



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

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

## ACTION PLAN FOR CHILAW FINAL REPORT Volume V-2B SUPPORTING REPORT

DECEMBER 2000

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**Ministry of Home Affairs, Provincial Councils and Local Government**  
**Democratic Socialist Republic of Sri Lanka**

**THE STUDY  
ON IMPROVEMENT  
OF SOLID WASTE MANAGEMENT  
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IN SRI LANKA**

**ACTION PLAN FOR CHILAW**

**FINAL REPORT**

**Volume V-2B**

**SUPPORTING REPORT**

**DECEMBER 2003**



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### ***This is Action Plan for Chilaw, Supporting Report.***



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

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### **List of Abbreviations**

CDA	Community Development Assistant
CDO	Community Development Officer
CEA	Central Environmental Authority
CUA	Chilaw Urban Area
DEO	Divisional Environmental Officer
DF/R	Draft Final Report
EIA	Environmental Impact Assessment
F/S	Feasibility Study
GDP	Gross Domestic Product
IC/R	Inception Report
IDP	Infectious Disease Prevention
IEE	Initial Environmental Examination
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
UCC	Chilaw Municipal Council
MOH	Medical Officer of Health
M/M	Minutes of Meeting
MOHALG	Ministry of Home Affairs, Provincial Councils and Local Government
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
PDM	Project Design Matrix
PHI	Public Health Inspector
POS	Public Opinion Survey
P/R	Progress Report
S/W	Scope of Work
SWM	Solid Waste Management
UCC	Urban Council of Chilaw (Chilaw Urban Council)
WTP	Willingness to Pay

# Chapter 1

## Chilaw Waste Stream Data



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## Chapter 1 Waste Stream Data

### 1.1 Introduction

This appendix summarises information collected from field investigations carried out between July-August 2002, undertaken primarily to quantify the waste stream for the Chilaw Urban Area (CUA). It complements and provides further information concerning the waste stream data, assists in understanding the present CUA solid waste management (SWM) system and identifies some issues that do or may need to be addressed at some stage in the future.

### 1.2 Households

Provisional results of the July 2001 Census give the total CUA population as 24,105. The 2002 population is estimated to be 24,539, based on a population growth rate of 1.8%, derived from long term growth rate data for Chilaw (1946-2001), Urban Development Authority (UDA) projections and actual growth in the Puttalam district during 1981-2001.

Chilaw is subject to a number of factors affecting its population, including the festival season, particularly the annual Munneswaram festival which attracts a large influx of visitors, while some fishermen may work outside CUA during the fishing off-season<sup>1</sup>. The floating population was estimated to be 2,000 through informal discussions with Divisional Secretariat staff<sup>2</sup>.

Information on household waste generation and management practices was obtained from a survey of 120 households in six different areas of Chilaw covering two high, two middle and two low income areas. 95% of the surveyed households are located in areas where garbage is collected by UCC, but only 67.5% stated they actually use this service. However, the overall UCC garbage collection service coverage is about 75-85% on a population basis, as there are some areas that do not receive a collection service at all. Hence, these survey results were adjusted to account for the other parts of CUA not provided with a garbage collection service in order to estimate the proportions of garbage disposed of by different means for the entire CUA. The corresponding results are tabulated below.

The waste generation rate for Chilaw was estimated based on the Matale value of 0.451kg/cap.d, increased to 0.530kg/cap.d to account for differences in garden waste generation<sup>3</sup>. Although the household survey indicated that 53% of surveyed households produce garden waste in both Matale and Chilaw, WACS data indicates that household waste comprises approximately 28.2wt% garden waste in Chilaw, compared with 15.7wt% in Matale. This difference is attributed mainly to higher garden waste generation in Chilaw, rather than higher garden waste collection. This is believed to be due to the different climate and abundance of coconut trees in the coastal belt. Coconut trees produce a lot of palm

<sup>1</sup> Approximately six months in duration based on Negombo data.

<sup>2</sup> As no actual data is available.

<sup>3</sup>  $0.514 = 0.451 \times (100 - 15.68) / (100 - 28.23)$ , assuming non-garden waste generation is the same in both towns.

and leaf waste, while coconut palms are also used by many low income households in Chilaw as roofing and fencing material, which require regular replacement.



*Coconut palm thatching at one of UCC's disposal sites*

Table 1-1: Household Waste Management

Waste Management Method	Households in Survey Area (%)	All Households in CUA (adjusted %)	Waste Amount (T/d)
Service coverage (%)	95	80	
Self-disposal	18.6	22.0	2.86
Discharge for UCC collection	53.8	45.3	5.89
Home composting	0.0	0.0	0.00
Recycling	1.1	1.3	0.16
Illegal dumping	26.6	31.5	4.09
Total	100.0	100.0	13.00

**Notes:**

1. Detailed calculations are set out in the supporting report "waste stream analysis" section.
2. Estimated 2002 population based on a compound growth rate of 1.8%, giving a 2002 population of 24,539.
3. Total household waste generation = 24,539 persons x 0.530kg/person.d = 13.0T/d.
4. Waste amounts disposed of by different means calculated using total waste generation x adjusted percentages in above table, which relate to the entire CUA.

Household waste is expected to be mainly organic, as in Kandy and Matale, but with a higher proportion of garden waste.

## 1.3 Commercial Sector

### 1.3.1 Commercial Enterprises

Commercial enterprises covers all commercial operations (e.g. restaurants, bakeries, retail shops, communications centres, banks, hotels, etc.) except for markets and industries, which are classified as separate categories. This includes government or semi-government enterprises that operate commercial oriented businesses and services (e.g. banks, Post Office, Sri Lanka Telecom, etc.). According to UDA

data<sup>4</sup>, 10.7ha (2.1%) of CUA is used for commercial activities, most of which is concentrated in the town centre.

UCC data gives a total of 605 trade licences<sup>5</sup> within CUA, which is greater than the actual number of business enterprises, as some trade licences are issued on an activity rather than an enterprise basis. For example, hardware shops may have up to three trade licences depending on the type of goods they sell. Trade licences have roughly been divided into 97 (16%) large waste generators (six bakeries, seven restaurants, 22 local hotels, 16 timber/carpentry shops, seven garages, 11 welding/lathe and metal workshops, 13 private banks and 15 miscellaneous (e.g. Main Post Office, Sri Lanka Telecom)) and 508 (84%) small enterprises.

The actual number of retail shops, local hotels/restaurants and business centres within CUA is estimated to be 413<sup>6</sup>.

Limited specific investigations were undertaken for commercial enterprises as part of this study, involving interview surveys of 14 small and eight large commercial enterprises, covering four retail shops, four local hotels/restaurants, two hotels, two pharmacies, two banks, hairdresser, communications centre, garage, printers, finance company, furniture maker/seller, Main Post Office and Sri Lanka Telecom. Estimated garbage generation and composition, based on the four most common waste types, are summarized below.

Table 1-2: Commercial Enterprises Waste Generation and Composition

Source	Estimated waste generation (kg/d)	Most common waste types
Small enterprises (14), including three local hotels	0.5 – 15	Pa > F/K > PI > Ca > Me
Large retail/service (5)	20 – 51	F/K > Pa > PI > Ga = Ca
Hotels/restaurants (3)	25 - 40	F/K > Ga = PI > GI > Pa

**Notes:**

1. Waste generation amounts were estimated by the survey respondents. Such estimates are generally not very accurate, but give an indication of the amount of waste generated.
2. Waste types: Ca = cardboard, F/K = food/kitchen, Ga = garden, Me = metals, Pa = paper, PI = plastics.

Commercial waste generation is estimated to be 3.60T/d, based on survey data together with discussions with UCC Supervisors, giving a waste generation rate of 8.71kg/enterprise.d. Waste generation increases approximately 2-3 times on average during festivals and other special occasions (e.g. Munneswaram).

Seven commercial enterprises produce very small quantities of hazardous waste, comprising a small quantity of tubelights (4 enterprises), batteries (1 enterprise), old drugs from a pharmacy and polish cans from a furniture maker/seller, all of which are disposed of with their normal garbage.

<sup>4</sup> Draft Development Plan Chilaw UC (1998 or later).

<sup>5</sup> Actual UCC total = 631, which was adjusted to 605 to account for trade licences covered under separate categories in this study (two private hospitals, two international schools, five sawmills, 14 hatcheries, one ice factory and two boatyards).

<sup>6</sup> Source: "Waste Generation Places in Chilaw" (July 2002).

Most of these enterprises discharge their garbage for collection by UCC, except for a few places that burn some (e.g. Main Post Office, Sri Lanka Telecom, Bank of Ceylon) or most of their waste on-site (e.g. Rathna Garage, Desha Pharmacy, Dhammika Furniture, Chilaw Rest House). Nine enterprises recycle some of their waste, either giving it away or selling it, primarily to individual collectors on a variable basis, ranging from daily (e.g. animal feed) to annually (e.g. sale of paper by tender). The main materials recycled are paper/cardboard (Desha Pharmacy, Sudasena Printers, Cargills Food City), plastic containers (Desha Pharmacy, Dhammika Furniture, Serandib Chinese Restaurant), glass bottles (Serandib Chinese Restaurant, Chilaw Rest House, Chilaw Chinese Restaurant), metals (Rathna Garage) and food/kitchen waste for animal feed (Mayura Centre, Serandib Chinese Restaurant and the Chilaw Rest House), with glass bottles (141kg/mth) and animal feed (120kg/mth) being the most significant items. The Ceylon Bank composts 10kg/mth of food/kitchen waste for their own use.

Based on this information, it is estimated that 71.1% of commercial waste is collected by UCC, 25.4% is disposed of on-site primarily by burning (e.g. paper waste), 3.4% is recycled and 0.1% composted.

### 1.3.2 Markets

Chilaw has three main public markets, comprising the fish, vegetable and retail markets. There are no Pola (daily or weekly fairs) held within Chilaw and there is no public slaughterhouse within CUA. Instead, most of Chilaw's meat is brought into the town from outside.

The fish and vegetable market are located on the western side of the lagoon near Bridge St. These markets mainly produce organic waste. They comprise a total number of 541 active stalls (refer table below), including 150 "basket stalls" selling fish. The fish market is open six days per week and the vegetable and retail markets seven days. Opening hours are from 6am-6pm.

The retail market is located in the Bazaar area, near Bridge St/Lake Rd and has been included in the "commercial enterprises" category, due to it comprising mainly retail shops selling goods rather than fresh meat, fish, fruit or vegetables. It contains a total of 78 active stalls (refer table below) and is open seven days per week from 6am-6pm.

Table 1-3: Public Markets Details

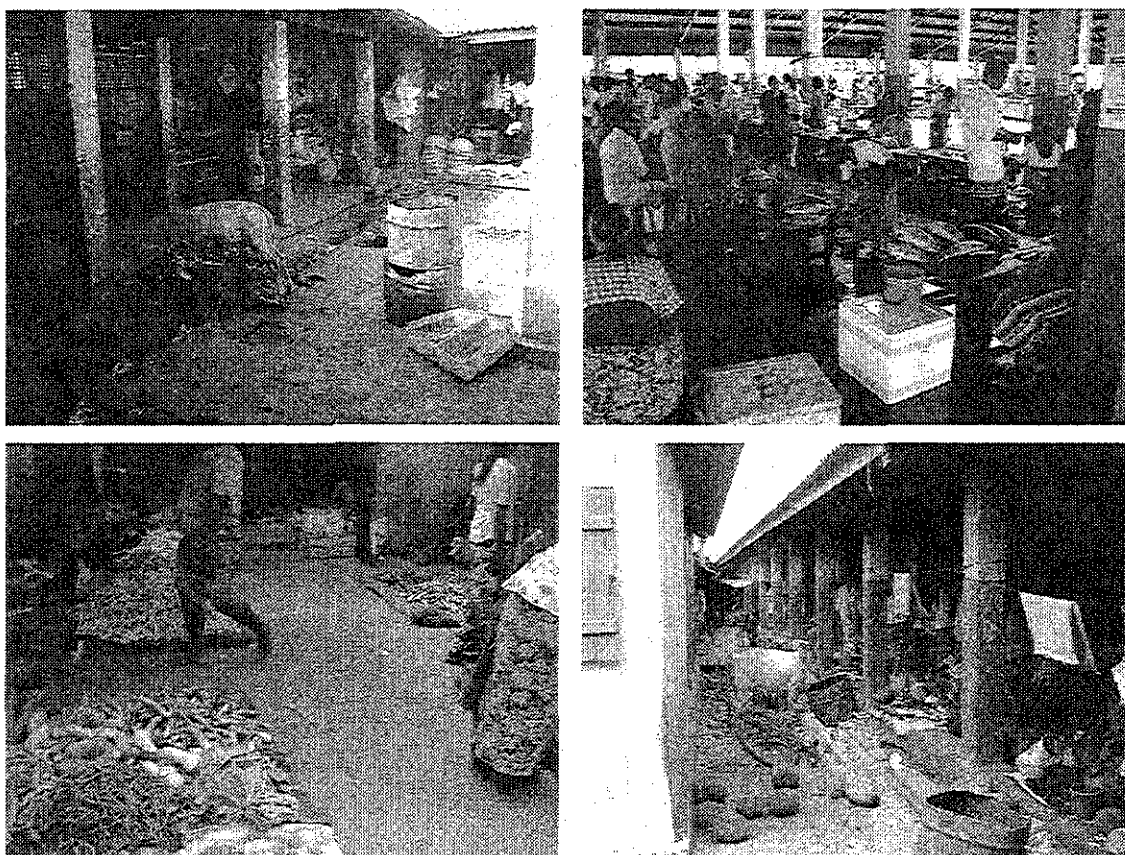
Market	Number of stalls		SW collection/ disposal
	Description	Total	
Fish	Fish: 250 retail (100 tables + 150 baskets) + 25 wholesale; other: 1 meat	276	UCC collection to ORDE compost facility.
Vegetable	225 vegetable/fruit, 25 goods and 15 other	265	
Total		541	
Retail	9 fish/meat, 2 vegetable/fruit, 58 goods, 9 other	78	UCC collection to disposal site

**Note:** Stall numbers are based on currently functioning market stalls, as determined during JICA field surveys. Stall space is available at some of these markets but is not currently being utilized, including five stalls at the retail market and one at the fish market.

About 840kg/d<sup>7</sup> of market waste is generated by the fish and vegetable markets, while the retail market produces around 243kg/d of waste<sup>8</sup>. Market waste comprises mainly king coconut shells, followed by fish/meat, vegetable/fruit, paper and polythene, wastes. Market waste generation shows some seasonal changes, increasing by up to seven times during the Sinhala/Tamil New Year and Christmas.

Recycling from all three markets amounts to around 40kg/mth of paper/cardboard, 500kg/mth of organic waste for animal feed, 200kg/mth of king coconuts and 200kg/mth of animal parts, which are collected for free by various individuals for a wide range of uses. Virtually all of the organic wastes recycled are believed to originate from the fish and vegetable markets, while paper/cardboard are collected from all three markets for recycling.

Traders at all three markets generally don't use dustbins, discharging their waste directly onto the ground. Eleven UCC labourers clean the markets during the morning (5-9am) and evening (4-7pm) shifts. A wheelbarrow or handcart is used to take market waste to collection points from where it is collected once or twice daily by UCC tractors. Fish and vegetable market waste is taken to the ORDE compost facility, while retail market waste is taken to one of UCC's disposal sites.



*Chilaw Fish and vegetable markets*

The Special Zone Supervisor indicated the existing waste collection system functions reasonably well but could be further improved by reducing the distance to market bins, improving the collection system

<sup>7</sup> From ORDE July-Aug 2002 "waste input" records and JICA market survey recycling data.

and implementing education/awareness raising programmes as well as promoting waste recycling/composting. He was somewhat willing to promote recycling within the three markets, via the source separation of waste, but considered it likely that UCC would require more market labourers to separate market waste at source, as he believes trader co-operation would be poor. The markets would also need more suitable bins, designed for protection from animals and the wind, particularly at the fish/vegetable markets.

He also commented that a major problem at the fish and vegetable markets is the lack of a functioning toilet. The retail market does have a toilet with toilet waste going to a septic tank, which is emptied approximately six monthly.

## 1.4 Institutions

In this category, investigations focused on hospital waste, primarily due to the hazardous nature of some of the waste (e.g. clinical, waste, sharps, body parts) generated by this sector. Interviews were also conducted with some schools, other educational institutes and government offices in order to estimate the amount and composition of waste generated by these sectors.

### 1.4.1 General

According to UDA data, 22.1ha (4.3%) of CUA is used by public/government institutions, while an additional 6.8ha (1.4%) is designated for religious use. Interview survey results for institutional waste generation and composition data are set out below.

Table 1-4: Institutional Waste Generation and Composition

Source	Waste generation (kg/d)	Most common waste types
Schools (4)	30-357	Ga > F/K > Pa > Ca
Other educational institutes (1)	30	Ga > Pa > F/K
Hospitals (3)	21-727	F/K > Pa > Pl > Ot
Government offices (3)	6-250	F/K > Pa=Ca > Ga > Pl

**Notes:**

1. Waste types: Ca = cardboard, F/K = food/kitchen, Ga = garden, Ot = other, Pa = paper, Pl = plastics.
2. The number of institutes shown here in brackets differs in some cases from the number mentioned in the text below, because the above numbers refer to complete interview surveys that were conducted, while the number in the text may be greater than this due to additional statistical/waste stream information obtained from UCC.

Institutional waste generation increases approximately 1-3 times on average, mainly during special functions (e.g. school sports meets, fairs) and also due to seasonal variations in garden waste generation. Three institutions produce very small quantities of hazardous wastes (batteries (2), tubelights (1), laboratory chemicals (1)).

<sup>8</sup> From observations during the JICA time and motion study and JICA market survey recycling data.

### 1.4.2 Schools

Chilaw has a total of nine schools, comprising five Type 1AB<sup>9</sup> schools, two Type 2 schools and two Type 3 schools. The total estimated number of students and school staff are 11,178 and 378 respectively, giving a combined total of 11,556 students and staff. The student population amounts to 47% of the total 2002 CUA population (24,539).

Interview surveys were conducted with four schools, while additional information was obtained from UCC for two other schools. Together, these six schools make up 75% of the total CUA schools' staff and student population.

Four of these six schools burn some (3) to all (1) of their garbage on-site while four discharge some (2) to all (2) of their garbage for UCC collection. Carmel Girls Central College composts a small quantity of garden waste, while Ananda College disposes of most of its waste by open dumping at a nearby cemetery.

Based on this data, total school waste generation was estimated to be 1.07T/d, equivalent to a waste generation rate of 0.093kg/(students+staff).d, with 44.6% of this waste collected by UCC, 32.7% burned/buried on-site, and 22.7% illegally dumped.

### 1.4.3 Other Educational Institutes

Chilaw has a number of other educational institutes, comprising the Withanika Technical College, two international schools, one large (Vidyakara Pirivena) and 7-8 smaller tuition centres. Together, these institutes are estimated to comprise 2,050 students and 57 staff, giving a total of 2,107 staff and students.

Only the Vidyakara Pirivena tuition centre was surveyed. This has 650 students and 10 staff. It generates around 30kg/d of waste (0.045kg/(staff+students).d) which it burns on site.

Total other educational institute waste generation amounts and waste stream percentages was estimated as follows:

- Adopting the schools waste generation rate and corresponding waste stream percentages for the Technical College and two international schools.
- Adopting the survey data for the Vidyakara Pirivena.
- Adopting the surveyed tuition centre waste generation rate for the other smaller tuition centres, but assuming 50% of their waste is disposed of on-site and 50% collected by UCC.

This gave a total waste generation amount of 119kg/d, equivalent to 0.056kg/(staff+students).d, with 55.2% of this waste being disposed of on-site, 35.0% collected by UCC and 9.8% illegally dumped.

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<sup>9</sup> Type 1AB = Years 1-13 (sometimes 6-13) with A level science/commerce/arts; Type 2 = Years 1-11 (up to O-level only). Type 3 = Years 1-5 (sometimes 9) primary.



#### 1.4.4 Hospitals

There are three main hospitals within CUA, as well as a number of medical centres/dispensaries. The main survey findings for these three hospitals only, including hospital statistical data are set out in the following two tables and summarized below:

- The combined hospital facilities in Chilaw are :
  - A total of 488 beds.
  - Average bed occupancy equivalent to 380 beds per day (78%).
  - Average total clinical and outpatients of 1,372 patients per day.
  - Total staff of 569.

Corresponding hospital waste generation is estimated to be 0.79T/d, equivalent to 0.339kg/(staff+patients).d.

- Food/kitchen waste is the most common waste type, followed by paper, plastic, other (not specified), garden, cardboard and glass waste. Healthcare hazardous waste was listed as the sixth most common waste type by two hospitals.
- Most normal waste is collected by UCC, except for small quantities of plastic/glass bottles/containers recycled by the Chilaw Base Hospital and Chilaw Clinic, as described further below.
- Currently, the Base Hospital disposes of most of its healthcare hazardous wastes (clinical waste, body parts, placentas, sharps, highly infectious wastes) by burning and/or burial on-site, either in a pit or old local incinerator (theatre wastes). The Chilaw Clinic and St Mary's Nursing Home<sup>10</sup> produce very small quantities of healthcare hazardous wastes which are discharged for collection by UCC except for body parts (Chilaw Clinic buries these on-site) and sharps which the St Mary's Nursing Home burns on-site.
- The Base Hospital reuses waste containers. For example:
  - Saline and penicillin bottles are reused (e.g. as containers for blood and urine specimen collection).
  - Cardboard boxes are used as sharps storage containers.
- The Base hospital recycles some of their used plastic/glass containers/bottles and coconut shells. These items are stored and then advertised for sale by auction at six month intervals for containers/bottles and approximately every two years for coconuts. Indicative data on the quantities of materials sold by tender was obtained from the Base Hospital, showing they recycle around 10,000 plastic containers, 500-1,000 glass syrup bottles and 10,000 glass vials per six months. The Chilaw Clinic also recycles around 1,000 glass bottles on an irregular basis.
- The Chilaw Clinic and St Mary's Nursing Home pay garbage collection workers an unofficial collection fee of 300 and 2,000Rs/yr respectively.

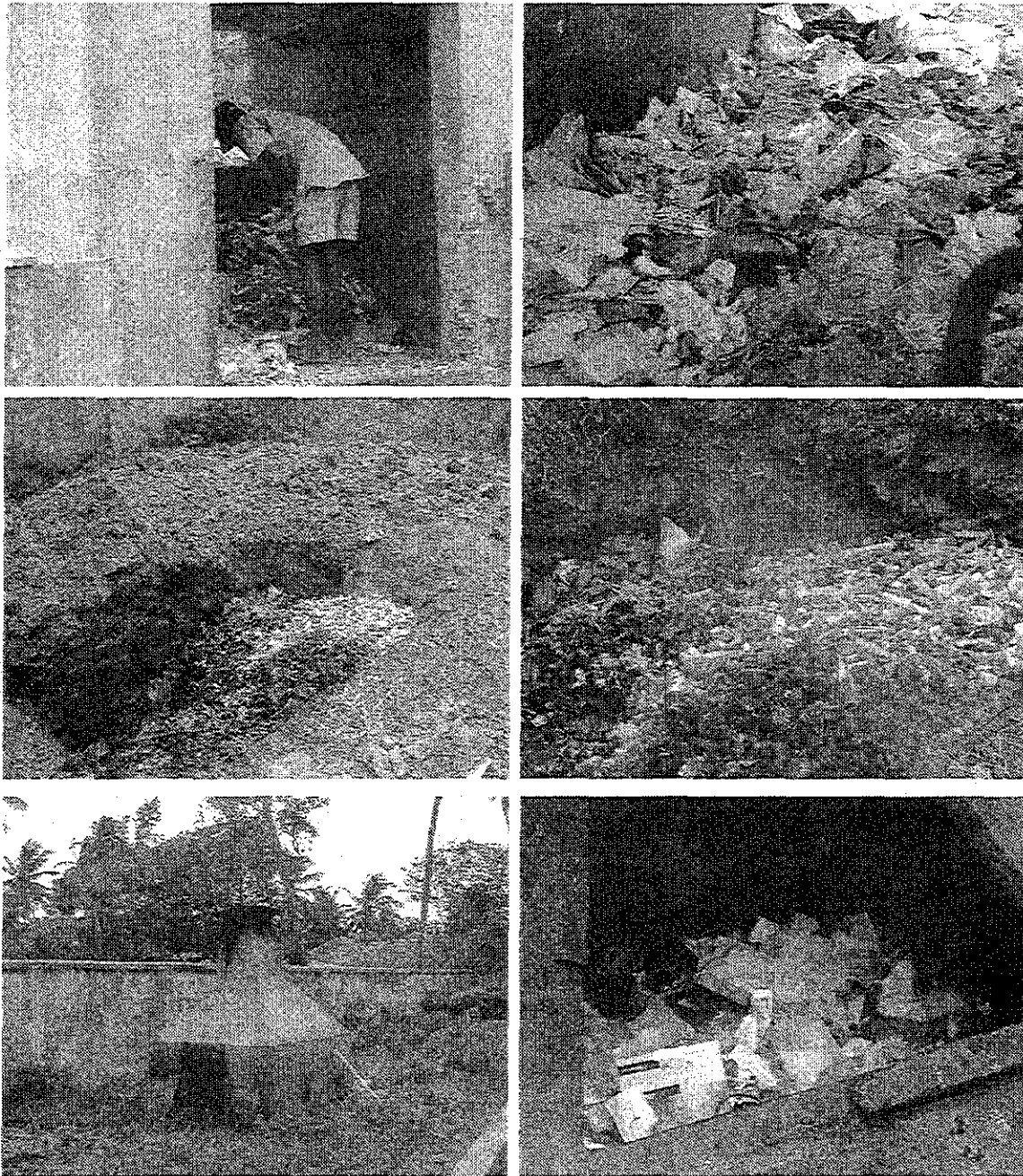
- None of the three hospitals whose waste is collected by UCC are satisfied with the present waste collection system, the main reasons being the collection frequency is too low (2), collection is irregular (1) or not properly done (1), the collection point is too far away (1) and a lack of recycling (1).
- Desired SWM improvements ranked in descending order are (numbers shown are weighted average ranks (WAR) for desired improvements):
  - Improved garbage discharge system 5.5
  - Greater recycling/composting of garbage 4.0
  - Improved collection frequency 3.0
  - Education to change peoples' bad habits 3.0
  - Shorter distance to garbage collection point 2.0
  - Improved collection and disposal of hospital hazardous waste 2.0

The Base Hospital would also like a proper incinerator, while it needs financial assistance to implement the colour coded garbage discharge system recommended by the Ministry of Health and to provide hospital labourers with appropriate garbage collection equipment (e.g. gloves).

- The two private hospitals were both willing to pay for improved garbage collection services: Chilaw Clinic (1,200Rs/mth), and St Mary's Nursing Home (2,000Rs/mth). The Base Hospital said that this question should be referred to the Deputy Director of Health Services, Western Province for a response.
- The Base Hospital and St Mary's Nursing Home are very willing to cooperate in separating their waste into different categories for recycling, if requested, while the Chilaw Clinic said the hospital owner should be contacted for a response to this question.

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<sup>10</sup> Sometimes referred to as Dr Washington's Hospital.



*Chilaw Base Hospital: Top – hospital concrete garbage collection bin; middle – pit where sharps and some other hospital hazardous waste is burnt; bottom – old local incinerator used for burning theatre wastes.*

Table 1-5: Hospital General Statistics and Waste Generation

Hospital	Type	No of Beds	Bed occupancy (%)	Out-patients (no/d)	Clinical patients (no/d)	Staff	Waste composition	Normal waste (kg/d)	Clinical waste (kg/mth)	Body parts (kg/mth)	Sharps (per month)	Highly infectious (/mth)	Other
Base Hospital	Govt	460	77	774	418	531	F/K > P/Ca > Pl	673	Clin + BP: 960 Plac: 432		259	34	Small
Chilaw Clinic	Private	8	100	60	10	6	O > Gl > Pl > P/Ca	20	Small	Small (no plac)	Small	0	Small
St Mary's Nursing Home	Private	20	100	100	10	32	F/K > Ga > Pa > Pl > Ca	25	0.8	BP: 1 Plac: 5	Small	0	Small
Total		488	78	934	438	569	F/K > P > Pl > O	718	Clin + BP: ~962 Plac: 437		~259	34	Small

**Notes:**

1. Data for hospitals obtained from interviews with relevant staff members of each institute.
2. Average total number of beds occupied = Sum of (number of beds x bed occupancy rate) for all hospitals = 452.
3. Waste types: BP = body parts, Ca = cardboard, Clin = clinical waste, F/K = food/kitchen waste, Ga = garden, GI = glass, HH = healthcare hazardous waste, O = other, P = paper, Plac = placenta, Pl = plastic. NA = no answer.
4. An accuracy check has only been made on the amount of normal waste, with survey data being amended based on UCC data, as required.

Table 1-6: Hospital Waste Disposal Practices

Hospital	Normal waste	Clinical waste	Body Parts and/or placentas	Sharps	Highly infectious	Other	WWTP	Incinerator	Comments
Base Hospital	Collected by UCC except for some recycling of plastic/glass containers/bottles and coconut shells.	Burned on site	Body parts are burned on-site, while placentas are buried on-site.	Burned on site	Burned on site	No answer	Yes (see note)	No	Would like proper incinerator and financial support to set up colour coded waste discharge system.
Chilaw Clinic	Collected by UCC except for some recycling of glass bottles.	Collected by UCC	Buried on site	Collected by UCC	Not applicable	No answer	No	No	
St Mary's Nursing Home	Collected by UCC.	Collected by UCC	Collected by UCC	Burned on site	Not applicable	No answer	No	No	

**Note:** The Base Hospital burns healthcare hazardous wastes on-site either in a pit or local incinerator (refer photos). It's wastewater treatment plant (WWTP) has been out of service for about three years (UCC PHI).

### **1.4.5 Government Offices and Police**

There are approximately 16 central and provincial government departments/ministries/authorities with offices in CUA, including the prison and police. These offices, together with UCC employ approximately 888 workers, while the prison has about 10 inmates. Interview surveys were conducted with three of these offices, including UCC, while additional information was obtained from UCC for the Police Station and Prison.

All of the three offices surveyed dispose of some (1) to all (2) of their garbage by on-site burning/burial; two discharge some of their garbage for UCC collection, while another recycles a small quantity of paper waste. UCC data indicates that garbage from the Police Station and Prison is collected by them.

Both the Police Station and UCC produce relatively high quantities of waste, giving a waste generation rate of 1.27kg/worker.d, which is considered too high (c.f. average government office waste generation rate measured for Kandy, Matale and Negombo = 0.207kg/worker.d). Hence, this lower average waste generation rate has been used to estimate waste generation from other unsurveyed government offices in Chilaw and then combined with the survey data to give an estimated government office waste generation amount of 0.73T/d (0.807kg/worker.d), with 75.1% of this waste collected by UCC, 24.8% burned/buried on-site and 0.1% recycled.

### **1.4.6 Religious Places**

The total number of religious places within CUA is approximately 12, comprising four churches, four buddhist temples and other institutes (Vidyakara Pirivena), three mosques and one hindu temple (kovil). The associated number of religious workers is estimated to be 45.

Adopting a religious places waste generation rate of 1.01kg/clergy.d, based on Kandy and Matale data, this gives a total waste generation amount of 0.05T/d, of which 80% is assumed to be collected by UCC and 20% disposed of on-site.

## **1.5 Industries**

According to UDA data, industrial land use constitutes 1.9ha (0.4%) of total land use within CUA, while shrimp farms make up another 8.0ha (1.6%). UCC data indicates there are a total of 14 shrimp/prawn farms/hatcheries within CUA which seems consistent with the allocated land use. However, UCC data suggests that other industrial activity may be on a slightly larger scale than suggested by the UDA data, with a total of six other industries and five sawmills being classified as industries for the purposes of this study, as tabulated below. Two prawn/shrimp farms, four other industries and five sawmills were surveyed for this study.

### 1.5.1 Shrimp/Prawn Farms

The Prima Shrimp Farm generates about 30kg/d of waste, most of which it burns on-site while recycling around 700 paper bags per month and some metal barrels (total recycling estimated to be 2.5kg/d). The Furnishel Aqua Project (prawn hatchery/water quality testing service) produces only about 2kg/d of waste, taking most of its garbage off-site to an unknown place (assumed to be illegal dumping), apart from some waste which is burnt on site.

Other shrimp farms are assumed to follow similar waste management practices, although the recycling details may differ. Applying this data to all 14 prawn/shrimp farms/hatcheries, gives a waste generation amount of 0.22T/d (16kg/farm.d) of which 88.4% is disposed of on-site, 7.8% is recycled and 3.8% illegally dumped.

### 1.5.2 Sawmills

Interview surveys were conducted with all five sawmills within CUA to find out about their waste disposal practices and their willingness to co-operate with UCC in giving/selling their sawmill wastes for use in composting as an amendment/bulking agent. The results of these interview surveys are tabulated below and summarized here:

- These five sawmills employ a total of 19 workers.
- All five sawmills produce significant quantities of wood wastes, comprising around 11.3-12.1T/mth of sawdust and 7.2-9.0T/mth of woodchips.
- Four of these sawmills give away or sell some (1) to all (3) of their sawdust, while one disposes its sawdust on-site and another burns some of its sawdust on-site.
- Three sawmills use some (2) to all (1) of their woodchips (e.g. for firewood), while three sell some (2) to all (1) of their woodchips.
- Three sawmills are willing to sell all their sawdust to UCC, with 2.25T/mth being available at 150Rs/TL and 3.75T/mth at 500Rs/TL.
- Two sawmills are willing to sell their woodchips to UCC, with 2.9-3.8T/mth being available at 1,800-2,000Rs/TL and another 2.9-3.8T/mth available at 3,000Rs/TL.

Total sawmill waste generation within CUA was estimated to be 0.66T/d (132kg/sawmill or 34.7kg/worker.d), with 73% of it being recycled and 27% disposed of on-site.

Table 1-7: Sawmills Interview Survey Results

Timber Industry Name and Location	Waste Quantities (T/mth)			Waste disposal	Willing to give /sell to UCC for composting	Comments
	Sawdust	Woodchips	Bark			
Mahalekam Timber Depot 1 Kurunegala Rd, Chilaw (Mr.Nalare, owner's son; tel 032 27283)	0.75	0	0	Sawdust is given away for free	Not willing to give/sell	6 workers; introduce new technology for using sawmill waste
Be Lings Sawmill 43 Kurunegala Rd, Chilaw (Mr.Sarath, Manager; tel 032 22102)	3.75	2.9-3.8	Mixed with woodchips	Sawdust is given away for free; woodchips are sold at 10Rs/5kg	Willing to sell all sawdust at 500Rs/TL and woodchips at 3,000Rs/TL	4 workers
St Anthonys Timber Depot 137 Puttalam Rd, Chilaw (Mr. P. G. Anthony, owner; tel 032 20417)	1.5	0.48		Sawdust is given away for free; woodchips are used for firewood	Willing to sell all sawdust at 150Rs/TL; not willing to give/sell woodchips	2 workers, sawdust can be used in ice production and on poultry farms
Siripura Sawmill 35 Sena St, Chilaw (Mr.Gunapala, Manager; tel 032 22405)	4.5 – 5.3	2.9-3.8	Mixed with woodchips	Sawdust is disposed on-site; woodchips are used and sold at 20Rs/20kg	Not willing to give/sell sawdust; willing to sell woodchips at 1,800-2,000Rs/TL.	6 workers
Clodiyas Timber Shop 57,Colombo Rd, Chilaw (Mrs A Deepani, owner's sister)	0.75	0.95		Sawdust is burnt and given away; woodchips are used and sold at 1500Rs/TL	Willing to sell all sawdust at 150Rs/TL; not willing to give/sell woodchips	1 worker; sawdust can be used on poultry farms and spread on the land.
Total	11.3 – 12.1	7.2-9.0	0			

**Notes:** TL (tractor loads) refers to four wheel tractor loads unless otherwise stated. Loads data was converted to tonnes for tractors based on information supplied by survey respondents, with one load of sawdust being equivalent to 0.75T and one load of woodchips/bark to 0.9-1.0 T.

### 1.5.3 Other Industries

Six enterprises were classified as other industries for this study, comprising two boatyards, one garment factory, one ice factory, one shoe packaging company (Bata Shoe Co), and the Sri Lanka Fisheries Board, which is also believed to be an ice factory (not confirmed).

Four of these six industries were surveyed. Three discharge some of their garbage for UCC collection, including fibreglass waste from the Neil Marine Boatyard, while two burn/bury some of their garbage on-site. The fibreglass waste is difficult to handle and UCC has also experienced problems with disposing it, as some people have on occasions set fire to it, creating an odour problem.

Two recycle various materials including 150kg/mth of textiles (Mid Garment Factory) and smaller quantities of metal barrels. Justin Cooray Boat Producers illegally dumps its garbage, which includes some fibreglass waste.

Additional information was obtained from UCC for Bata Shoe Co. (shoe packaging operation) indicating it generates around one handcart/day of garbage which is collected by UCC.

Total other industry waste generation was estimated to be 0.20T/d, of which 74.8% is collected by UCC, 20.1% disposed of on-site and 5.0% illegally dumped.

## 1.6 Other Waste

Other waste accounts for waste collected from public places such as parks, beaches, streets, drains and canals and from other “informal” sources that are not registered with the relevant authorities and hence not included in official statistics. It may also include some of the waste that is illegally dumped around the city and subsequently collected by UCC.

Chilaw has a Children’s Park, situated behind the Magistrate Courts and one Stadium (sportsground), which are cleaned by the UCC Health Section. UCC estimated that it collects the equivalent of about 1.5 handcarts/d (0.18T/d) from the Children’s park and one handcart/d (0.12T/d) from the Stadium. Stadium waste generation increases significantly during sports meetings and other special events. UCC also cleans religious places at no cost.

UCC data gives the total length of roads and concrete drains within CUA as 22-23km and 26km respectively. The road network is made up of 8.3km of tarmaced roads, 13.1km of gravel roads and 0.7km of sand roads. UCC normally clean the tarmaced roads and concrete drains.

Most road sweeping, drain cleaning and weeding is undertaken by designated sweeper and drain cleaning labourers. There is often a shortage of drain cleaners due to absenteeism. The road sweeping and drain cleaning waste is usually collected by the normal garbage collection vehicle assigned to each zone, although some drain cleanings are simply left at the side of the drain.



Road/drain cleaning waste is estimated to be 0.40T/d, based on comparative data from Kandy, typical road sweeping waste generation estimates from other JICA studies, and considering the average length of roads/drains that can be cleaned by a handcart per day. All of this waste is assumed to be collected by UCC.

## 1.7 Recycling

### 1.7.1 General

Informal reuse and recycling is relatively active in Chilaw, with there being several shops in the town selling used items and/or recyclables such as used newspapers/exercise books, bottles, containers, tins, shoes, bags, bikes, umbrellas, books, etc. These may be used for a wide range of purposes, including:

- Waste paper may be used to make paper bags for wrapping purposes (e.g. medicines, food, small goods, etc.).
- Glass and PET bottles may be used as containers for local products (e.g. sauce).
- Empty metal tins may be used to make the metal support that secures broom bristles to the broomstick (ekel broom) or for making toys and other items (e.g buckets).

### 1.7.2 At Source

This section focuses on household recycling at source, as recycling at source from other waste generators has previously been described. Household at source recycling was estimated from the household survey results (120 households), with the relevant results being summarized below. These indicate that 43% of households have recyclables collected from them by individual collectors, 23% take some recyclables to shops for refund/sale, while no surveyed households compost kitchen and/or garden waste.

Table 1-8: Household Survey Recycling Results Summary

Waste Type	Composting	Individual collects from House	Resident takes to shop
Yes	0	52	28
No	120	68	92
Food/kitchen	N/a	0	0
Garden/wood	N/a	0	0
Paper/cardboard	N/a	18	5
Plastic	N/a	0	0
Glass	N/a	47	23
Metal	N/a	11	0
Textile	N/a	0	0
Other	N/a	0	0

**Notes:**

1. The household survey indicated that 87 households are visited by individual collectors but only 52 households actually give recyclable materials to these collectors.
2. N/a = not applicable.

The total amount of materials recycled from households at source was estimated using this data together with approximate household waste composition data, 80% average CUA garbage collection service coverage and assuming a 90% recycling rate. This gives a household recycling quantity of 0.16T/d (1.3% of total household waste generation).

It is difficult to verify how realistic these values are. However, one household collector, met by chance, indicated there are about 25-50 individual collectors like him. He collects around 50-200kg/d of recyclable materials, comprising mainly bottles and some exercise books, which he takes to a middleman shop in the town, earning an average of 200Rs/d. These figures suggest the actual household recycling quantity could be as high as 1.25T/d (low estimate, based on 25 workers x 50kg/d). The middleman survey also supports a slightly higher rate of household recycling than indicated by the household survey, with 0.22T/d of recyclable materials purchased by them estimated to originate directly from households within CUA.

The household survey figure of 0.16T/d has been adopted for this study, this being a conservative approach.

### 1.7.3 During Collection

Both handcart and collection vehicle workers collect recyclable materials in Chilaw, which they generally sell to middlemen within Chilaw.

The collection worker survey found that five out of 30 labourers interviewed are involved in recycling. These five labourers collect an estimated total of 148.5kg/mth, comprising mainly bottles (134kg, 203 in number<sup>11</sup>) and smaller quantities of iron (14kg) and aluminium (0.5kg), earning an average of 51-59Rs/labourer.mth<sup>12</sup>, as tabulated below. Total quantities of recyclables recovered during collection by all SWM labourers are estimated to be 366kg/mth.

During the time and motion study, UCC four wheel tractor labourers indicated that they collect recyclable items, comprising mainly glass bottles and some metals, selling beer/arrack bottles at 1Rs ea, tins at 5Rs/kg, aluminium at 50Rs/kg and copper/brass at 60Rs/kg to a middleman on Corea Mw. They can earn around 150Rs/wk for the whole crew (driver + three labourers), equivalent to an average income of 161 Rs/labourer.mth, which is approximately three times higher than the income figure obtained from the collection worker survey, suggesting that the quantity of materials recovered by recycling may be higher than indicated by the collection worker survey.

It is expected that a four wheel tractor crew will collect more recyclables than a two wheel tractor crew and handcart labourers. Hence, the time and motion study data can be regarded as an upper limit for

<sup>11</sup> Average bottle weight = 0.66kg, obtained by measuring a mixture of 10 arrack and beer bottles, th185se being the most common bottles recycled.

recycling, while the collection worker survey data is more likely to be a lower limit as it includes all labourers, including drain cleaners and sweepers. For these reasons, the collection worker recycling quantity was increased to 25kg/d, based on the relative income figures from both sources (see Note 3, below table).

Table 1-9: Recyclable Materials Recovered by Collection Workers

Item	Collection Worker Survey			Estimated Total Quantity (kg/mth)
	No of workers collecting	Quantity (kg/mth)	Price	
Bottles	4	134	1-1.5Rs ea	685
Iron	2	14	4-5 Rs/kg	72
Aluminium	1	0.5	50 Rs/kg	3
Total	5	148.5		759
Average earnings (Rs/labourer/mth)	59	51		106

**Notes:**

1. No of labourers interviewed = 30, while total UCC labourers + drivers = 74.
2. Total quantity calculated from collection worker survey =  $74/30 \times 148.5 = 366\text{kg/mth}$ .
3. Revised total quantity/mth =  $(161+51)/2 \times 366/51$ , taking into account time and motion study results.

#### 1.7.4 Final Disposal

There are no UCC labourers stationed at any of the final disposal sites used by UCC. Hence, recycling by UCC workers at this point is considered to be negligible.

Interviews of 50 households living in close proximity to five different disposal sites used by UCC found no one involved in collecting recyclable materials or food/kitchen waste for animal feed from any of these sites. However, two people were allowing their animals (four cows, 12 goats and four pigs at Althuwatta and 3 pigs at Suduwella) to graze on these disposal sites on a daily basis.

Hence, recycling at final disposal is considered to be negligible.

### 1.8 Disposal Quantities

Current trips data and disposal quantities over the seven day period from Aug 12-18, 2002 (UCC data) are summarized below.

<sup>12</sup> 51 Rs/mth calculated from quantities and prices of recyclable materials, while 59Rs/mth was average figure calculated from collection worker survey results. Both figures are quoted in Table 11, with the former being used in calculations.