0.0	0.0	0.0	300.0	
LW35	Technical Collage	NE	320	35	355		8	Sw>M>F	E,F	A	6.4	0.0	1.6	0.0	0.0	8.0	
3	Gamini Dissanayake Foundation	Rajasinghe Mw	98	15	113		5	F>P>Pl			2.0	0.0	3.0	0.0	0.0	5.0	
4	Cultural Centre	Hill St	400	14	414		5	P>F>Pl			1.3	0.0	2.0	1.7	0.0	5.0	
LW34	SOS Childrens village	Bambarakale,NE		35	35	85	25	G>P>T	C	G,F	4.8	0.0	19.3	0.8	0.0	25.0	
6	SOS Preschool	Bambarakale,NE	57	4	61		4	P>F>Pl			1.6	0.0	2.4	0.0	0.0	4.0	
7	SOS Youth centre	Bambarakale,NE	14	1	15		10	F>P>Pl			4.0	0.0	6.0	0.0	0.0	10.0	
8	SOS Girls hostel	Bambarakale,NE				10											
Total			949	141	1090		357				320.2	0.0	34.3	2.5	0.0	357.0	
							WGR =	0.33	kg/(S+S).d		89.7	0.0	9.6	0.7	0.0	100.0	

Notes:
1. Complete surveys conducted for those institutes shown + waste stream data obtained from other places
2. LW36 generates 300 kg/d, *which is reasonable as their main waste type is garden waste + confirmed by interviewer's informal comments*
3. LW35 - main method is OSD - assume OSD = 80 %; residual to LA colln
4. LW34 recycles 25 kg/mth paper = 0.83 kg/d; as main disp method = C, assume 80 % of other waste to LA colln; re kg/d to LA colln
5. Cultural centre recycles 50kg/mth of newspaper = 1.67 kg/d
6. For Gamini Dissanayake Foundation, SOS Pre-school & Youth centre, assume 60 % = LA colln; residual = OSD (also for Cultural centre's non-recycled waste)
7. SOS Girls hostel staff (1) and waste amt included in SOS Childrens village data.

c. Hospitals

Name		Location	Type	No of beds	Bed Occup. (%)	Avg no per day Out-patients	Avg no per day Clinical patients	Staff	Patients + Staff	SW (kg/d) survey	WDR (kg/(P+S	Main waste types	Notes
BH	Base Hospital	Hawa Eliya	Govt/	265	129%	431	460	304	1536	482	0.314	F>P>Pl	
CH	Cooperative Hospital	Kina Rd	SG	24	100%	12	45	14	95	5	0.053	F>P>HH	
IH	*Ideal Hospital*		*priv.*	*0*	0%	55	0	10	65	7.5	0.115	HH>F>P	
Total				289	1	498	505	328	1696	494	0.292		

Notes:

1. WDR = 0.292 kg/(patients+staff)/d - c.f. Kandy = 0.374 & Galle = 0.28 - OK

JICA survey data

All waste (normal + HH)

		Main/Other	OSD	Comp	LA colln	Recy	ID	Total
BH	Base Hospital	A	8.7	0.0	481.9	7.8	0.0	498.4
CH	Cooperative Hospital	C/F	Small	0.0	5.0	0.0	0.0	5.0
IH	Ideal Hospital	C	0.0	0.0	7.5	0.0	0.0	7.5
		Total	8.7	0.0	494.4	7.8	0.0	510.9
		Waste stream %	1.7	0.0	96.8	1.5	0.0	100.0

Notes:

1. BH normal waste = average (Hosp: 25 x 40Lbins @ 300kg/m3; NEMC: 37.5% tr load = 664kg/d; avg = 482kg/d). It recycles 40 x 25L plastic cans & 14 x 25L metal cans per 3-6mths & unspecified quantities of glass + 20 coconuts/d (40 shells). As this data is incomplete, recycling was estimated by scaling up Peradeniya Hospital data by no of staff+patients ratio (= 22.4kg/d x 1195/3426) = 7.81 kg/d
2. BH produces 25kg/mth of clinical waste which is collected by LA (assumed included in normal waste), 25kg/mth body parts, 37kg/mth placentas and 200kg/mth sharps, all of which are burned/buried on-site. OSD = 8.73 kg/d (sharps based on 10-15 boxes/wk @ 4kg ea.)
3. CH produces very small quantities of clinical waste and placentas, which are disposed of on-site - assumed negligible.
4. IH produces very small quantities of clinical waste which are discharged for LA colln - assumed included in LA colln amount
5. Hospital WGR = 0.301 kg/(staff+patients).d

d. Religious Places

	Name	Address	No of residents	Avg no of guests	Total	SW Gen (kg/d)	WGR kg/clergy.d	Main wastes	Disp method Main	Disp method Other	OSD	Comp	LA colln	Recy	ID	Total	Notes
LW51	Ashokaramaya	HawaEliya	13	35	48	10	0.77	F>G>Pl	E	F	10	0	0	0	0	10	
LW50	*Muththu Mari Amman kovil*	*HawaEliya*	5	25	30	50	10.00	G>F>T	A		0	0	50	0	0	50	
			18	60	78	60	3.33		Total		10	0	50	0	0	60	
									Waste stream %s		16.7	0.0	83.3	0.0	0.0	100.0	

Name	No	No of "workers"
Buddhist	9	45
Hindu	8	26
Mosques	2	6
Churches	8	44
Total	27	121

Notes:

1. Waste stream data based on:
   a. buddhist institutes - average of 4 monks @ all but one place + 13 at Ashokakaramaya, Vajira Mw, Moon Plains
   b. Hindu kovil - average of 3 clergy at each place & 2 extras due to 5 at MMA kovil
   c. Mosque - average of 3 clergy at each place
   d. Churches - average of 3 clergy at each place 20 at St Xaviers, Lady McCallum Drive
2. Assume avg WGR = 1.01 kg/clergy.d and use above waste stm %s (consistent with Kandy/Matale data - 20% LA colln; 80% OSD)
3. Excluding MMA kovil, waste genera 117.16 kg/d + 50 kg/d for kovil = 167.16 kg/d, equiv to 1.38 kg/worker.d

e. Forces

	Name	Address	Avg workers	Main 3 wastes	SW Gen (kg/d)	Disposal methods Main	Disposal methods Other	OSD	Comp	LA colln	Recy	ID	Total	Notes
LW28	Police Station		50	F>Pa	25	C	G	0.0	0.0	18.0	7.0	0.0	25.0	
	Police Shooting Training Centre	Moon Plains											0.0	Assume negligible
LW25	Third Singha Regiment (Army Camp)	Upper Lake Rd	NA	F>G>P	200	G	F,E	124.9	0.0	0.0	75.1	0.0	200.0	
		Total			225		Total	124.9	0.0	18.0	82.1	0.0	225.0	
						Waste stream %s		55.5	0.0	8.0	36.5	0.0	100.0	

Notes:

1. No workers data was available from the Army camp for security reasons
2. Police recycles 210kg/mth of F/K waste for animal feed (police dog kennels) = 7 kg/d
3. Army camp recycles 2kg/mth of paper and 2250kg/mth of F/K waste (collected by Nazareth Farm) = 75.1 kg/d - assume correct, based on G being main disposal method (Naz farm said 25kg/d)
4. Police Training Centre is used only during training sessions, with no people staying there full-time. Waste generation assumed to be negligible.

f. Government Offices

	Name	Address	Avg workers	Main 3 wastes	SW Gen (kg/d)	Disposal methods Main	Disposal methods Other	OSD	Comp	LA collin	Recy	ID	Total	Notes
LW24	Divisional Secretariat Office	NE	85	F>P>G	5	D		0.0	0.0	5.0	0.0	0.0	5.0	
	Assist. Commissioner Local Dept	Bammarakelle	61											
	Agrarian Service Office		25											
	Agriculture Dept (Directors office)	HawaEliya	35											
	Aquaculture Development Centre	Kandy Rd	3											
LW49	State Timber Corparation	NE	12	In>G>P	10	C	F	4.0	0.0	6.0	0.0	0.0	10.0	In=timber waste
	Ceylon Transport Board		232											
	Cooperative Development Office		58											
	Deputy Inspector General		9											
	District Court		28											
	Education Dept		25											
	Election Office		17											
	Excise Dept		18											
LW22	Divisional Forest Office	NE	23	P>G>F	3	F	G	2.7	0.0	0.0	0.3	0.0	3.0	Forest off-150 field staff
	RDA	Hawa Eliya	15											
LW33	Superintendent of Health Service		70	F>P>Hz	4	C	F	1.6	0.0	2.4	0.0	0.0	4.0	
	Income Tax Office		24											
	Irrigation Dept		29											
	IRDB		closed											Closed
LW23	Kachcheri	NE	150	P>F	10	D		0.0	0.0	10.0	0.0	0.0	10.0	
	District Labour Office		30											
	Land Commissioner		37											
	Land Reform Authority		10											
	Land Consumption Office		7											
	Meteorological Dept		6											
	Mount Division (Police)		18											
	Municipal Council		315											
	National Housing Dev Authority		35											
	Police HQI Office		190											240 less police station staff
	Rent Control Board		closed											Closed
	Senior Superintendent of Police		31											
	Survey Dept	Bammarakelle	20											
	UDA		14											
	Weights and Measures Office		NA											No data
	Wildlife Dept		8											
	Inland Revenue Regional Office		24											
	District Land Use Office		25											
	District Statistics Office		8											
	Land Development Office		25											
	Minor Crops Export Board		7											
	Youth Council		16											
		Total	1745		32			8.3	0.0	23.4	0.3	0.0	32.0	
						Waste stream %s		25.8	0.0	73.1	1.0	0.0	100.0	

Notes:

1. Worker numbers obtained from individual places, either by telephone or survey
2. Other govt institutions not included in above list = Peoples Bank, Bank of Ceylon, National Savings Bank, CEB, Main PO (more commercial type govt enterprises)
3. Waste stream breakdown based on:

a. LW49 - assume LA collin = 60 %, residual = OSD
b. LW22 recycles 10kg of paper/mth = 0.33 kg/d
c. LW33 -assume LA collection = 60 %, residual = OSD
3. WGR based on surveyed waste generation and corresponding 340 workers -> WGR = 0.094 kg/worker.d
4. Total no of govt offices = 41 less 2 closed offices = 39

4. OTHER WASTE

a. Farms

	Name	Address	Avg workers	Main 3 wastes	SW Gen (kg/d)	Disposal methods Main	Other	OSD	Comp	LA collin	Recy	ID	DH	Total	Notes
LW41	Nazareth Farm	Hawa Eliya,NE	21	O>Pl>F	60	F	E,G,H,J	21.5	50.0	0.0	12.2	0.0	38.6	122.3	O = animal waste
LW42	Huejay International	Badulla Rd.,NE	220	G>Hz>Pl	1100	E	G	962.5	0.0	0.0	137.5	0.0	0.0	1100.0	
LW48	Agricultural farm	Sita Eliya	150	O>F>G	650	H	E	33.1	616.9	0.0	0.0	0.0	650.0	1300.0	O = animal waste
			391					1017.1	666.9	0.0	149.7	0.0	688.6	2522.3	
	WGR =		6.45	kg/worker/d		waste stream %s		40.3	26.4	0.0	5.9	0.0	27.3	100.0	

Notes:

1. LW41 said they produce 60kg/d; assumed this = OSD+DH with recyclable items (from hotel waste) & compost qtys not included in waste gen + they take 1 TL/wk to disp site = 270kg/wk from JICA disp. site survey or 38.6 kg/d
They recycle 100bott/mth, 150kg/mth metal and 150kg/mth F/K waste for animal feed = 12.2 kg/d and compost 50 kg/d of animal/food waste
2. LW42 recycles 1 lorry load of polythene/yr - assume 75 % of gen'd waste is ga waste (to OSD), 12.5 % is Hz (to OSD) and residual = recycling.
3. LW48 composts 18,508kg/mth of mainly animal and F/K waste = 617 kg/d

b. Parks

			Workers	Main wastes	SW(kg/d)	Main disp	Other disp	OSD	Comp	LA collin	Recy	ID	DH	Total	Notes
LW43	Victoria Park	N-Eliya	40	G>Pl>F	100	H	C,F,J	33.3	23.5	33.3	0.0	0.0	9.9	100.0	
P2	Race Course	N-Eliya	94		240	B,I		0.0	0.0	63.0	0.0	177.0	0.0	240.0	
P3	Race Course ground	N-Eliya	5		36	D		0.0	0.0	36.0	0.0	0.0	0.0	36.0	
		Total	139		376			33.3	23.5	132.3	0.0	177.0	9.9	376.0	
Notes:		WGR =	2.71	kg/worker/d		waste stream %s		8.8	6.3	35.2	0.0	47.1	2.6	100.0	

1. LW43 composts 706kg/mth = 23.5 kg/d; takes 5 TL/yr to NEMC disposal site = 9.9 kg/d based on 2.2 m3 Tr @ 300.0 kg/m3; 110 % full
Assume for remaining waste, OSD & LA collin = 50 %
2. P2 generates 2 HC/d = 126 kg/d, using 63 kg/HC (assuming mainly ga waste - hence lower density of 150kg/m3 used); MC collects 1HC; other is disposed to nearby stream
3. P3 Racecourse ground generates 3bins @ 40L = 36 kg/d, based on 300 kg/m3

c. Road and drain cleaning

1. NEMC has a total of 60.21 km of roads and 23.4 km of drains that are cleaned by them.
2. NEMC has ~20HCs with road sweeping and drain cleaning generally being undertaken by labourers assigned to HCs.
3. Average road sweeping waste estimate = 49.1 kg/km.d from three other JICA studies in Poland, Honduras and Dar-es-salaam
4. Assuming that 10 % of all roads are swept daily, total waste gen'n = 296 kg/d or 2.5 HC/d based on 120 kg/HC
5. Assuming drain cleanings are of similar magnitude to road sweepings/km = 115 kg/d
6. Total road/drain cleaning waste = 410 kg/d or 3.4 HC/d; average length of road cleaned per HC = 0.25 km based on 20 HCs
This is considered reasonable.
7. It is assumed that 50 % of this waste is left at the side of the roads/drains/canals and 50 % collected by NEMC.

5. WASTE STREAM ESTIMATION

Waste Source	Waste Generation Rate (WGR)		No	Gen'n (T/d)	Sub-total (T/d)	(%)	OSD Disp	Comp	LA collln	Recycle	ID	DH	Total (check)	Notes
	WGR	Units												
Households	0.498	kg/cap.d	28201	14.04	14.04	48.8	1.31	1.53	9.37	0.26	1.57	0.00	14.04	1
Commercial	9.31	kg/business.d	504	4.69	4.69	16.3	0.28	0.00	3.86	0.55	0.00	0.00	4.69	2
Markets	10.80	kg/stall.d	197	2.13	2.13	7.4	0.00	0.00	2.13	0.00	0.00	0.00	2.13	3
Hotels	1.61	kg/(guests+staff).d	859	1.38	1.38	4.8	0.20	0.00	0.52	0.66	0.00	0.00	1.38	4
Guesthouses	0.67	kg/(guests+staff).d	637	0.43	0.43	1.5	0.09	0.05	0.27	0.02	0.00	0.00	0.43	5
Institutions														
a. Schools	0.021	kg/(students+staff).d	10815	0.23			0.20	0.00	0.03	0.00	0.00	0.00	0.23	6
b. Other Educ Inst.	0.328	kg/(students+staff).d	1090	0.36			0.32	0.00	0.03	0.00	0.00	0.00	0.36	7
c. Hospitals	0.301	kg(patients+staff).d	1696	0.51			0.01	0.00	0.49	0.01	0.00	0.00	0.51	8
d. Govt offices	0.094	kg/worker.d	1745	0.16			0.04	0.00	0.12	0.00	0.00	0.00	0.16	9
e. Forces (Police and Army Camp)	0.23	T/d		0.23			0.12	0.00	0.02	0.08	0.00	0.00	0.23	10
f. Religious places	1.38	kg/clergy.d	121	0.17	1.65	5.7	0.03	0.00	0.14	0.00	0.00	0.00	0.17	11
Industries	0.57	kg/worker.d	2047	1.16	1.16	4.0	0.34	0.00	0.52	0.16	0.00	0.15	1.16	12
Farms	6.45	kg/worker/d	391	2.52	2.52	8.8	1.02	0.67	0.00	0.15	0.00	0.69	2.52	13
Other														
a. Parks	2.71	kg/worker/d	139	0.38			0.03	0.02	0.13	0.00	0.18	0.01	0.38	14
c. Rd and drain cleaning	0.41	T/d		0.41	0.79	2.7	0.21	0.00	0.21	0.00	0.00	0.00	0.41	15
Total	1.02	kg/cap.d	28201	28.79	28.79	100.0	4.19	2.28	17.83	1.90	1.74	0.85	28.79	
Recycling from discharge									0.00	0.00				16a
Recycling from collection									-0.04	0.04				16b
Adjusted totals					Adjust =	1.93	4.19	2.28	17.80	1.94	1.74	0.85	28.79	
Adjustment to final disposal amount									-1.93		1.93			17
Disposal to landfill from within and outside NMA (labourer survey data)									15.87			0.85		18
Recycling from final disposal									-0.16	0.16				16c
Recycling from illegal dumps										0.04	-0.04			16d
Revised total				28.79	28.79		4.19	2.28	15.71	2.13	3.64	0.85	28.79	
						%	14.5	7.9	54.6	7.4	12.6	2.9	100.0	

Method	OSD	Comp	Disch	Recy	ID	DH	Total
%	9.3	10.9	66.7	1.9	11.2	0.0	100.0

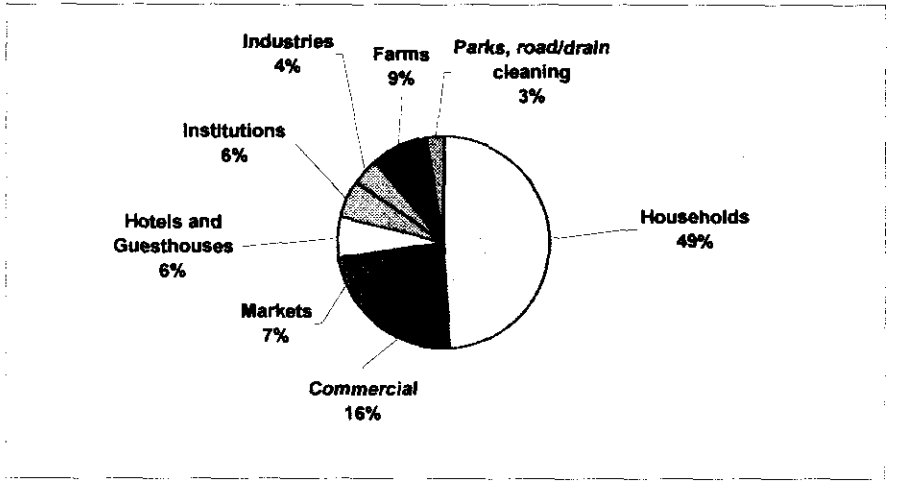
% details on separate sheet

Notes:

1. Household WGR was determined from Kandy, Matale & NE WACS data while waste stream %s were calculated using household survey data and taking into account service coverage, which gave the following %s:
2. Commercial waste generation calculated from interview survey results and other data collected.
3. Market waste generation calculated from interview survey results and other data collected - see details above.
4. Hotel waste stream data calculated using interview and piggery survey results - see calculations under hotel data.
5. Gusethouses waste stream data calculated using interview survey results and additional guesthouse statistics collected by NEMC
6. School's waste stream data calculated from interview survey results
7. Other educational institutes waste stream data calculated from interview survey results - see calculations under institute data
8. Hospital waste stream data calculated from interview survey results.
9. Govt offices waste stream data based on no of workers, estimated WGR (obtained from survey data) and waste stream breakdown (survey data)
10. Forces covers police and army camp, with waste stream breakdown based on survey data.
11. All religious places treated together.
12. Industries waste stream data based on survey information.
13. Farms covers large farms in the town, with waste stream data being based on survey data.
14. Parks covers Victoria Park and the racecourse (ground and buildings).
15. Road and drain cleaning waste based on total length of roads and drains cleaned by NEMC & data from other studies & NEMC comments.
16a. Recycling at discharge: 0.00 T/d, assumed negligible due to high at source recycling (collectors/direct to shops) + very few scavengers seen collecting recyclables after discharge
16b. Recycling during collection: 0.039 T/d, from collection worker's survey data
16c. Recycling at landfill: 0.160 T/d, from disposal site survey, CPHI comments and estimated recycling rates.
16d. Recycling from illegal dumps 0.035 T/d, pro rata from illegal dumping amt/total waste disposal to landfill
17. Illegal dumping amount adjusted to account for difference between estimated collection+direct haul amount and measured landfill disposal amounts
18. JICA disposal site survey gave a total of 15.87 T/d, excluding direct haulage.

Data for Waste Generation by source graph

Waste Source	Generation (T/d)
Households	14.0
Commercial	4.7
Markets	2.1
Hotels and Guesthouses	1.8
Institutions	1.7
Industries	1.2
Farms	2.5
Parks, road/drain cleaning	0.8
Total	28.8



Trade licence data -supporting data

This data obtained from Health Dept

Category	No	Notes
Commercial		
Tourist Hotels	8	
Guesthouses	41	
Local hotels	34	
Tea shops	31	
Restaurants	6	1 closed
Retail shops	155	
Bakeries (using firewood)	5	
Bakeries (using gas/elec)	7	
Industrial		
Garment factories	2	
Eye lashes manufacture	2	
Brewery	1	closed
Pedro Tea Factory	1	
Polythene manufacture	1	

This data obtained from Revenue Section, NEMC

Category	No	Notes
Sale's Agents	21	
S.S. International Company		16, Hawa Eliya
Bird Wear Inter Fashion		15, Hawa Eliya
P.A.R.S. Perera	3	3/16, Bakers Farm, Mahagastota
Gunawardena Traders (Quarry)	1	Bambarakele
D.M.S. Mattel crusher	1	Bambarakele
Potato storing or selling	9	
Clubs	2	
Tourist hotels	14	
Liquor bars	15	
Middlemen	4	
Guesthouses	39	
Tea shops	14	
Grinders	5	
Retail	89	
Bakery	10	
Film halls	1	
Salon	7	
Timber depot/carpentry	4	
Carpentry	1	
Hardware	13	
Paint	12	
Tyre & tube	7	

Category	No	Notes
Radio repair	2	
Pawn shops	18	
Incense sticks	1	
Guides	1	
Textiles	12	
Restaurant	1	
Jewelry	11	
Fertilizer	14	
Pesticides	17	
Local hotels	19	
Fridge repairing	1	
Vehicle spare parts	9	
Pharmacy	9	
Newspaper/magazine	2	
Electric items	4	
Video cassettes	13	
Dry fish	4	
Fish	8	
Welding/Lathe	13	
Goods	15	
Eastern pharmacy	2	
Tailors	9	
Jewellery making	4	
Battery	1	
Betel, Erica nut	3	
Milk collecting centre	2	
Cool drinks (wholesale)	1	
Vegetable (Wholesale)	8	
Cushion works	2	
Betting centres	6	
Nursing home	2	
Eggs (whole sale)	3	
Photo colour labs	1	
frozen food	3	
Measure Balance repair /selling	2	
Picture framing	2	
Furniture	5	
Cement bricks	6	
Warm clothes	3	
Laundry	1	
Communication	14	
Photocopy	3	
Studio	3	
Bicycle repairing	3	
Footwear repaiing & selling	6	
Garage	10	
Spectacles	1	
Filling stations	5	
Cigaret (whole sale)	1	
Learners	3	
Computer classes	3	

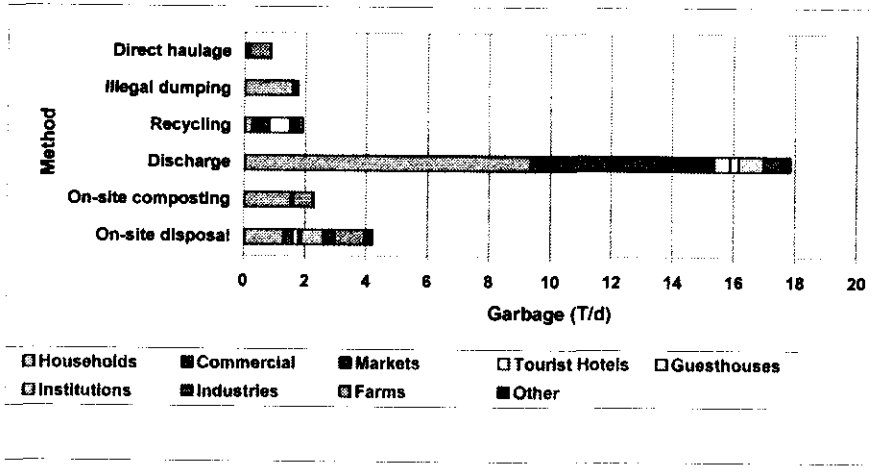
Category	No	Notes
Water pumps selling/repairing	1	
Auctions	3	
Confectionery	2	
Fruit & vegetable	6	
Bicycle repairing	2	
Plastic number plates & name boards	1	
Stationery	5	
Gas	1	
Insurance	5	
Gas stores (whole sale)	1	
Printers	3	
Auditors	1	
Environment applications	1	
Funeral parlours	3	
Computer	1	
Garments	4	
Milk powder (whole sale)	1	
Financial institutes	8	
Rice (whole sale)	1	
Nut selling	1	
Beauticulture	1	
Tea leaves	1	
Service stations	1	
Foreign employment	1	
Total	619	

Notes:

1. No attempt has been made to reconcile these two lists, as there are some discrepancies (e.g. tourist hotels, guesthouses) Instead, the total no of trade licences has been used together with other data obtained from NEMC for the actual number of *enterprises and relative proportions of small and large waste generators (see commercial waste generation)*

Data for graphing

	On-site disposal	On-site co	Discharge	Recycling	Illegal dump	Direct haulage
Households	1.31	1.53	9.37	0.26	1.57	0.00
Commercial	0.28	0.00	3.86	0.55	0.00	0.00
Markets	0.00	0.00	2.13	0.00	0.00	0.00
Tourist Hotels	0.20	0.00	0.52	0.66	0.00	0.00
Guesthouses	0.09	0.05	0.27	0.02	0.00	0.00
Institutions	0.73	0.00	0.83	0.09	0.00	0.00
Industries	0.34	0.00	0.52	0.16	0.00	0.15
Farms	1.02	0.67	0.00	0.15	0.00	0.69
Other	0.24	0.02	0.34	0.00	0.18	0.01
Total	4.19	2.28	17.83	1.90	1.74	0.85



Chapter 5

Nuwara Eliya Waste Collection Analysis

Mar 02

No	Veh	From	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Tot	Avg			
			Veh. Reg	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su		Trips/d	CF (T/L)	T/d	T/mth
1	4WT	NEMC SWM	49-9427											2	2	2	0	0	3	0	3	0	0	0	1	0	0	0	0	0	0	0	0		13	0.65	1.53	1.00	30.9
2	4WT	NEMC SWM	49-9428											1	1	2	2	2	1	2	0	0	1	1	2	0	0	2	2	2	0	0	0		21	1.05	1.79	1.88	58.4
3	4WT	NEMC SWM	49-9429											2	1	1	2	2	0	2	1	2	0	0	2	1	0	2	2	2	1	1	1		25	1.25	1.63	2.04	63.3
4	4WT	NEMC SWM	37-0959											0	0	0	3	2	0	0	1	2	1	1	2	2	2	2	1	2	2	0	2		25	1.25	1.90	2.37	73.6
5	L	NEMC SWM	27-4934											0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		1	0.05	3.07	0.15	4.8
6	4WT	NEMC Works	37-7295											0	1	1	2	1	1	1	1	2	1	1	1	1	2	1	2	1	0	2	0		22	1.10	0.84	0.92	28.6
7	4WT	NEMC Works	48-3738											1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0.05	0.84	0.04	1.3
8	4WT	NEMC Works	37-7787											0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0		2	0.10	0.84	0.08	2.6
9	4WT	NEMC Works	37-6479											0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	1		5	0.25	0.84	0.21	6.5
10	4WT	Unknown	37-3828											0	0	0	1	0	0	0	0	0	0	0	2	1	1	1	0	0	0	0	1		7	0.35	0.84	0.29	9.1
11	4WT	Unknown	37-3728											0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		1	0.05	0.84	0.04	1.3
	Total	All												6	5	6	10	7	5	5	6	6	3	5	10	7	6	8	7	7	6	3	5		123	6.15		9.04	280.2
		NEMC Lorry												0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0		1	0.05		0.15	4.8
		NEMC 4WT												6	5	6	9	7	5	5	6	6	3	3	8	6	5	7	7	7	6	3	4		114	5.70		8.55	265.1
		Other												0	0	0	1	0	0	0	0	0	0	0	1	2	1	1	1	0	0	0	1		8	0.40		0.34	10.4
12	4WT	NEMC GS	42-7552											0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0.05			
13	4WT	NEMC JCB	49-8109											0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0		1	0.05			

Notes:

1. Same trailers were used in Mar 2002 as being used currently.
2. 37-3828 and 37-3728 are not NEMC vehicles but could not be positively identified - suspect both are the same vehicle but not confirmed.
3. Shaded cells represent days without any data.
4. Works trailer 4WT conversion factor used for NEMC Works and unknown vehicles.

No of days reported	20
Days in month	31

Aug 02

No	Veh	From	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Tot	Avg	Avg T/d	T/d	T/m
			Veh. Reg	Th	Fr	Sa	Su	M	Tu	We	Th	Fr	Sa	Su	M	Tu	We	Th	Fr	Sa	Su	M	Tu	We	Th	Fr	Sa	Su	M	Tu	We	Th	Fr	Sa		Trips/d			
1	4WT	NEMC SWM	49-9427	3	2	3	2	0	3	3	3	2		3	3	3	2	3	3		3	2	0		2		0	0	2		4	3	3	3	60	2.31	1.53	3.54	109.7
2	4WT	NEMC SWM	49-9428	2	2	2	1	1	2	2	1	1		0	1	1	2	2	0		1	1	2		1		0	4	2		2	2	2	2	39	1.50	1.79	2.69	83.4
3	4WT	NEMC SWM	49-9429	2	1	1	1	2	1	1	2	0		2	2	2	1	1	0		1	1	2		1		2	2	0		2	2	1	1	34	1.31	1.63	2.14	66.2
4	4WT	NEMC SWM	37-0959	0	1	1	1	1	1	2	1	0		1	1	1	1	1	2		0	0	2		2		3	0	1		1	1	2	2	29	1.12	1.90	2.12	65.6
5	L	NEMC SWM	27-4934	1	1	0	1	1	0	1	1	1		1	0	1	1	1	0		1	1	1		0		0	0	1		1	1	1	1	19	0.73	3.07	2.24	69.5
6	4WT	NEMC Works	37-7295	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0		0		1	2	0		0	0	0	0	3	0.12	0.84	0.10	3.0
7	4WT	NEMC Works	36-9845	0	1	0	0	0	3	0	0	0		0	0	0	2	0	0		0	0	0		0		0	0	0		0	0	0	0	6	0.23	0.84	0.19	6.0
8	4WT	NEMC Works	48-0082	0	0	0	0	0	0	0	1	0		0	0	0	0	0	0		0	0	0		0		0	0	0		0	0	0	0	1	0.04	0.84	0.03	1.0
9	4WT	NEMC Works	65-3266	0	0	0	0	0	0	0	0	0		0	1	0	0	0	0		0	0	0		0		0	0	0		0	0	0	0	1	0.04	0.84	0.03	1.0
10	4WT	NEMC Works	36-5368	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0		0	0	0		0		0	0	0		0	0	0	0	1	0.04	0.84	0.03	1.0
	Total	All		8	8	7	6	5	10	9	9	4		7	8	8	9	9	5		6	5	7		6		6	8	6		10	9	9	9	193	7.42		13.11	406.5
		NEMC Lorry		1	1	0	1	1	0	1	1	1		1	0	1	1	1	0		1	1	1		0		0	0	1		1	1	1	1	19	0.73		2.24	69.5
		NEMC 4WT		7	7	7	5	4	10	8	8	3		6	8	7	8	8	5		5	4	6		6		6	8	5		9	8	8	8	174	6.69		10.87	337.0
11	4WT	NEMC JCB	49-8109	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0		0	0	0		0		1	0	1		0	0	0	0	2	0.08			

Notes:

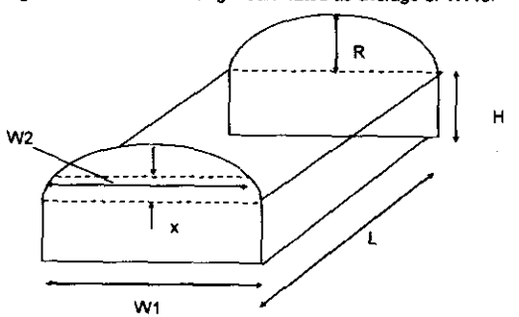
1. Same trailers were used in Mar 2002 as being used currently.
2. Shaded cells represent days without any data.
3. Works trailer average 4WT conversion factor used for NEMC Works vehicles.

No of days reported	26
Days in month	31

Veh	Veh Reg'n	Trailer Reg'n	Internal dimensions (m)				Vol (m3)				Avg FF	Weight (T)		
			H	L	W1	R	Rect	SC	SC (adj)	Tot		Actual	Full	
NEMC 4WT & Trailer	49-9427	T-18588	0.44	2.93	1.71	0.92	2.20	3.90	4.10	6.31	0.62	1.52	2.46	
		T-17105	0.40	2.90	1.73	0.90	2.01	3.69	3.89	5.89	0.72	1.66	2.30	
		46-1794	0.61	2.97	1.79	0.90	3.24	3.78	3.98	7.22	0.46	1.30	2.82	
		Avg								6.47	0.61	1.53	2.52	
	49-9428	T-17103	0.40	2.90	1.71	0.89	1.98	3.61	3.80	5.78	0.80	1.79	2.26	
	49-9429	T-17104	0.39	2.93	1.74	0.89	1.99	3.65	3.84	5.83	0.72	1.63	2.27	
	37-0959	T-18589	0.43	2.94	1.73	0.89	2.19	3.66	3.85	6.04	0.81	1.90	2.36	
	Avg		0.45	2.93	1.74	0.90	2.27	3.71	3.91	6.18	0.70	1.58	2.42	Avg of all trailers
NEMC Lorry		27-4934	0.61	4.85	2.24	0.00	6.63	0.00	0.00	6.63	1.19	3.07	2.58	
NEMC Works 4WT			0.45	2.93	1.74	N/a	2.26	N/a	N/a	2.26	0.95	0.84	0.88	
Naz. Farm	4WT	36-5368	0.66	2.96	1.77	0.00	3.46	0.00	0.00	3.46	0.71	0.95	1.35	
INCO-1	4WT	36-9273	1.41	2.93	1.71	0.00	7.06	0.00	0.00	7.06	0.98	0.69	0.71	Trailer has added on top section
INCO-2	4WT	36-9273	0.43	2.91	1.73	0.00	2.16	0.00	0.00	2.16	1.35	1.14	0.84	Same tractor with diff trailer (no extra top section)
Huejay Int'l	4WT	49-9273	0.49	3.59	1.85	0.00	3.25	0.00	0.00	3.25	0.75	0.95	1.27	

Notes:

1. FF = fill factor, Rect = rectangular bottom section, SC =semi-circular top section
2. Adopted waste density = 390 kg/m3 from WACS survey
3. INCO-1 *mainly contains textiles - adopt density = 100 kg/m3*
4. SC vol = area of SC of radius R x L
5. SC (adj) vol = SC vol x correction factor to account for SC formula underestimating actual vol by ~5%.
6. Average fill factors from JICA survey results
7. Avg 4WT actual and full weight calculated as average of 4WTs.
8. NEMC works trailer assumed same size as average rectangular section of other trailers. Consistent with other MC's data. Also assumed high filling factor for these trailers.



Calculating Filled Volume of Semi-circular Section

X (m)	W (m)	Section Vol (m3)	Cumul Vol (m3)	Cumul Vol (%)	Calc Table X (m)	Calc Table Vol (%)
0	1.850	0.00	0.00	0.00	0.05	6.91
0.1	1.840	0.55	0.55	13.82	0.15	20.64
0.2	1.800	0.54	1.09	27.45	0.23	31.43
0.3	1.735	0.52	1.61	40.69	0.35	47.04
0.4	1.655	0.50	2.12	53.39	0.49	64.19
0.5	1.548	0.48	2.59	65.39	0.55	70.92
0.6	1.408	0.44	3.03	76.46	0.67	83.33
0.7	1.215	0.39	3.42	86.28	0.78	92.78
0.8	0.954	0.32	3.74	94.40	0.88	98.88
0.9	0.540	0.22	3.96	100.00		

Notes:

1. Trailer 46-1794 - width measured as function of height.
2. Trailer dimensions:

Radius (R) = 0.90 m
Width (W1) = 1.85 m (external dimension)
Length (L) = 2.97 m

3. Average volume for section 1 (X = 0 to 0.1m) = 0.5x(W1+W2)x0.1xL, etc.
4. Cumulative volume = sum of volumes for each section.
5. SC vol = 3.77 m3 c.f calc volume using trapeziums = 3.96 m3

Trapezium calc is more accurate from scaled drawing - hence vol correction factor = 1.053 (trap vol/SC vol)

6. Procedure for converting measured x values to volumes:

a. Convert x (cm) to x (m) - if 0.1, 0.2, 0.3, etc. use cumul vol % from this table directly
b. If not exact multiple of 0.1, put x value into 2nd to last column in appropriate row (I.e. if 0.15, put on 0.1 line) - final column then uses linear interpolation to calculate cumulative volume for this x value. This must then be manually input into trips table which is used for calculating actual SC vol and thus the total volume.
c. Correction factor calculated above also applied to SC volume in above table.

Calculations from JICA Disposal Site Survey

Tractor	Trailer	Trips	FF	Eq FLs
49-9427	T-18588	9	0.62	5.6
	T-17105	8	0.72	5.8
	46-1794	7	0.46	3.2
	Avg	24	0.61	14.6
49-9428	T-17103	12	0.80	9.5
49-9429	T-17104	11	0.72	7.9
37-0959	T-18589	9	0.81	7.3
Avg 4WT		56	0.70	39.3
27-4934		6	1.19	7.1
36-5368		2	0.71	1.4
INCO-1		3	0.98	2.9
INCO-2		2	1.35	2.7
Huejay		1	0.75	0.8

			Fill factors				4WT 49-9427			4WT 49-9428			4WT 49-9429			4WT 37-0959			Lorry 27-4934			Other Vehicles			
Date		Time	Rect Fill %	SC X(cm)	Trailer Reg	SC Vol %	Trips	Vol (m3)	Equiv F Lds	Trips	Vol (m3)	Equiv F Lds	Trips	Vol (m3)	Equiv F Lds	Trips	Vol (m3)	Equiv F Lds	Trips	Vol (m3)	Equiv F Lds	Vehicle	Trips	Vol (m3)	Equiv F Lds
12-Sep	Th	8:20	100	30	T-18588	40.69	1	3.87	0.61									0.00			0.00				
		10:15	100	30	T-17105	40.69	1	3.59	0.61									0.00			0.00				
		11:15	100	40	T-17103	53.39				1	4.01	0.69						0.00			0.00				
		11:25	100	51	T-17104	66.49							1	4.54	0.78			0.00			0.00				
		12:10	100	19	46-1794	26.09	1	4.28	0.59									0.00			0.00				
		13:10	122		N/a													0.00	1	8.08	1.22				
		13:15	100	28	T-18588	38.04	1	3.77	0.60									0.00			0.00				
		14:10	100	43	T-17104	56.99							1	4.18	0.72			0.00			0.00				
		15:10	100	54	T-18589	69.81										1	4.88	0.81			0.00				
		15:55	100	53	T-17103	68.71				1	4.59	0.79						0.00			0.00				
Sub Tot							4	15.51	2.41	2	8.61	1.49	2	8.72	1.50	1	4.88	0.81	1	8.08	1.22		0	0.00	0.00
13-Sep	Fr	8:25	100	21	T-18588	28.78	1	3.39	0.54									0.00			0.00				
		10:30	40		N/a																	36-5368	1	4.18	1.21
		10:45	100		46-1794		1	3.24	0.45									0.00			0.00				
		12:15	100	65	T-18589	81.37										1	5.32	0.88			0.00				
		12:20	100	70	T-17104	86.28							1	5.30	0.91			0.00			0.00				
		12:45	100	80	T-17103	94.40				1	5.57	0.96						0.00			0.00				
		13:20	100	85	T-17105	97.2	1	5.78	0.98									0.00			0.00				
		13:40	118		N/a													0.00	1	7.82	1.18				
		14:40	100	32	T-17103	43.23				1	3.63	0.63						0.00			0.00				
		16:10	85		T-17104	0							1	1.69	0.29			0.00			0.00				
Sub Tot							3	12.41	1.97	2	9.20	1.69	2	6.99	1.20	1	5.32	0.88	1	7.82	1.18		1	4.18	1.21
14-Sep	Sa	8:20	100	20	T-18588	27.45	1	3.33	0.53									0.00			0.00				
		9:15	100		N/a																	INCO/1	1	7.06	1.00
		9:35	100	30	T-17105	40.69	1	3.59	0.61									0.00			0.00				
		10:35	132		N/a																	INCO/2	1	2.86	1.32
		10:45	80		46-1794		1	2.59	0.36									0.00			0.00				
		10:50	100	48	T-17103	62.99				1	4.38	0.76						0.00			0.00				
		12:00	100	34	T-18588	45.77	1	4.08	0.65									0.00			0.00				
		12:10	97		N/a																	INCO/1	1	6.85	0.97
		12:25	100	68	T-17104	84.32							1	5.23	0.90			0.00			0.00				
		12:28	100	41	T-18589	54.59										1	4.29	0.71			0.00				
		13:00	100	73	T-17103	88.72				1	5.35	0.93						0.00							
		13:25	100	30	T-17105	40.69	1	3.59	0.61									0.00			0.00				
		15:40	100	30	T-18589	40.69										1	3.75	0.62			0.00				
Sub Tot							5	17.18	2.75	2	9.73	1.68	1	5.23	0.90	2	8.04	1.33	0	0.00	0.00		3	16.77	3.29
15-Sep	Su	8:35	100	15	46-1794	20.64	1	4.06	0.56									0.00			0.00				
		10:10	100	55	T-17105	70.92	1	4.76	0.81									0.00			0.00				
		11:30	100	40	T-17103	53.39				1	4.01	0.69						0.00			0.00				
		11:40	100	63	T-18588	79.4	1	5.46	0.87									0.00			0.00				
		12:20	100	70	T-17104	86.28							1	5.30	0.91			0.00			0.00				
		13:15	100	74	T-18589	89.53										1	5.64	0.93			0.00				
		13:30	123			31.43												0.00	1	8.15	1.23				
		13:55	100	37	T-17103	49.58				1	3.87	0.67						0.00			0.00				
		14:15	20																			36-5368	1	0.69	0.20

Sub Tot							3	14.29	2.24	2	7.88	1.36	1	5.30	0.91	1	5.64	0.93	1	8.15	1.23		1	0.69	0.20
16-Sep	Mo	8:20	90		46-1794	0	1	2.92	0.40									0.00			0.00				
		9:35	100	10	T-18588	13.82	1	2.77	0.44									0.00			0.00				
		10:50	100	45	T-17105	59.39	1	4.31	0.73									0.00			0.00				
		11:25	100	35	T-17104	47.04							1	3.79	0.65			0.00			0.00				
		11:35	145			59.39												0.00	1	9.61	1.45				
		12:15	100	60	T-18589	76.46										1	5.13	0.85			0.00				
		12:25	100	73	T-17103	88.72				1	5.35	0.93						0.00			0.00				
		14:40	100	35	T-17104	47.04							1	3.79	0.65			0.00			0.00				
		15:35	100	38	T-18589	50.85										1	4.15	0.69			0.00				
Sub Tot							3	10.00	1.58	1	5.35	0.93	2	7.59	1.30	2	9.28	1.54	1	9.61	1.45		0	0.00	0.00
17-Sep	Tu	8:25	100	5	46-1794	6.91	1	3.52	0.49									0.00			0.00				
		9:25	100	40	T-17105	53.39	1	4.08	0.69									0.00			0.00				
		11:35	100	35	T-18588	47.04	1	4.13	0.66									0.00			0.00				
		12:55	100	67	T-17104	83.33							1	5.19	0.89			0.00			0.00				
		13:20	100	82	T-17103	95.52				1	5.61	0.97						0.00			0.00				
		13:25	120			27.45												0.00	1	7.95	1.20				
		14:35	100	20	T-17103	27.45				1	3.03	0.52						0.00			0.00				
		15:20	100	88	T-18589	98.88										1	6.00	0.99			0.00				
Sub Tot							3	11.73	1.84	2	8.64	1.49	1	5.19	0.89	1	6.00	0.99	1	7.95	1.20		0	0.00	0.00
18-Sep	We	8:25	100	37	T-18588	49.58	1	4.24	0.67									0.00			0.00				
		9:40	85	0	46-1794	0	1	2.76	0.38									0.00			0.00				
		9:50	96		N/a																	INCO/1	1	6.78	0.96
		10:50	138		N/a																	INCO/2	1	2.99	1.38
		12:10	100	78	T-17104	92.78							1	5.55	0.95			0.00			0.00				
		12:20	100	47	T-17105	61.79	1	4.41	0.75									0.00			0.00				
		12:50	85		N/a													0.00	1	5.63	0.85				
		13:15	100	90	T-17103	100.00				1	5.78	1.00						0.00			0.00				
		14:05	75		T-17104								1	1.49	0.26			0.00			0.00				
		15:00	137		N/a																	HueJay	1	2.44	0.75
		15:35	100	49	T-18589	64.19										1	4.66	0.77			0.00				
Sub Tot							3	11.40	1.80	1	5.78	1.00	2	7.04	1.21	1	4.66	0.77	1	5.63	0.85		3	12.21	3.09
Total							24	92.5	14.6	12	55.2	9.5	11	46.1	7.9	9	43.8	7.3	6	47.3	7.1		8	33.9	7.8

Notes:

1. The filled capacity of the NEMC 4WT trailers was measured as the rectangular section fill factor (%) x rect section vol + SC filled factor (%) x adjusted SC vol (where SC fill factor is calculated using trapeziums from the measured height, x(cm)). Hence, overall fill factor is calculated as estimated vol/total vol.
2. Gully sucker (42-7552) load on 18/9 not entered in above table.

JICA Survey Data Summary

No of trips per day

Date		NEMC Vehicle					Other Vehicles				NEMC Total	Avg trips/veh.d	
		4 WT 49-9427	4 WT 49-9428	4 WT 49-9429	4 WT 37-0959	L 27-4934	Naz F 36-5368	INCO-1	INCO-2	Huejay		All NEMC	NEMC 4WT
12-Sep	Thu	4	2	2	1	1	0	0	0	0	10	2.0	2.25
13-Sep	Fri	3	2	2	1	1	1	0	0	0	9	1.8	2.00
14-Sep	Sat	5	2	1	2	0	0	2	1	0	10	2.0	2.50
15-Sep	Sun	3	2	1	1	1	1	0	0	0	8	1.6	1.75
16-Sep	Mon	3	1	2	2	1	0	0	0	0	9	1.8	2.00
17-Sep	Tue	3	2	1	1	1	0	0	0	0	8	1.6	1.75
18-Sep	Wed	3	1	2	1	1	0	1	1	1	8	1.6	1.75
Tot		24	12	11	9	6	2	3	2	1	62	12.4	14.00
Avg		3.43	1.71	1.57	1.29	0.86	0.29	0.43	0.29	0.14	8.86	1.8	2.00

No of equivalent loads/d

Date		NEMC Vehicle					Other Vehicles				NEMC Total	Avg eq Loads/d	
		4 WT 49-9427	4 WT 49-9428	4 WT 49-9429	4 WT 37-0959	L 27-4934	Naz F 36-5368	INCO-1	INCO-2	Huejay		All NEMC	NEMC 4WT
12-Sep	Thu	2.41	1.49	1.50	0.81	1.22					7.42	1.5	1.55
13-Sep	Fri	1.97	1.59	1.20	0.88	1.18	1.21				6.82	1.4	1.41
14-Sep	Sat	2.75	1.68	0.90	1.33	0.00		1.97	1.32		6.66	1.3	1.67
15-Sep	Sun	2.24	1.36	0.91	0.93	1.23	0.20				6.67	1.3	1.36
16-Sep	Mon	1.58	0.93	1.30	1.54	1.45					6.79	1.4	1.34
17-Sep	Tue	1.84	1.49	0.89	0.99	1.20					6.41	1.3	1.30
18-Sep	Wed	1.80	1.00	1.21	0.77	0.85		0.96	1.38	0.75	5.63	1.1	1.20
Tot		14.58	9.54	7.90	7.25	7.13	1.41	2.93	2.70	0.75	46.41	9.3	9.82
Avg Equiv loads		2.08	1.36	1.13	1.04	1.02	0.20	0.42	0.39	0.11	6.63	1.3	1.40
Avg FF		0.61	0.80	0.72	0.81	1.19	0.71	0.98	1.35	0.75	0.75		
Full Capacity (T		N/a	2.26	2.27	2.36	2.58	1.35	0.71	0.84	1.27			

Solid Waste Tonnage (T/d)

Date		NEMC Vehicle					Other Vehicles				Total to disposal			Avg T/d/veh	
		4 WT 49-9427	4 WT 49-9428	4 WT 49-9429	4 WT 37-0959	L 27-4934	Naz F 36-5368	INCO-1	INCO-2	Huejay	NEMC	Other	All	All NEMC	NEMC 4WT
12-Sep	Thu	6.05	3.36	3.40	1.90	3.15					17.86	0.00	17.86	3.6	3.7
13-Sep	Fri	4.84	3.59	2.73	2.08	3.05	1.63				16.28	1.63	17.91	3.3	3.3
14-Sep	Sat	6.70	3.80	2.04	3.14	0.00		1.39	1.11		15.67	2.51	18.18	3.1	3.9
15-Sep	Sun	5.57	3.07	2.07	2.20	3.18	0.27				16.09	0.27	16.36	3.2	3.2
16-Sep	Mon	3.90	2.09	2.96	3.62	3.75					16.31	0.00	16.31	3.3	3.1
17-Sep	Tue	4.58	3.37	2.02	2.34	3.10					15.41	0.00	15.41	3.1	3.1
18-Sep	Wed	4.45	2.26	2.75	1.82	2.20		0.68	1.17	0.95	13.46	2.80	16.26	2.7	2.8
Tot		36.09	21.53	17.96	17.09	18.42	1.90	2.07	2.28	0.95	111.08	7.20	118.28	22.2	23.2
Avg		5.16	3.08	2.57	2.44	2.63	0.27	0.30	0.33	0.14	15.87	1.03	16.90	3.2	3.3

Converting 49-9427 equiv loads for different tractors to individual tonnages and calculating overall daily tonnages

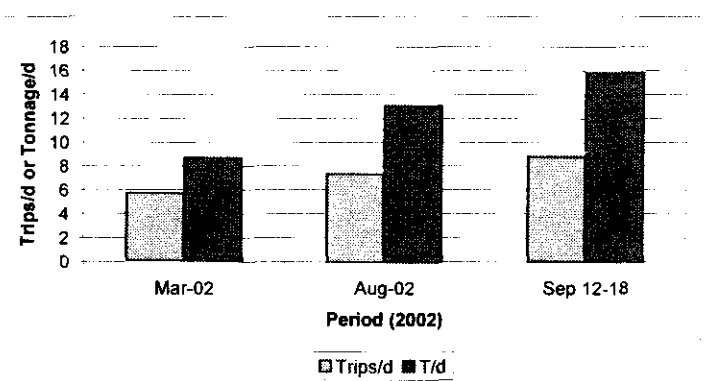
Date		49-9427 Equiv loads				49-9427 T/d			
		T-18588	T-17105	46-1794	Total	T-18588	T-17105	46-1794	Total
12-Sep	Thu	1.21	0.61	0.59	2.41	2.98	1.40	1.67	6.05
13-Sep	Fri	0.54	0.98	0.45	1.97	1.32	2.25	1.27	4.84
14-Sep	Sat	1.18	1.22	0.36	2.75	2.89	2.80	1.01	6.70
15-Sep	Sun	0.87	0.81	0.56	2.24	2.13	1.86	1.59	5.57
16-Sep	Mon	0.44	0.73	0.40	1.58	1.08	1.68	1.14	3.90
17-Sep	Tue	0.66	0.69	0.49	1.84	1.61	1.59	1.37	4.58
18-Sep	Wed	0.67	0.75	0.38	1.80	1.65	1.72	1.08	4.45
Tot		5.56	5.79	3.24	14.58	13.67	13.30	9.12	36.09
Full Cap (T)		2.46	2.30	2.82					

NEMC and JICA Survey Data

	No	Vehicle		Avg trips/d			Avg T/d		
				Mar-02	Aug-02	Sep 12-18	Mar-02	Aug-02	Sep 12-18
NEMC SWM 4WT	1	4WT	49-9427	0.65	2.31	3.43	1.00	3.54	5.16
	2	4WT	49-9428	1.05	1.50	1.71	1.88	2.69	3.08
	3	4WT	49-9429	1.25	1.31	1.57	2.04	2.14	2.57
	4	4WT	37-0959	1.25	1.12	1.29	2.37	2.12	2.44
Lorry	5	L	27-4934	0.05	0.73	0.86	0.15	2.24	2.63
NEMC Works 4WT	6	4WT	37-7295	1.10	0.12		0.92	0.10	
	7	4WT	48-3738	0.05			0.04		
	8	4WT	37-7787	0.10			0.08		
	9	4WT	37-6479	0.25			0.21		
	10	4WT	36-9845		0.23			0.19	
	11	4WT	48-0082		0.04			0.03	
	12	4WT	65-3266		0.04			0.03	
	13	4WT	36-5368		0.04			0.03	
Unkn-own	14	4WT	37-3828	0.35			0.29		
	15	4WT	37-3728	0.05			0.04		
Naz F	16	4WT	36-5368			0.29			0.27
INCO-1	17	4WT	36-9273			0.43			0.30
INCO-2	18	4WT	36-9273			0.29			0.33
Huejay	19	4WT	49-9273			0.14			0.14
Total									
NEMC				5.75	7.42	8.86	8.70	13.11	15.87
Private				0.40	0.00	1.14	0.34	0.00	1.03
Total				6.15	7.42	10.00	9.04	13.11	16.90

For graphing

	NEMC only		
	Mar-02	Aug-02	Sep 12-18
Trips/d	5.75	7.42	8.86
T/d	8.70	13.11	15.87



A. General Notes **Nuwara Eliya MC**

1. SWM Staff Salary + allowance costs

Item	Salary	Allowance	Total	Adopted
Driver	3765	2200	5965	5,965
Labourer	3400	2200	5600	5,600

Notes:

a. NEMC data - driver salary = 5,965; labourer salary = 5,600

d. Collection worker survey gave average salary of 5,122 Rs/mth, including allowances, or 2,922 Rs/mth basic salary

e. Adopt labourer salary = 3400 Rs/mth and driver salary = 3765 Rs/mth + 2200 allowance, as per NEMC data

2. Equipment Costs

Item	Cost (Rs)	Lifetime	Notes
Ekel broom	45	1 mth	
Sorondi	40	6 mths	
Fork	280	3 mths	
Mamoti	300	1yr	
Raincoats	275	1yr	
Gumboots	1000	3yr	only to disposal site workers
Gloves	60	3 mths	Not issued
Uniform			Not issued
Aprons	150		Issued once, about 3yrs ago

Notes:

1. NEMC provided lump sum *protective equipment costs for the tractors, lorry and compactor of* 6903 *Rs/yr*
This is > 2x higher than equipment costs derived from considering allocated equipment/vehicle, no of labourers and associated equipment costs. Hence, actual equipment costs have been calculated based on NEMC data for equipment allocation per vehicle & above costs and equipment lifetimes.

B. SWM Vehicles - Current Costs

Handcart - 2 labourer	**Rate**	**Unit**	**No**	**Amt (Rs)**	**Notes**
Labourers	5600	Rs/mth	24	134400	Labrs = 2
Protective gear/equipment	2010	Rs/yr	1	2010	
Oil	0	Rs/mth	12	0	
Maintenance	2500	Rs/yr	1	2500	Incl. wheel repair/replacement
Insurance	0	Rs/yr	1	0	
Rev Licence	0	Rs/yr	1	0	
Depreciation	1733	Rs/yr	1	1733	
Total				140643	
			Case A		Case B
Avg no of trips per day		trips/d	3.0		5.0
Avg amt collected per mth		T/mth	9.4		15.6
Average amount collected per yr		*T/yr*	*112*		*187*
Unit cost		Rs/T	**1252**	Rs/T	**751** Rs/T

Notes:

1. Staff protective equipment based on NEMC equipment data and current prices:

a. Sorandi	1 sorondi/HC	2 sets/yr @	40 Rs ea =	80	Rs/yr
b. Ekel broom	2 broom/HC x	12 sets/yr @	45 Rs ea =	1080	Rs/yr
c. Mamoti	1 mamoti/HC x	1 set/yr @	300 Rs ea =	300	Rs/yr for drain cleaner
d. Raincoats	2 labrs/HC x	1 set/yr @	275 Rs ea =	550	Rs/yr
Total labourer protective equipment costs =				2010	Rs/yr

2. Handcart maintenance costs based on data from other towns/cities, with quoted cost being relatively standard.

3. Consider two cases for average no of HC trips/d, based on NEMC Supervisor data for handcarts to disposal @ 0.12 T/load

Case A - No of trips/d = 3.0 Average tonnage per HC per d = 0.36 T/HC.d or 9.36 T/HC.mth, based on 26 working days/mth

Case B - No of trips/d = 5.0 Average tonnage per HC per d = 0.60 T/HC.d or 15.60 T/HC.mth, based on 26 working days/mth

4. Capital cost = 5,200 Rs with estimated lifetime of 3 yrs (capital cost of HCs in use now, from NEMC Revenue section)

Depreciation = 1733.3 Rs/yr (straight line method)

Handcart - 3 labourers	Rate	Unit	No	Amt (Rs)	Notes
Labourers	5600	Rs/mth	36	201600	Labrs = 3
Protective gear/equipment	2825	Rs/yr	1	2825	
Oil	0	Rs/mth	12	0	
Maintenance	2500	Rs/yr	1	2500	Incl. wheel repair/replacement
Insurance	0	Rs/yr	1	0	
Rev Licence	0	Rs/yr	1	0	
Depreciation	1733	Rs/yr	1	1733	
Total				208658	
			Case A		Case B
Avg no of trips per day		trips/d	3.0		5.0
Avg amt collected per mth		T/mth	9.4		15.6
Average amount collected per yr		T/yr	112		187
Unit cost		Rs/T	**1858**	Rs/T	**1115** Rs/T

Notes:

1. Staff protective equipment based on NEMC equipment data and current prices:

a. Sorandi	1 sorondi/HC	2 sets/yr @	40 Rs ea =	80	Rs/yr
b. Ekel broom	3 broom/HC x	12 sets/yr @	45 Rs ea =	1620	Rs/yr
c. Mamoti	1 mamoti/HC x	1 set/yr @	300 Rs ea =	300	Rs/yr (for drain cleaner)
d. Raincoat	3 labrs/HC x	1 sets/yr @	275 Rs ea =	825	Rs/yr
Total labourer protective equipment costs =				2825	Rs/yr

2. Consider two case for average no of HC trips/d, based on NEMC trips data for handcarts to disposal and transfer @ 0.12 T/load

Case A - No of trips/d = 3.0 Average tonnage per HC per d = 0.36 T/HC.d or 9.36 T/HC.mth, based on 26 working days/mth

Case B - No of trips/d = 5.0 Average tonnage per HC per d = 0.60 T/HC.d or 15.60 T/HC.mth, based on 26 working days/mth

3. Capital cost = 5,200 Rs with estimated lifetime of 3 yrs (capital cost of HCs in use now, from NEMC Revenue section)

Depreciation = 1733.3 Rs/yr (straight line method)

Four Wheel Tractor	No	Rate	Unit	Total	Notes
Driver	12	5,965	Rs/mth	71580	
Labourers	36	5,600	Rs/mth	201600	No of labourers = 3
Protective gear/equipment	LS	3300	Rs/yr	3300	
Diesel	1	62244	Rs/yr	62244	2223 L/yr @ 28 Rs/L
Tractor Maintenance	1	30000	Rs/yr	30000	Includes oil (part of service)
Trailer Maintenance	1	10000	Rs/yr	10000	
Tyres and tubes	1	35550	Rs/yr	35550	Tractor = 25000 Trailer = 10550
Insurance	LS	8252	Rs/yr	8252	Tractor = 8049.7 Trailer = 201.84
Licence	LS	300	Rs/yr	300	Tractor = 150 Trailer = 150
Depreciation	LS	110585	Rs/yr	110585	
Total				533410	
Avg no of trips/d (12-18 Sep 02)		trips/d		2.00	
Avg amt collected 12-18Sep 02		T/d		3.3	T/d (avg T/d)/4WT
Average amount collected per yr		T/yr		1033	
Unit cost		Rs/T		**517**	Rs/T

Notes:

1. Staff protective equipment based on NEMC equipment data and current prices:

a. Ekel brooms	2 brooms/4WT	12 sets/yr @	45 Rs ea =	1080	Rs/yr
b. Fork	1 fork/4WT x	4 sets/yr @	280 Rs ea =	1120	Rs/yr
c. Raincoats	4 raincoats/4WT x	1 sets/yr @	275 Rs ea =	1100	Rs/yr (1 driver + 3 labrs)
Total labourer protective equipment costs =				3300	Rs/yr

2. Capital cost data: tractor = 950289.5 with estimated lifetime of 10 yrs (5-15yrs range)

Straight line deprec'n = 95029 Rs/yr

3. Capital cost data: trailer = 93,333 with estimate lifetime of 6 yrs (4-8yrs)

Straight line deprec'n = 15556 Rs/yr

(For both tractor and trailer, capital cost based on average cost of all units currently in use)

4. Annual tonnage based on avg T/d x 26 working days/mth x 12 mth/yr

Lorry	No	Rate	Unit	Total	Notes
Driver	12	5,965	Rs/mth	71580	
Labourers	36	5,600	Rs/mth	201600	No of labourers = 3
Protective gear/equipment	LS	3025	Rs/yr	3025	
Diesel	1	133952	Rs/yr	133952	4784 Ls/yr @ 28
Lorry maintenance	1	18000	Rs/yr	18000	Includes oil (part of service)
Tyres & tubes	1	41630	Rs/yr	41630	
Insurance	LS	8520	Rs/yr	8520	
Licence	LS	4800	Rs/yr	4800	
Depreciation	LS	57570	Rs/yr	57570	
Total				540677	
Avg no of trips/d (12-18 Sep 02)		trips/d		0.86	
Avg amt collected 12-18 Sep 02		T/d		2.6	T/d
Average amount collected per yr		T/yr		821	T/yr
Unit cost		Rs/T		659	Rs/T

Notes:

1. Staff protective equipment based on NEMC equipment data and current prices:

a. Ekel brooms	2 brooms/lorry	12 sets/yr @	45 Rs ea =	1080 Rs/yr
b. Fork	1 fork/lorry x	4 sets/yr @	280 Rs ea =	1120 Rs/yr
c. Raincoats	3 raincoats/lorry x	1 sets/yr @	275 Rs ea =	825 Rs/yr (3 labrs only)
Total labourer protective equipment costs =				3025 Rs/yr

2. Capital cost data: lorry = 575700 Rs with estimated lifetime of 10 yrs (8-12yrs)
Straight line deprec'n = 57570 Rs/yr (NEMC did not have any capital cost data - hence quoted price is for 1990 ELF350 lorry from Chilaw UC data)
3. Annual tonnage based on avg T/d x 26 working days/mth x 12 mth/yr

Compactor	No	Rate	Unit	Total	Notes
Driver	12	5,965	*Rs/mth*	71580	
Labourers	36	5,600	Rs/mth	201600	No of labourers = 3
Protective gear/equipment	LS	3025	Rs/yr	3025	
Diesel	1	87640	Rs/yr	87640	3130 L/yr @ 28 Rs/L
Compactor maintenance	1	25000	Rs/yr	25000	Includes oil (part of service)
Tyres & tubes	1	26460	Rs/yr	26460	
Insurance	LS	11880	Rs/yr	11880	
Licence	LS	2800	Rs/yr	2800	
Depreciation	LS	166667	Rs/yr	166667	
Total				596652	
Avg no of trips/d		*trips/d*		2.00	NEMC estimates
Avg amt collected		T/d		4.3	T/d
Average amount collected per yr		T/yr		1334	T/yr
Unit cost		Rs/T		447	Rs/T

Notes:

1. Staff protective equipment based on NEMC equipment data and current prices (assuming same equipment as lorry):

a. Ekel brooms	2 brooms/comp'r	12 sets/yr @	45 Rs ea =	1080 Rs/yr
b. Fork	*1 fork/comp'r x*	*4 sets/yr @*	*280 Rs ea =*	*1120 Rs/yr*
c. Raincoats	3 raincoats/comp'r x	1 sets/yr @	275 Rs ea =	825 Rs/yr (3 labrs only)
Total labourer protective equipment costs =				3025 Rs/yr

2. Capital cost data: compactor = 1000000 with estimated lifetime of 6 yrs (3-9yrs)
Straight line deprec'n = 166667 Rs/yr
3. Annual tonnage based on compactor capacity of 3.7 m3 (from NEMC - 4m3 nominal capacity reduced to 3.7m3 as per Kandy/Matale data) and estimated compaction density of 608 kg/m3 (Colombo weighbridge data)
NEMC said compactor does about 2 trips/d @ 95 % assumed fill factor
4. Annual tonnage based on avg T/d x 26 working days/mth x 12 mth/yr

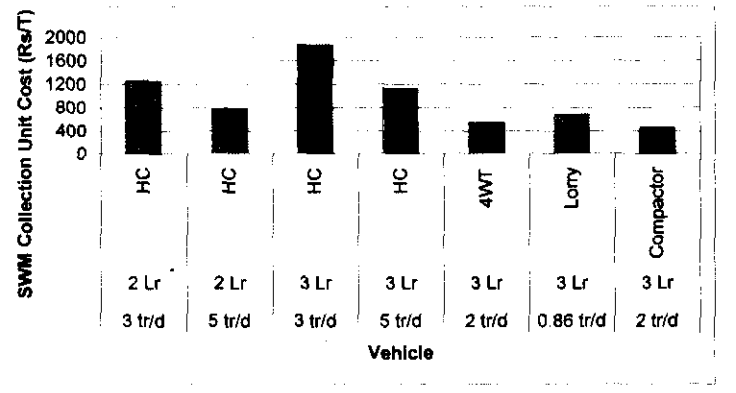
Summary

	Item	SW Amt (T/yr)	Cost (Rs/yr)	Unit cost (Rs/T)
Current				
4WT	4WT (3Lr, 2 trips/d)	1033	533410	517
Lorry	Lorry (3Lr, 0.9 trips/d)	821	540677	659
Compactor	Compactor (3Lr, 2 trips/d)	1334	596652	447

C. Graphical Data

1. Current Situation

Trips/d	No of Labrs	Vehicle	Unit costs (Rs/T)
3 tr/d	2 Lr	HC	1252
5 tr/d	2 Lr	HC	751
3 tr/d	3 Lr	HC	1858
5 tr/d	3 Lr	HC	1115
2 tr/d	3 Lr	4WT	517
0.86 tr/d	3 Lr	Lorry	659
2 tr/d	3 Lr	Compactor	447



NEMC Supervisor Interview Survey Results

Area	Basic SWM Data	Problems	Ideas for Improvement
Zone 1	• Vehicles: 4WT (shared with zone 2), 6 HCs • Labrs: 15HC • CPs: 29 perm, 5 temp • LWG: Pola; Safari, Food Lanka, Devon and Sulaiman local hotels; Cargills Ground Stall. • L/d: 1 Tr/d (HCs = 3-5 loads/d; sometimes 6).	• Poor public cooperation, with people discharging waste anywhere (e.g. Chapel St, Gamunu Mw, James St) and at any time. • Some commercial enterprises throw their garbage into the drains. • Insufficient labourers, due to absenteeism. • Supervisor has to cover large distance by foot or bicycle. • Pola cleaning drains resources from other zones. • Beggars discharge human excrement for collection.	• Public awareness. • Use 2WT/4WT rather than handcarts in Bazaar area – more efficient.
Zone 2	• Vehicles: 7HC, 4WT (shared with zone 1); other tractors may sometimes assist in emptying stationary trailers. • Labrs: 17HC, 1 public toilets • CPs: 15 perm, 9 temp • LWG: Kavithas building, Samurdhi stalls near bus stand, Lawson St, guesthouses on Park Rd, Bus stand. • L/d: 4 Tr/d from stationary market trailers + 1 Tr/d library trailer + 0.5Tr/d normal collection (26 (normal) – 29 (long w/e) HC/d; may be 2-3 times this during the Mar-Apr "season").	• Poor cooperation from traders, discharging their garbage into drains or with labourers having to enter their premises to collect their garbage. • Some garbage is discharged next to the stationary trailers rather than inside due to the trailer doors being difficult to open. Some of this garbage gets wet when it rains or is scattered by the wind.	• Use 2WT rather than handcarts. • Covered area for stationary trailers. • Cover drains with concrete slabs.
Zone 3	• Vehicles: HC, 4WT (shared with zone 4), lorry (shared with zones 4-6) • Labrs: 4HC • CPs: 10 perm, 6 temp • LWG: Grand Hotel, Glendower Hotel, many guesthouses. • L/d: 1 4WT/d (HC – 4-5L/d; long w/e = 8-10/d; April = 10-15/d).	• Only one handcart to cover entire area. • Few concrete bins in guesthouse area, meaning handcart has to discharge its load to bins along Nanuoya Rd for emptying, which is some distance away (unless it meets a collection vehicle in transit). • Handcart collection is difficult along Haddon Hill and Unique View roads which are both steep. • Pony dung is common around the racecourse area.	• Use two handcarts (MC has additional handcarts but insufficient labourers to deploy these) or a 2WT. • Possible stationary covered trailer near town hall for handcart discharge.
Zone 4	• Vehicles: 2HC, 4WT (shared with zone 3), lorry (shared with zones 3,5-6). • Labrs: 6HC (1 Pr, 2SW), 1DC • CPs: 28 perm, 9 temp • LWG: small vegetable stalls in front of White House, Nesby Estate, garment and polythene factories (not collected by NEMC) • L/d: 1 Tr/d (Kelegala, Kalukele, Bonivista), 0.5Lorry/d (Magustota) (HCs do 4-5L/d, 8-10/d during season)	• Poor public co-operation in Kalukele and Bonivista with residents discharging their garbage anywhere, anytime. • High garden waste generation – mainly grass and tree cuttings. • Drain cleaning is difficult, due to long drain length, illegal septic tank/pit connections, cattle farm effluent discharges (e.g. Upper Gibson Rd) and silt/sediment runoff. Another drain cleaner is needed. • Insufficient labourers due to absenteeism and this being an unpopular zone with labourers – if they want water, residents may sell it to them at 10Rs/bottle and there are no perks compared with zone 3 where labourers are often given tea, food and money. • Large area with some steep areas – difficult to cover by handcart.	• Public awareness/education. • Use one more handcart. • More labourers. • Divide zone into two as big area. • Use mini-tractor or other alternative for garbage collection in steep areas with narrow roads. • Provide walkie talkies to Supervisors in the field (e.g. for reporting problems).

Area	Basic SWM Data	Problems	Ideas for Improvement
Zone 5	• Vehicles: HC, 4WT (shared with zone 6); lorry (shared with zones 3-4,6). • Labrs: 4HC (1 Pr, 1DC, 2SW) • CPs: 23 perm, 13 temp • LWG: Base Hospital (25-50% Tr/d), City Junction stalls, MC Line (~128 houses), Other Quarters (~250 houses) • L/d: 1 4WT/d (HC do 5L/d)	• Poor public cooperation, particularly in the MC Line area. Most residents don't use the concrete bins provided but discharge their garbage (including human excrement) anywhere, including to drains. MC labourers don't like to work here. • Labourer absenteeism – generally they have no labourers for 1-2 d/mth and only two for 6-7d/mth; particularly bad during festivals and after payday. • Labourer shortage – six more required. • Stray dogs, scattering waste and sometimes threatening workers, especially in the MC Line area. • Base Hospital waste often contains some needles/sharps and clinical waste (also placentas previously but this has now stopped). One labourer was stabbed with a needle recently.	• Public awareness, especially for the MC Line area. • Proper hospital waste collection system. • Another HC and more labourers. • Public toilet for Hawa Eliya area. • Covered trailer.
Zone 6	• Vehicles: 3HC, 4WT (shared with zone 5) • Labrs: 6HC (also do DC+SW) • CPs: 38 perm, 10 temp • LWG: PWD Quarters[1], Mahinda Mw, Eyelashes Factory (3HC/d), Interfashion (not collected by NEMC), Boralanda Junction stalls, Nazareth farm (OSD), Muththu Mari Amman Kovil • L/d: 2 Tr/d (Mahinda Mw – 375houses, 7HC/d; PWD Qtrs 3HC/d)	• Densely populated area, especially in Mahinda Mw but only six labourers to cover the area. • Poor public cooperation in the PWD Quarters area. • Some steep areas, where it is difficult for the tractor to turn. Handcarts are used, discharging their loads into four bins for subsequent collection by tractor. • High periodic waste generation by Kovil (Fridays, festivals and weddings), sometimes up to 1 Tr load.	• More labourers, especially one for Boralanda. • Another Kangani, as a big area to supervise. • Provide stationary trailer for Mahinda Mw area. • Procure spare trailer which could be placed at the Kovil on request.

Notes: CP = collection point, DC = drain cleaner, HC = handcart, LWG = large waste generators, L/d = loads/day, OSD = on-site disposal, Pr = handcart pusher, SW = sweeper, Tr = tractor, w/e = weekend, 2WT = two wheel tractor, 4WT = four wheel tractor. Tractor and lorry labourers are not included in the zone labourers tabulated above but are specified separately.

[1] Now called Navagamgoda.

JICA