

# SOLID WASTE MANAGEMENT BASELINE SURVEY



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# 1 Introduction

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Current solid waste management systems in Asia are strained, and landfill space is fast becoming a rare commodity. Governments face increasing costs for disposal, while public health and the environment suffer from the damaging effects of untreated solid waste. In 2009, the United Nations Economic and Social Commission for Asia and the Pacific embarked on a regional project, Pro-poor and Sustainable Solid Waste Management in Secondary Cities and Small Towns, to find appropriate approaches to waste management that would transform waste products into valuable resources, improve waste collection services and provide better income and working conditions for waste pickers.

The overarching objective of the project is to enable participating towns to develop and execute solid waste management strategies that are decentralized, particularly benefit the urban poor, contribute to low-carbon development priorities and can be partly financed through the sale of carbon credits. Cambodia is one of the countries targeted in the project. Based on the outcomes of workshops and consultations with civil society groups, local government representatives and other United Nations organizations, Kampot town was selected for a baseline study, the first step in developing the pilot project. The study centred on collecting accurate information on solid waste management in Kampot.



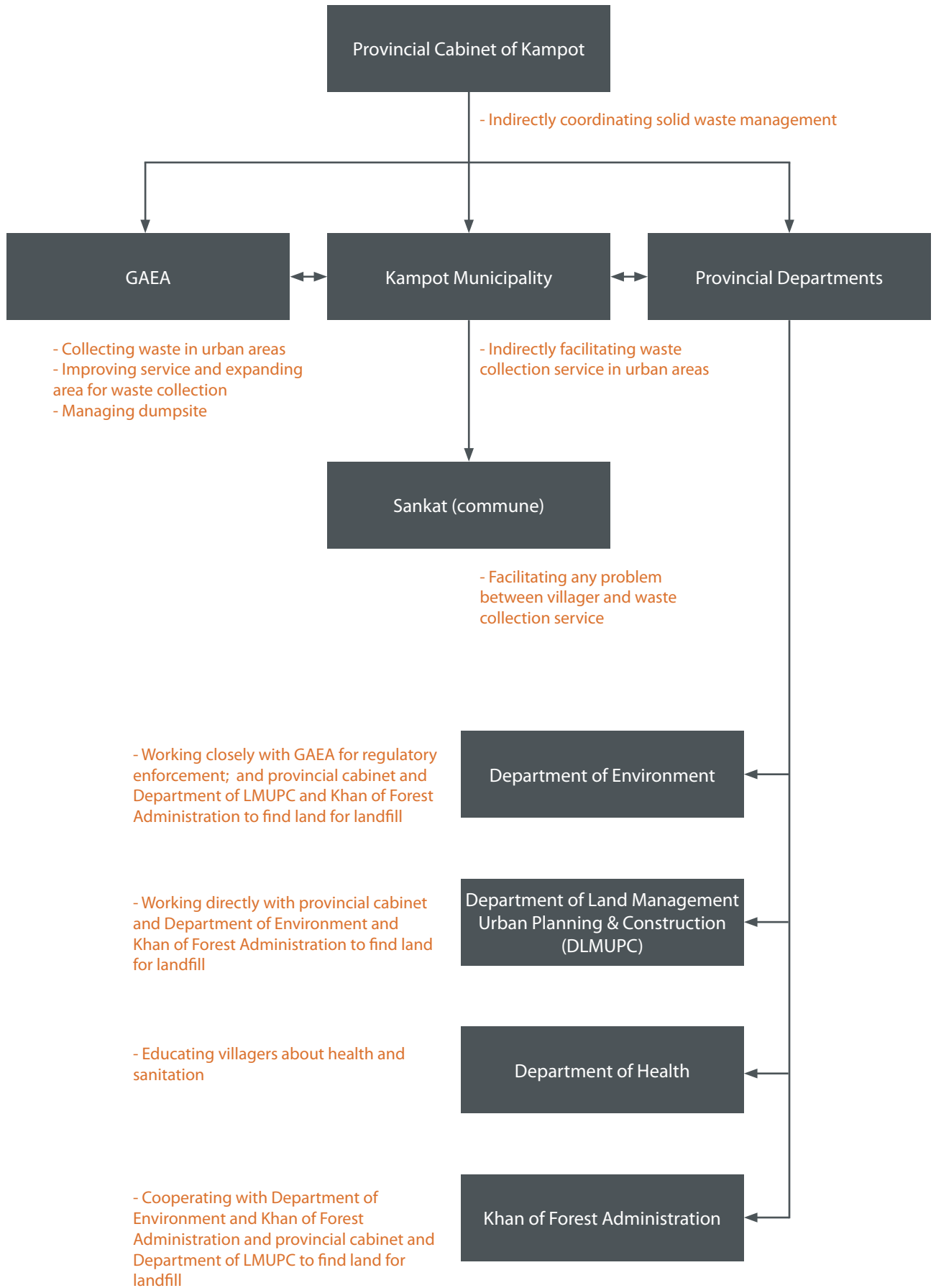
## 2 Overview: Solid Waste Management in Kampot

### STRUCTURE FOR SOLID WASTE MANAGEMENT

Three parties have primary responsibility for solid waste management in Kampot: the provincial authority (advisory role and decision making at the provincial level), the municipality (implementer) and the Global Action for Environment Awareness (GAEA) a private waste collector. Since 2010, waste collection and disposal has been the responsibility of GAEA. The contract was transferred to GAEA from a previous private operator who failed to continue to provide the service. GAEA signed a 12-year contract (2007–2019) with the provincial authority. However, there is no mechanism to monitor and evaluate the contractor's performance. The following diagram reflects the structure and role of agencies in Kampot's waste management.







## WASTE COLLECTION AND DISPOSAL SYSTEM

The town's waste collection rate remains very limited, with much of the waste still burned, buried or dumped in public areas and water bodies. Currently, waste collection services cover only the main roads, the main markets and the town centre. Only about 36 per cent of households in Kampot town have access to waste collection services. According to the GAEA staff, poor road access and scattered settlements limit the expansion of the service. The frequency of waste collection service varies from two to seven times per week, depending on the area and the provincial authority's priorities.

According to the GAEA staff, approximately three trucks of waste are transported to the town dumpsite on a daily basis. Two of the trucks have a 4.5 m<sup>3</sup> capacity each and the third has a 10 m<sup>3</sup> capacity. The GAEA staff estimate that equates to some 15–20 tons of waste collected daily and then disposed in the dumpsite, including waste from the town's two markets (roughly 5 m<sup>3</sup> per day, according to a market authority estimate).

Households use different items for storing waste, such as bamboo baskets, plastic bags and/or waste bins. Most commonly, waste is packed in plastic bags. Households that do not have access to the collection service (or refuse to pay for the service, though that is estimated to be few) dispose their waste at collection points in the markets or waste bins nearby. Some burn or dispose their waste in a public space or water body. It is quite common that waste packed in plastic bags

is opened by informal waste pickers searching for recyclable materials and then left scattered where it attracts dogs, insects and rodents.

## FEE COLLECTION

As noted, there is no mechanism to monitor the GAEA performance in terms of service or fee collection. There is no data recording or monitoring system tracking waste collection, waste generation and transport. Only the operational costs are reported to the municipality authority. In general, according to staff interviewed during the survey, fuel is the largest operational expense, followed by salaries for the staff and collection workers. The figures provided during the survey interview did not include any costs for maintenance of the dumpsite (although the dumpsite operation mainly involves the levelling of waste dumped into the open site).

The major income of GAEA derives from the service fee that is collected on a monthly basis from the market authorities, public institutions and commercial entities (restaurants, hotels and other businesses). Fees collected from households are minimal because people tend not to pay for or receive the collection service. GAEA also collects a fee from the provincial authority for collecting waste in public areas and cleaning the roads.

## COVERAGE OF WASTE COLLECTION SERVICE

Sangkat	Households in Sangkat	Households receiving waste collection service	Percentage of household receiving waste collection service
Kampong Bay	1115	710	64%
Kampong Kandal	1376	900	65%
Krang Ampil	858	310	36%
Trey Koh	1356	0	0%
Andong Khmer	1899	450	24%
Total	6604	2370	36%

Source: Interview with GAEA staff, 2011

## EXPENDITURE FOR WASTE COLLECTION SERVICE AND STREET CLEANING

Expenditure	Quantity	Unit	Riel/unit	Riel/month	USD/month
Staff (administration)	5	Person	600,000	3,000,000	750
Waste collectors	10	Person	600,000	3,000,000	750
Street cleaning	6	Person	300,000	1,800,000	450
Fuel	3,600	Liter	USD 1.3	18,720,000	4,680
Total	-	-	-	26,520,000	6,630

Source: Interview with GAEA staff, 2011

## HUMAN RESOURCES AND EQUIPMENT

GAEA employs a total of 21 staff and collection workers within the Kampot municipality. These include ten workers for waste collection and transport (all male, including the driver), six workers for street cleaning (all females), five administrative workers (administration and finance, custom relations and billing, of mixed sex) and a mechanical engineer. Staff members lack training for their jobs.

The municipality does not have a unit that is responsible for planning, monitoring or implementing solid waste management. The Provincial Department of Environment provides limited technical support to the municipal authority on environmental issues. GAEA staff members are accountable to the Department of Environment and not the municipal authority.

## EQUIPMENT FOR WASTE COLLECTION

Equipment	Load volume	Quantity
Truck (compactor)	10 Ton	1
Truck	4.5 Ton	2
Tractor	-	1
Bulldozer	-	1
Cart	-	16
Dustbin	-	57

Source: Report of GAEA, 2011

### OPERATION OF THE DUMPSITE

A small open dumpsite in Prey Khmou commune, Teuk Chhuo district, which GAEA operates, has been in use since 2005. The dumpsite is situated on 4 ha of suburban land and located approximately 11 kilometres from the municipal centre. Some parts of the area were excavated to accommodate the waste disposal. The area is reported to be safe from flooding. It is a typical open, uncontrolled dumpsite with little attention given to adverse environmental impacts.

The dumpsite operation is under the control of the municipality authority. Actual operation is contracted to GAEA for daily management. The contract designates that GAEA is responsible for maintaining the access road and levelling the incoming waste. Road maintenance and waste levelling, however, is limited. The Provincial Department of Environment is responsible for enforcing the contract obligations and controlling the dumpsite environment. The entrance road to the dumpsite is in poor condition, and worsens in the rainy season. Due to the GAEA's limited budget, many of the recommendations for improvement made by the Department of Environment have not been followed through.

According to interviews with GAEA staff, approximately 19 waste pickers (including ten female waste pickers and three children) work at the dumpsite every day. Three families live within the dumpsite area and earn their income from waste recycling. There are daily fires on the dumpsite, either ignited spontaneously or lit by the waste pickers.

Based on the current waste generation levels, the municipal authority estimates that the dumpsite will reach its capacity in one or two years. The provincial authority has already designated a new land area of approximately 17 ha for construction of a new dumpsite. It is located about 1 km from the current dumpsite. The new dumpsite, which belongs to the provincial authority, will open for operation in 2012. The provincial authority is seeking external funding to begin construction of a safer site.



### 3 Study methodology



For the purpose of this baseline study, three of five communes (sangkat) in the Kampot municipality were selected: Andong Khmer, Kampong Kandal and Kampong Bay.

The methodology involved: i) a household survey, ii) interviews with waste pickers, shop owners, households and staff within the Kampot provincial and municipal authorities, the Department of Environment and with the Global Action for Environment Awareness (GAEA) and iii) a waste generation and composition analysis carried out by the Community Sanitation and Recycling Organization (CSARO).

The household survey, also conducted by CSARO researchers, covered a total of 120 households within the three sangkat. Households were randomly selected and categorized into “low income” and “high income”, with the classification based on visual assets, such as house structure (materials) and size and assets (modes of transport). Semi-structured questionnaires were prepared and tested with respondents from selected households prior to the actual survey. The content included the level of understanding of the current waste management and collection service, preferences for future services, waste disposal practices and opinions on environmental impacts.

Additionally, waste was collected from 28 shops, six offices, one market and three restaurants for the waste generation and composition analysis. Waste was collected and analysed over a period of seven consecutive days.

## 4 Findings from the waste composition and generation analysis

### HOUSEHOLD WASTE

On average, waste generation from the two categories of selected households was 3 kg per household per day, or 0.4 kg per person. Based on this calculation, total household waste generation in the municipality is estimated at 14 tons per day. The average density for household waste was 0.156 kg per litre. Some of the selected urban households appeared to be rural in nature (large land parcels with trees and wooden houses).

Across the three communes in the study, the level of waste generated seemed to have a strong correlation with the population and the status of the local economy.

The recent increase in tourism activities is likely to increase waste generation in the future. However, the past few years of economic crisis have severely impacted the tourism sector in the province. The local authority has noticed an outmigration for jobs, particularly to the construction sector and garment factories in Phnom Penh and in the agriculture sector. This is the likely explanation for the slight decline in population in the municipality in 2010 and 2011. No official population data with future projections was available at the time of the study.

Based on the results of the survey, with a per capita waste generation of 0.409 and a population of 33,351, the estimated total household waste generation is 13,886 kg/day.

### POPULATION IN KAMPOT

Year	Population
2006	34,380
2007	34,371
2008	34,546
2009	34,594
2010	33,989
2011	33,951

Source: Kampot Municipality, 2011

### SHOP AND OFFICE WASTE

According to information from the provincial authority, there are 646 shops and 51 offices (public institutions and private companies) operating in Kampot municipality (data as of October 2011).

Waste was collected from 28 shops and 6 offices for analysis. In the seven-day analysis period, the waste level from those shops and offices declined, not surprisingly, over the weekend due to closed hours.

The majority of waste collected for the analysis came from shops. According to the analysis, organic waste contributed 60 per cent of the waste; grass and wood accounted for 38 per cent, followed by vegetable waste (28 per cent) and plastic material (13 per cent). Throughout the analysis, the use of plastic bags for packaging was commonly found. Several shops sold coconuts and packed foods (wrapped in banana leaves), which contributed to a large share of the waste composition. These two types of waste were classified as grass and wood waste.

### GUESTHOUSES AND RESTAURANTS WASTE

The municipal data indicated 6 hotels, 44 guesthouses, 23 food shops and 112 restaurants operating. The researchers selected 5 guesthouses (with a total of 93 rooms and 148 beds), 1 hotel (49 rooms with 71 beds) and 3 restaurants/food shops for analysis. On average, the restaurants/food shops generated almost double the waste per day (9 kg) as the guesthouses and hotels produced (4 kg), simply reflecting the function of services delivered.

### MARKET WASTE

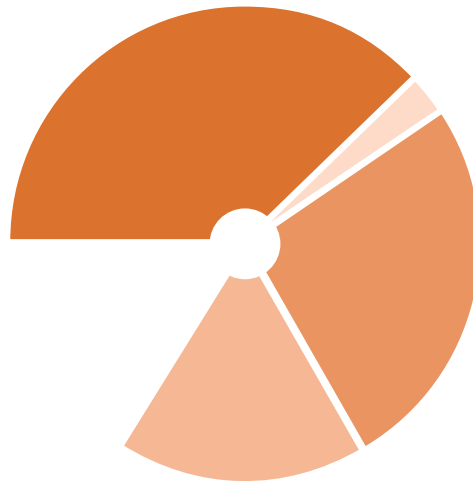
There is no wholesale market for vegetables in the municipality. However, once the railway renews operations, Kampot is expected to become a major hub for vegetable distribution. It is likely that a wholesale vegetable market will be constructed next to the railway station in the future. Hence, vegetable waste from the markets is expected to increase significantly.

Currently, there are two major markets selling a mix of products, including packaged food, meat and vegetables. According to the municipal authority, the two markets generate a total of about 5 m<sup>3</sup> of waste per day (Samaki market produces approximately 4.5 m<sup>3</sup> per day and the Deihoy market generates approximately 0.5 m<sup>3</sup>). The Samaki market disposes waste twice a day; once in the morning at 11:30 a.m. and again at 5 p.m. There are several pushcarts (as collection containers) placed at various gates or collection points around the markets. Market cleaning teams collect waste (mainly vegetables and leaves) and deposit it into the carts, which are then unloaded into a truck every day at 5:30 p.m.

### TOTAL WASTE GENERATION

Using an average of 0.5 kg per capita per day, the analysis indicates that a total of 17 tons of waste is generated daily. Of this, 11 tons are estimated to be organic waste. As noted previously, several establishments were not included in the analysis, and thus actual waste generation is assumed to be greater than what was calculated in the analysis.

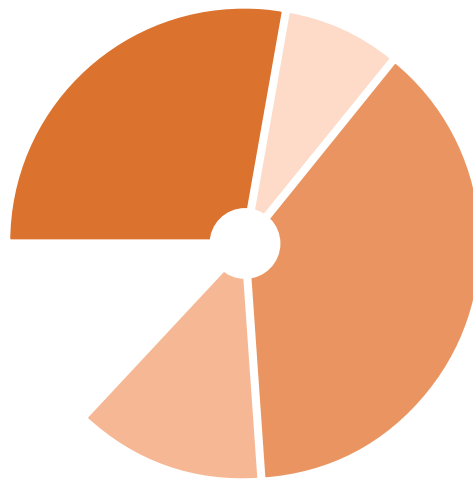




COMPOSITION OF HOUSEHOLD WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
38.1%	2.7%	26.0%	17.2%	16.0%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September 2011

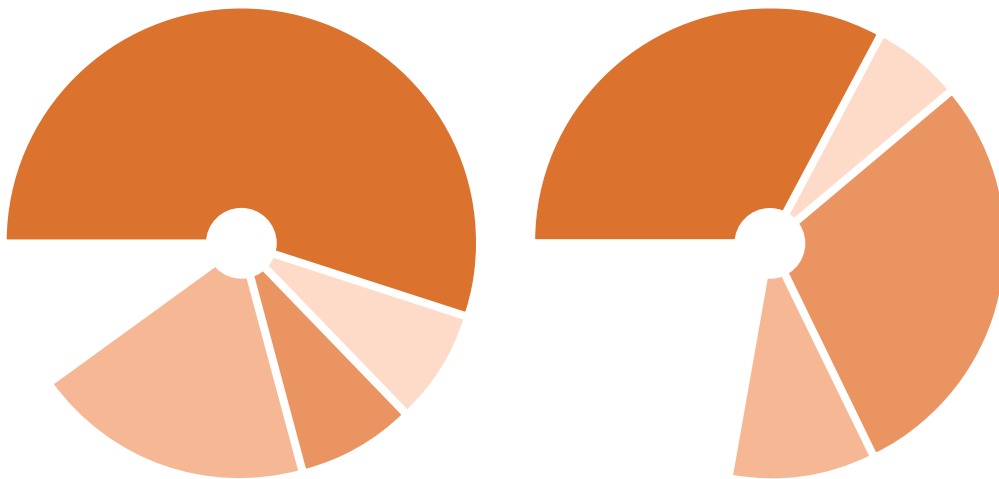


COMPOSITION OF SHOP AND OFFICE WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
28.0%	8.0%	38.0%	13.0%	13.0%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September 2011

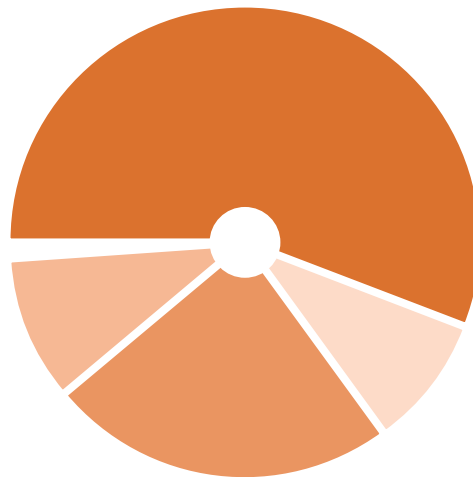




COMPOSITION OF GUESTHOUSE/HOTEL WASTE (A) AND RESTAURANT AND FOOD SHOP WASTE (B)

	Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
A	55.0%	8.0%	8.0%	19.0%	10.0%
B	33.0%	6.0%	29.0%	10.0%	22.0%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September 2011



COMPOSITION OF MARKET WASTE

Vegetables and kitchen waste	Paper	Grass and wood	Plastic	Others
56.0%	9.0%	24.0%	10.0%	1.0%

Others includes bone, textile, metal, rubber, leather, glass and ceramic / Source: Field Survey, September 2011

SUMMARY OF WASTE GENERATION IN KAMPOT

Places	Formula for calculation	kg/day	% Organic	Organic Waste (kg/day)
Domestic Waste	0.409*33,951	13,886	64	8,887
Shops/Offices and Institutions	2.8*697	1951.6	66	1,288
Restaurants and Food shops	9*23	207	62	128
Hotel/Guesthouses	4*42	168	63	105
Markets	Samaki	-	923	80
	Deihoy	102.51	103	
Total	-	17,238	-	11,229

Source: Field Survey, 2011

ESTIMATION OF TOTAL WASTE GENERATION IN KAMPOT

Total waste generation rate in City (kg/cap./day)	0.50
Total population in 2011 (person)	33,951
Total waste generated per day (kg)	16,975.5

Source: Field Survey, 2011

## 5 Findings from household survey and interviews with informal sector parties

### WASTE COLLECTION

A majority (70 per cent) of the interviewed households, which were located along the main roads, reported having access to the waste collection service, whereas 29 per cent of all interviewed households did not have the collection service at all. The tariff fee charged was in the range of 4,000–6,000 riel (\$1–\$1.50) per month. There was no complaint reported about the tariff, and willingness to pay for the service appears to be high. However, many respondents had limited or no knowledge about environmental impacts from improper waste disposal.

In terms of household responsibility for waste management, 81 per cent of the interviewed households said that female household members were directly in charge of waste disposal.

Nearly 50 per cent of the interviewed households reported that they pack and store waste in the house for collection vehicles, whereas 30 per cent said they dispose their waste in a public space or in the nearest water body. Others reported they burn their waste or drop it in a collection point near one of the main markets.

The survey also assessed people's perceptions of household waste separation. Some 80 per cent of respondents indicated that they were willing to separate waste if required. So far, there is no requirement for household waste separation. The remaining 20 per cent of respondents who did not separate waste said that they could possibly do so if they were given waste bins.

Interestingly, 98 per cent of respondents agreed that community participation was inevitably important to promote a sustainable local waste management system. They stated that villagers would work together to improve the environment of the

community. Some 91 per cent of respondents were in favour of forming a community-based organization to improve the current waste collection system and subsequently the environmental conditions. There was an apparent understanding of the links between keeping their community clean and improved health and environmental conditions of villagers.

### PREFERENCES FOR WASTE COLLECTION

The analysis on the preferred system for waste collection from households indicates that 96 per cent of the interviewed households would prefer to have door-to-door collection service rather than the current roadside collection service.

The interviewed households also were asked about their preferred time for door-to-door collection service and frequency. Some 51 per cent required the collection service at least once every two days, 18 per cent preferred daily collection service and 29 per cent asked for it once every three days. Some 64 per cent of the respondents preferred the morning for service provision, while the rest preferred the afternoon. Currently, some areas receive collection service in the morning and some in the afternoon.

### INFORMAL RECYCLING SYSTEM

As in other urban areas in Cambodia, informal recycling activities are very active in Kampot. Compostable waste (vegetable waste) is deposited into the dumpsite, and the waste pickers collect the recyclable material (plastics, aluminium cans, etc.) and sell it to local recycling shops. Five recycling shops were located in Kampot municipality during the study. Some waste pickers also collect recyclable waste from the roadsides, and others (with pushcarts) buy it from households or other waste pickers and sell it in bulk

to the recycling shops. The study found that the local recycling shops collectively purchase an average of 625 kg of recyclable material every day from the waste pickers.

The researchers were not able to obtain the price paid for recyclable material paid in the commercial market; the shop owners who were interviewed would not disclose the information. Once purchased, the recyclable material is cleaned and packed for export to neighbouring countries, especially Viet Nam. According to the shop owners, the price of recyclable material increases after cleaning and packing.

The researchers counted 32 waste pickers involved in recycling activities (9 males and 23 females). Young children were also observed engaging in

such activities. In the interviews, the waste pickers disclosed that children tend to collect the recyclable waste to sell in order to buy food rather than for any other purpose, including savings.

The reported income of the waste pickers varied, depending on their daily working hours and their resources, such as financial capital and ownership of a pushcart. Waste pickers who use a bag to collect waste material earn 8,000–14,000 riel per day (\$2–\$3.5), compared with the 15,000–20,000 riel per day (\$3.75–\$5) of waste pickers who purchase recyclable waste from others and then sell to the recycling shops. In this case, the latter act as middlemen who purchase (but who don't collect recyclable waste) recyclable material at a lower price and sell at a higher price to the shops.



## 6 Conclusions and forthcoming plans

With Kampot emerging as a popular tourist destination, the incentive for keeping the town clean to attract foreign tourists is increasingly important. During the course of the study and subsequent discussions, the researchers found strong support and interest from the provincial and municipal authorities for making improvements on solid waste management.

### WASTE GENERATION

There are no official data kept on waste generation in Kampot. This report provides the results of the first field research on waste generation in the municipality. According to the survey conducted by CSARO, the total amount of waste generated in Kampot is about 17 tons, of which at least 65 per cent is organic material. Although the survey was conducted with a relatively large sample, the figures presented here are estimates; it would be valuable to confirm the results with another waste generation and composition survey. Previous reports cited higher estimates of waste generation, but they were based on interviews rather than actual data collection.

Given the estimates on waste generation, a more comprehensive, long-term waste generation study as well as improved record keeping on collection is encouraged to enable the provincial authority to better plan for the future.

### WASTE COLLECTION

Collection coverage is still limited, with only 36 per cent of households receiving such service. Collection only covers the markets, businesses in the town centre and households situated along main roads.

Both GAEA and the municipal authorities aim to increase collection; thus, it will be important to also

increase the monitoring of the services and the collection of fees. The household survey indicates that households are willing to pay a collection fee if they receive regular door-to-door service. Linking improved service and collection fees are important. It is encouraging that households show willingness to participate in solid waste management activities, including the separation of waste.

At the moment, GAEA is collecting fees from households and businesses. However, there is no data on how many pay the fee or their satisfaction with the quality of service. An improved system for data recording would provide a better understanding of the situation.

### DUMPSITE

Increased collection will also put more pressure on the dumpsite. Currently, there is no proper management or oversight of the dumpsite operations. According to observations by the CSARO researchers, some medical waste was collected and transported to the dumpsite. It is positive that the Kampot authorities have designated land for a new dumpsite and are trying to identify sources of financing for constructing a sanitary dumpsite. A new dumpsite with better management and oversight would reduce the risk of pollution from solid waste.

### POTENTIAL FOR COMPOSTING AND RECYCLING

As in other urban areas in Cambodia, the organic proportion of the waste is large and therefore suitable for composting. The first focus for composting activities would be the market waste, followed by waste from restaurants and food shops. Working with hotels and restaurants to reduce the amount of plastic packaging, which constitutes a large proportion of the waste, would also reduce the amount of waste deposited into the dumpsite.

### THE WAY FORWARD

Based on the results of the study as well as subsequent discussions with the provincial and municipal government authorities, ESCAP and CSARO have agreed to initiate an integrated resource recovery centre (IRRC) in Kampot. The IRRC will initially treat waste from the main markets.

The IRRC will be operated as a partnership between CSARO, the local government and GAEA. CSARO will be responsible for the IRRC operations, GAEA for the collection and transportation of separated organic waste and the provincial and municipal authorities will promote source separation and oversee the activities. The IRRC will be located next to the planned wastewater treatment plant in Sangkat Trang Ampel. The IRRC is expected to be operating by August 2012.

The project will also initiate activities to promote source separation of waste. Initially, this will be done in the central market and then later will expand to restaurants and one commune on a pilot basis. At the same time, the municipality will also carry out campaigns for reducing, recycling and reusing waste in schools and public institutions.



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