King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste Monitoring Program

2002/2003 Comprehensive Waste Stream Characterization and Transfer Station Customer Surveys – Final Report

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Executive Summary

1.1 OVERVIEW

Project Purpose & Background

Each year, residents and businesses in King County throw away nearly 1 million tons of garbage, also known as mixed municipal solid waste.[1] What are people disposing, where does this waste come from, and where does it go? Since 1990, the King County Solid Waste Division has conducted its **Waste Monitoring Program** to answer these questions and learn more about the disposed waste. To help King County provide efficient and effective services, plan for future needs, and track progress towards its recycling goals, the Waste Monitoring Program includes waste characterization studies, customer surveys, as well as other studies as needed.

- **Waste characterization studies** analyze the waste stream by collecting and sorting samples of loads from customers bringing materials to facilities in King County. These studies help the county understand both the overall waste stream and its subsets, such as the materials disposed from single-family homes, apartments, businesses, and those who haul their own waste. Studying the items thrown away also helps target materials, such as food waste and other organics, for potential future efforts to increase recycling.
- **Customer surveys** of the drivers bringing loads to waste facilities track the types of vehicles using the sites and ask questions regarding the type of waste and its origins. These surveys help the county understand its customers and provide effective service.

Between June 2002 and May 2003, the Waste Monitoring Program conducted 6,381 customer surveys and sorted 369 waste loads at the 12 waste facilities in King County. This report presents the results of those customer surveys and waste sorts.

Study Methods

The 2002-2003 study of waste composition and customer use at King County waste facilities involved four major steps.

- **Develop a sampling plan.** Waste sampling and customer surveys were scheduled for each waste facility on different randomly selected days throughout the year. Waste samples were allocated according to collection type (commercially collected or self-hauled), source (residential or nonresidential), and vehicle type.

[1] This figure excludes wastes originating within the city of Seattle, which manages its solid waste separately from the rest of King County, and the city of Milton, which is part of Pierce County's solid waste system.

- **Capture and sort waste samples.** For the waste sampling, as vehicles entered each facility, a "gatekeeper" randomly selected waste loads according to the sampling plan. During the study, 369 waste samples were sorted into 73 distinct material types.
- **Survey waste facility users.** On separate days, customer surveys of drivers bringing loads to waste facilities gathered information such as the vehicle type, collection type, and source of the material. In the study, 6,381 customer surveys were conducted.
- **Analyze data and prepare report.** Data from waste sorting and customer surveys were entered into customized databases, compiled, and summarized. Waste composition results were calculated using a weighted average based on customer survey data and total waste tonnages.

Chapter 2 provides additional information on the project purpose, background, and methods.

Understanding King County's Waste Stream & Facility Customers

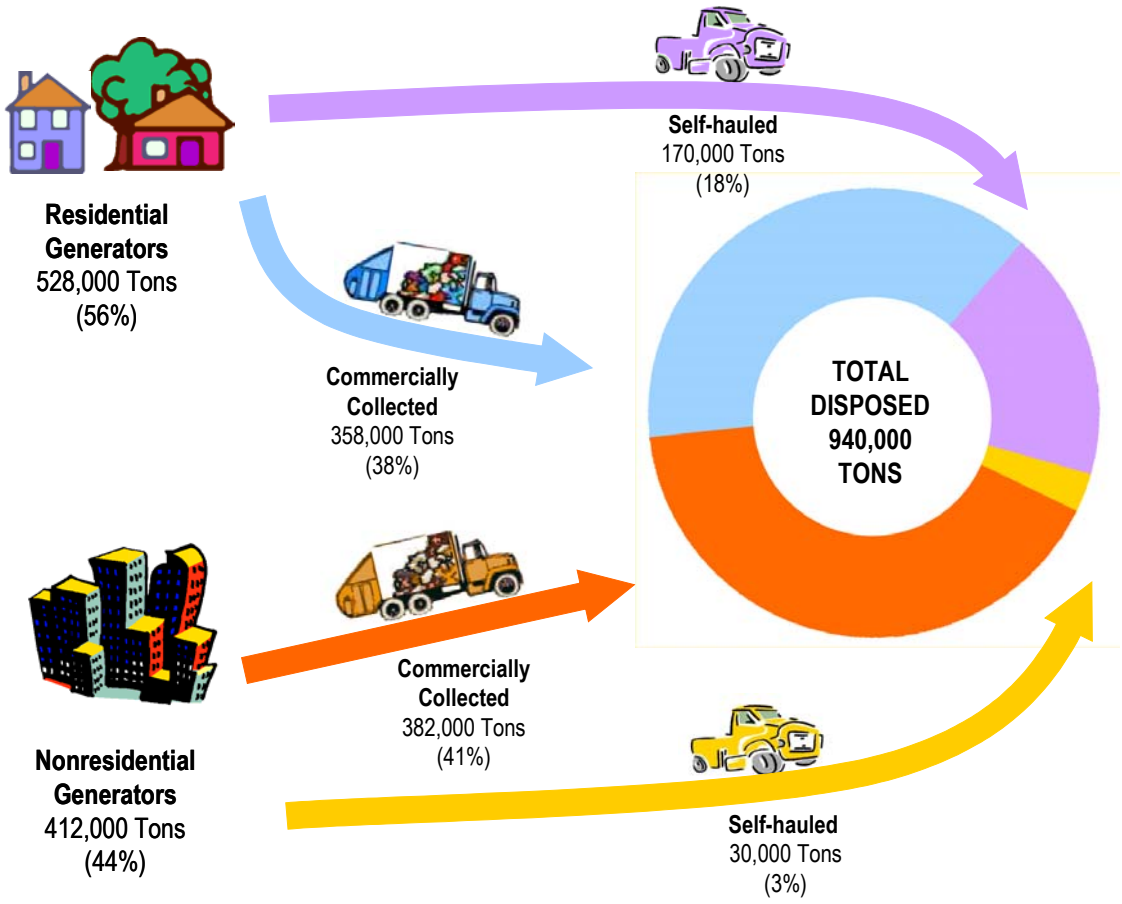
To manage its current waste effectively and to plan for the future, King County needs to understand both its existing solid waste stream and its customer base of waste facility users. In analyzing waste materials and customers, waste flows are often divided into various substreams, according to where the waste comes from and who brings it to the transfer stations and drop boxes. Such analysis is useful in waste management planning because the different substreams may have different waste types, user profiles, and public programs designed to reach target customers.

In this study, waste loads and customers surveyed are first divided according to the source, or generator, of the waste: **residential** or **nonresidential** substreams. Then wastes are further categorized according to how materials are delivered to waste sites: **commercially collected** by waste hauling companies or **self-hauled** by residents or other businesses that bring loads to waste facilities.[2]

[2] Commercial haulers are firms that contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area. The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. In the current study, King County included these waste deliveries with the commercially hauled loads; in previous study periods, these wastes were considered self-hauled. Self-hauled loads are categorized as residential or nonresidential according to the source of the load, not the type of hauler. For example, some companies collect waste from homes or businesses, but they are not the franchised haulers that deliver commercially collected waste to transfer stations. These loads are considered self-hauled residential if the waste is produced from homes, even though a company, not the residents, delivers the material to a waste facility.

Figure 1-1 illustrates how much waste each of the various substreams – residential and nonresidential, commercially collected and self-hauled – contributed to the 940,000 tons of solid waste disposed in King County during the study year. Chapter 2 provides additional discussion of the waste stream and its substreams beginning on page 17.

Figure 1-1. Waste Substreams & Tonnages in 2002-2003



1.2 KEY WASTE CHARACTERIZATION FINDINGS

During the waste characterization study, the project team collected and analyzed 369 randomly selected waste loads from 12 waste facilities in King County. The following section summarizes the key results first for the **overall** waste stream, and then for each of the four major substreams: **residential**, **nonresidential**, **commercially collected**, and **self-hauled** waste.

The waste characterization study divided each waste sample into 73 individual materials, grouped into eight main material classes, as follows:[3]

- ***Paper*** – including newspaper, cardboard (OCC), and other paper;
- ***Plastic*** – including plastic bottles, other containers, film, and bags;
- ***Organics (wood/yard/food)*** – including lumber, stumps, yard waste, and food waste;
- ***Other Organics*** – including clothes, carpet, tires, diapers, and animal waste;
- ***Glass*** – including clear, green, and brown containers as well as other glass;
- ***Metal*** – including aluminum cans, tinned food cans, and other metal;
- ***Other Waste*** – including construction and demolition wastes and appliances; and
- ***Household Hazardous*** – including used oil, batteries, paint, solvents, and TVs.

The waste composition results show that organics and paper continue to offer excellent opportunities for increased recycling, composting, and waste reduction efforts. The largest categories of waste were similar across the four substreams, with organics representing the largest share, at more than 30% of each substream. Paper comprised the second largest share (21-27%) of each substream except self-hauled waste, which contained less than half as much paper (10%) as the other substreams.

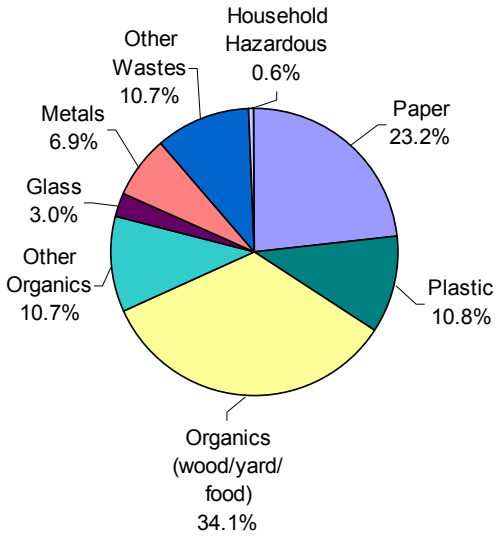
[3] Only selected materials are listed here as examples; please see Table 3-4 and Appendix B for more details.

Overall Waste

During the study period from June 2002 to May 2003, King County disposed of about 940,000 tons of mixed municipal solid waste. Figure 1-2 shows how this waste is divided among the eight major material classes, based on the percentage by weight of the overall tonnage. The following list highlights the material classes contributing the largest shares of the overall waste stream.

- ***Organics (wood/yard/food)***, comprising more than one-third of the overall waste stream, represented the largest group and an important composting opportunity.
- ***Paper*** constituted the second largest group, and much of this material is either recyclable or compostable.
- ***Plastic***, ***Other Organics***, and ***Other Wastes*** comprised the next largest shares of the overall waste stream. Viable recycling opportunities are emerging for some of these materials, such as plastic film and bags used in the manufacture of plastic/wood composite materials.

Figure 1-2. Waste Composition – Overall Disposed Waste
(n=369)[4]



[4] Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see *Interpreting the Results* on page 19. The "n=" figures show the total number of waste samples used in analyzing a particular waste stream.

Source Type: Residential or Nonresidential

To identify differences in wastes from homes or businesses and institutions, the overall waste stream was divided on the basis of who produced the waste. The study classified waste loads into one of two major generator types: residential or nonresidential sources.

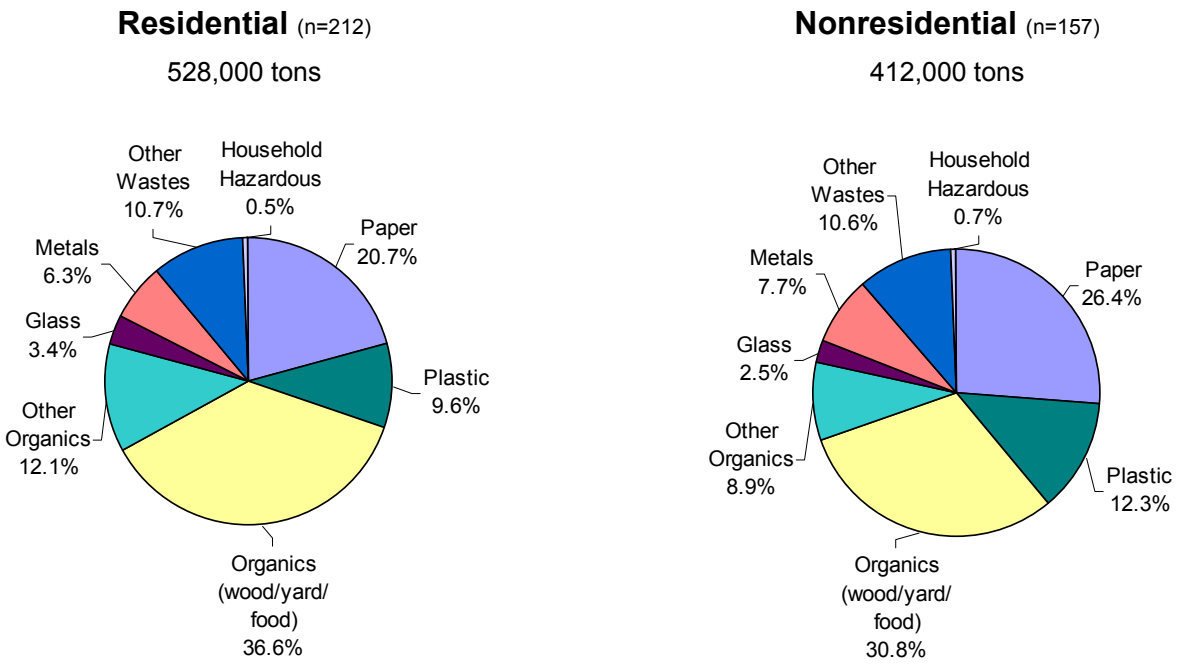
- The **residential** substream includes wastes that are either commercially collected or self-hauled from residential sources, including both single-family homes and multi-family buildings. This substream accounted for more than 528,000 tons (56%) of King County waste during the study period.
- The **nonresidential** substream includes wastes that are either commercially collected or self-hauled from nonresidential sources, such as businesses and public institutions.[5] Nonresidential waste totaled an estimated 412,000 tons (44%).

Figure 1-3 shows the proportion of the eight main classes of material in both the residential and nonresidential substreams. The following list describes the largest portions of these two substreams.

- ***Organics (wood/yard/food)*** represented the largest share in **both** the residential (37%) and nonresidential (31%) substreams.
- ***Paper*** was the second largest portion of **both** the residential (21%) and nonresidential (26%) substreams.
- ***Plastics*** and ***Other Organics*** also represented significant shares of **both** substreams.

[5] In addition, this substream includes mixed loads that contain both nonresidential waste (usually business waste) and residential waste (usually multi-family waste). Commercial waste haulers typically classify these mixed loads as "nonresidential"; for consistency, these mixed loads are included in the nonresidential substream in this study.

Figure 1-3. Waste Composition – Residential and Nonresidential Substreams



Collection Type: Commercially Collected or Self-hauled Waste Loads

To examine differences in wastes brought by commercial waste collectors or self-haulers, the waste characterization study also divided the overall waste stream on the basis of who delivered the loads to waste facilities. The study identified waste loads according to one of two collection types: commercially collected or self-hauled waste.

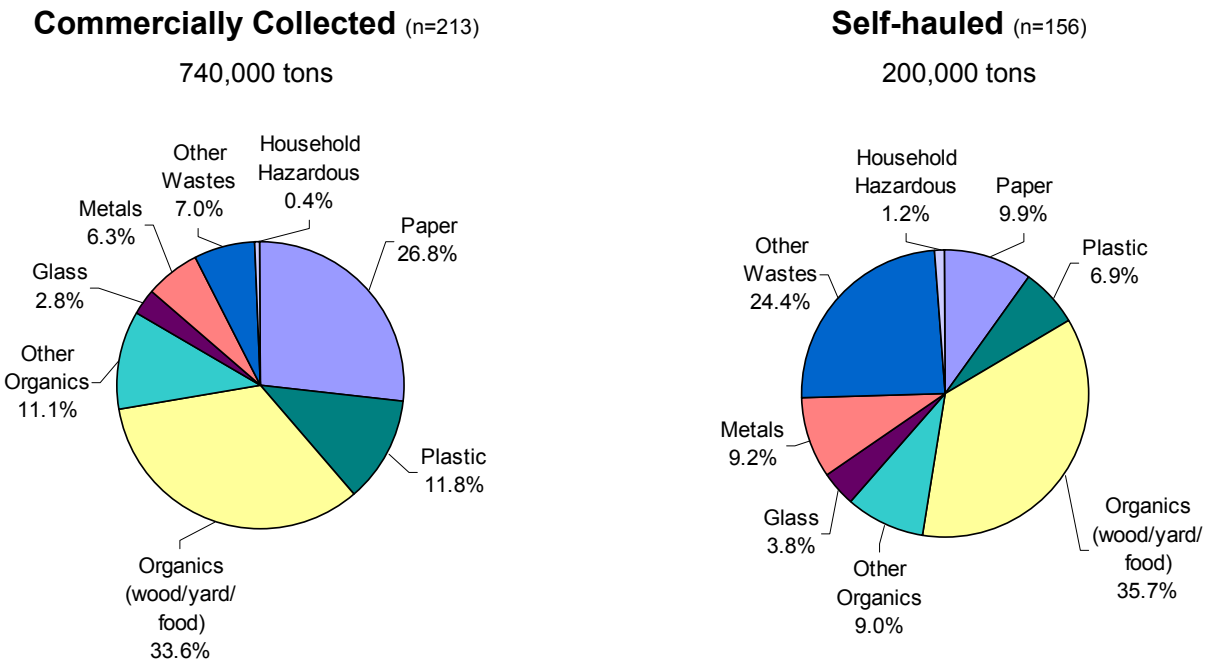
- The **commercially collected** substream includes waste that commercial haulers deliver to waste facilities. Commercial haulers are firms that contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area.[6] This substream accounted for more than 740,000 tons (79%) of King County waste during the study year.
- The **self-hauled** substream includes materials from residents or businesses that bring loads to waste facilities. Self-hauled waste totaled nearly 200,000 tons (21%).

Figure 1-4 shows the proportion that the eight main material classes comprise in both the commercially collected and self-hauled substreams. The following list describes similarities and differences in the largest material classes in these two substreams.

- ***Organics (wood/yard/food)*** accounted for more than a third of **both** the commercially collected (34%) and self-hauled (36%) substreams.
- ***Paper*** represented the second largest portion of the **commercially collected** (27%) substream, but it was a much smaller fraction of self-hauled waste (10%).
- Among **self-hauled** waste, the catchall category ***Other Wastes*** – which includes non-wood construction/demolition wastes and furniture/mattresses – was the second largest material group.

[6] The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. In the 2002-2003 study, King County included these waste deliveries with the commercially hauled loads.

Figure 1-4. Waste Composition – Commercially Collected and Self-hauled Substreams



1.3 KEY CUSTOMER SURVEY FINDINGS

During the customer survey study, the project team conducted 6,381 interviews with customers at 12 waste facilities in King County to determine who uses the sites and why. The following section summarizes the key results of these customer surveys, and Chapter 4 provides the full customer survey results.

Between June 2002 and May 2003, King County recorded approximately 848,000 waste transactions at its 10 public facilities. Loads reported from private facilities and direct hauls to the Cedar Hills landfill accounted for about 13,000 additional loads, for a total of nearly 861,000 transactions during the study year. Unless otherwise specified, the figures below represent the portion of waste transactions (customers, loads, trips, or users) surveyed at waste facilities – *not* the weight or tonnages of the waste they delivered.

- **Self-hauled loads represented 85% of the customers** surveyed at waste facilities, though they brought only 21% of the total waste by weight. Passenger vehicles comprised nearly four-fifths (79%) of the surveyed traffic at waste facilities.[7]
- **Mixed garbage accounted for 68% of all loads** that users surveyed brought to waste facilities; yard waste accounted for 13% and construction and demolition materials represented 19%.
- **Self-hauled loads came primarily from residences** (92%), while the majority of commercially collected loads originated from nonresidential sources (57%).
- **Most residential self-haulers subscribed to curbside garbage service** (67%), but the third that did not subscribe reported bringing loads to waste facilities 70% more often than the subscribers.
- **"Cleaning home or workplace"** (22%) was the top reason for self-hauling waste reported for both residential and nonresidential loads.

[7] Passenger vehicles include autos, pick-up trucks, and sport-utility vehicles.

1.4 WASTE CHARACTERIZATION CHANGES OVER TIME

The current waste characterization study also involved a comparison of waste composition results with the previous study, conducted in 1999-2000, as well as results from a decade prior, the 1993-1994 study. Key changes are summarized below, and Chapter 5 provides a full discussion.

- **Paper materials have decreased in most commercially collected wastes** since 1993-1994, with statistically significant reductions in cardboard and Kraft paper and other curbside paper in both single-family and nonresidential loads. Among nonresidential loads, cardboard and Kraft paper also showed a drop since 1999-2000. Disposal of other curbside paper increased in multi-family loads, however.
- **Organics show an apparent increase in nonresidential commercially collected** loads since both previous studies.
- **Construction and demolition materials appear to have increased in self-hauled** waste loads since 1999-2000.

Chapter 2
Introduction

2.1 PROJECT PURPOSE & BACKGROUND

Each year, residents and businesses in King County throw away nearly 1 million tons of garbage, also known as mixed municipal solid waste (MMSW).[8] What are people disposing, where does this waste come from, and where does it go? The King County Solid Waste Division's Waste Monitoring Program was started in 1990 to answer these questions and learn more about the disposed waste. This ongoing program seeks to characterize King County's waste disposal and to understand the customers using its waste facilities. Monitoring the waste stream helps the county provide effective and efficient services, plan for future needs, and track progress towards its recycling goals.

Waste Management in King County

The county's waste monitoring efforts are designed to track its complex waste management system. Private waste management companies collect much of the waste from homes and businesses. Some individuals and companies also choose to haul their own waste, either occasionally or on a regular basis. Most of King County's solid waste destined for disposal first goes to one of 12 facilities: eight county-owned transfer stations, two county-owned drop boxes, or two privately owned transfer stations. The county-owned transfer stations include Algona, Bow Lake, Enumclaw, Factoria, First Northeast, Houghton, Renton, and Vashon. The two drop boxes are located at Cedar Falls and Skykomish. The private transfer stations are both located in Seattle: Waste Management's Eastmont facility and Allied's Third & Lander site. From these transfer stations and drop boxes, trucks haul King County's waste to the Cedar Hills Regional Landfill for disposal.

King County's Waste Monitoring Program

The Waste Monitoring Program assesses how much and what type of materials both residents and businesses dispose. To help King County provide services and plan for the future, this program includes waste characterization studies, customer surveys, as well as other studies as needed.

[8] This figure excludes wastes originating within the city of Seattle, which manages its solid waste separately from the rest of King County.

- **Waste characterization studies** analyze the waste stream by collecting and sorting samples of loads from customers bringing materials to facilities in King County. These studies help the county understand both the overall waste stream and its subsets, such as the materials disposed from single-family homes, apartments, businesses, and those who haul their own waste. Studying the items thrown away also helps target materials, such as food waste and other organics, for potential future efforts to increase recycling.
- **Customer surveys** of the drivers bringing loads to waste facilities track the types of vehicles using the sites and ask questions regarding the type of waste and its origins. These surveys help the county understand its customers and serve them effectively.

Between June 2002 and May 2003, the Waste Monitoring Program conducted 6,381 customer surveys and sorted 369 waste loads at the 12 waste facilities in King County. During this study period, King County disposed of 940,000 tons of solid waste. This report presents the results of those customer surveys and waste sorts. Cascadia Consulting Group served as the primary contractor for this research. Table 2-1 shows the number of customer surveys conducted and waste loads sampled since 1990 as part of King County's Waste Monitoring Program.

Table 2-1. Customer Surveys Conducted & Waste Loads Sampled[9]

Study Period	Customer Surveys	Waste Samples
2002-2003	6,381	369
2001	7,050	–
1999-2000	7,809	412
1998	22,645	–
1997	12,610	–
1995-1996	11,132	630
1993-1994	12,523	568
1991	–	569
TOTAL	**80,150**	**2,548**

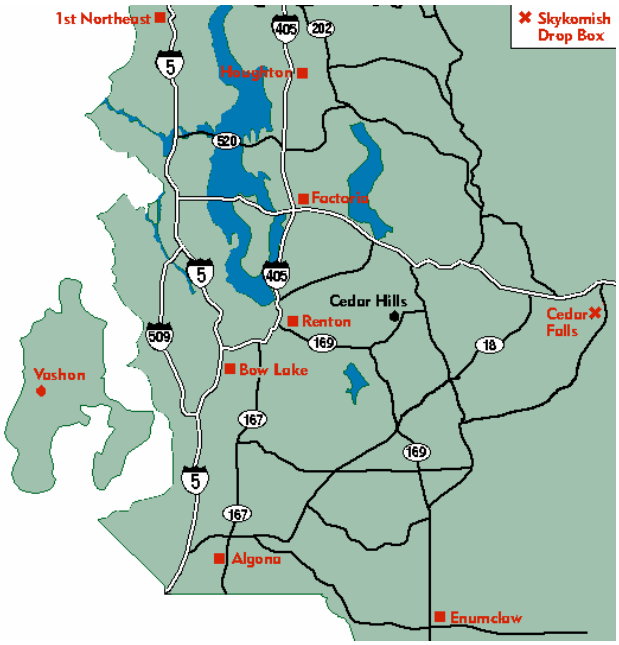
2.2 SUMMARY OF METHODS

The following section provides an overview of the 2002-2003 study methodology. This study of waste composition and customer use involved four major steps. Please see Appendix A for a detailed description of the waste sampling methodology and Appendix G for the surveying methodology.

[9] Since 1998, the number of surveys and samples obtained during each study period have decreased due to budgetary constraints.

Step 1. Develop Sampling Plan

- Samples were allocated by collection type (commercially collected or self-hauled) and then according to source or generator (residential or nonresidential) and vehicle type (packers or drop boxes for the commercially collected substream, passenger vehicles or other large vehicles for the self-hauled substream).
- A sampling schedule was constructed for the study period of June 2002 to May 2003, consisting of two or three sampling days at each transfer station during the year. Sampling days were randomly selected to assure a representative distribution across the days of the week and weeks of the month. Sampling took place at each of the county's eight public transfer stations and two private transfer stations. The Skykomish and Cedar Falls drop boxes were scheduled for analysis on the sampling days at the Houghton and Factoria transfer stations, respectively.



King County transfer stations and drop boxes (private facilities not shown)

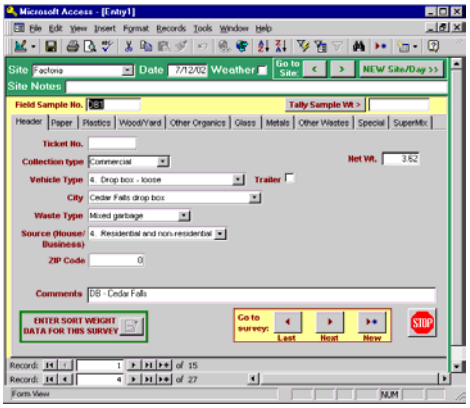
Sampling crew sorting waste into material types

Step 2. Capture & Sort Samples

- As each vehicle entered the facility, a "gatekeeper" charged with selecting vehicles for sampling interviewed the driver to determine the substream of the waste load. If selected for sampling, a front loader operator would scoop a portion of the waste dumped from the vehicle. About 250 pounds of the waste was placed on a tarpaulin for sorting.
- For this study, a total of 369 samples were sorted into 73 distinct material types, such as *high-grade printing paper* or *clear glass containers*.

Step 3. Survey Incoming Vehicles

- Separate from the sampling process, each transfer station (except for the Vashon facility) was surveyed one day per quarter, and each drop box was surveyed twice during the study period. Survey days were identified through a systematic process designed to ensure that over the yearlong study all facilities would be surveyed on different days throughout the week.
- The surveyor gathered information from the driver such as the vehicle type, collection type (commercially collected or self-hauled), category of waste brought for disposal (e.g., mixed garbage, yard waste, construction/demolition), and source or generator of the material (residential or nonresidential).



Data-entry form in customized database

Step 4. Analyze Data & Prepare Report

- Each month, the sort and survey data were entered into two separate customized databases and then were reviewed for data entry errors.
- At the conclusion of the study, waste composition estimates were calculated by aggregating waste sample data using a *weighted average* procedure. The calculations for the weighted averages are based on the surveys as well as waste tonnage data that the King County Solid Waste Division provided.

Table 2-2 shows the number of surveys and samples that were obtained from each facility during the study.

Table 2-2. Total Number of Waste Samples and Customer Surveys June 2002 – May 2003[10]

	Total Samples	Total Surveys
Algona	43	930
Bow Lake	45	1216
Cedar Falls	1	100
Enumclaw	30	394
Factoria	43	749
First NE	42	928
Houghton	34	986
Renton	29	631
Skykomish	1	15
Vashon	30	106
Subtotal	**298**	6,055
Private Facilities	*71*	*326*
Total	**369**	**6,381**

2.3 UNDERSTANDING THE WASTE STREAM

To understand the overall solid waste stream better, the total waste can be divided into various **substreams**, according to where the waste comes from and who brings it to the waste facilities. Such analysis is useful because the different substreams often have different waste types, user profiles, and public programs for reaching customers.

Substreams are identified according to such factors as the source, or generator, of the waste (residential or nonresidential) as well as how materials are delivered to waste sites (commercially collected or self-hauled). The sources of waste and types of delivery are defined as follows:

[10] The smaller number of samples at Houghton resulted from unanticipated operational difficulties during the February sampling. This situation had little to no impact on the final study results.

- **Residential waste** comes from single-family or multifamily dwellings.
- **Nonresidential waste** comes from businesses, schools, government offices, and other institutions that are not residences.
- **Commercial haulers** are firms that contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area.[11]
- **Self-haulers** are residents or businesses that bring waste themselves to transfer stations or drop boxes.[12]

In this study, waste loads and customers surveyed are first divided into residential and nonresidential categories. Then those categories are further divided between commercially collected and self-hauled waste, as shown in Figure 2-1. In some cases, loads contain a mixture of waste from residential and nonresidential sources, but these "mixed loads" represent only a small portion of the total waste.

Figure 2-1. Substream Definitions

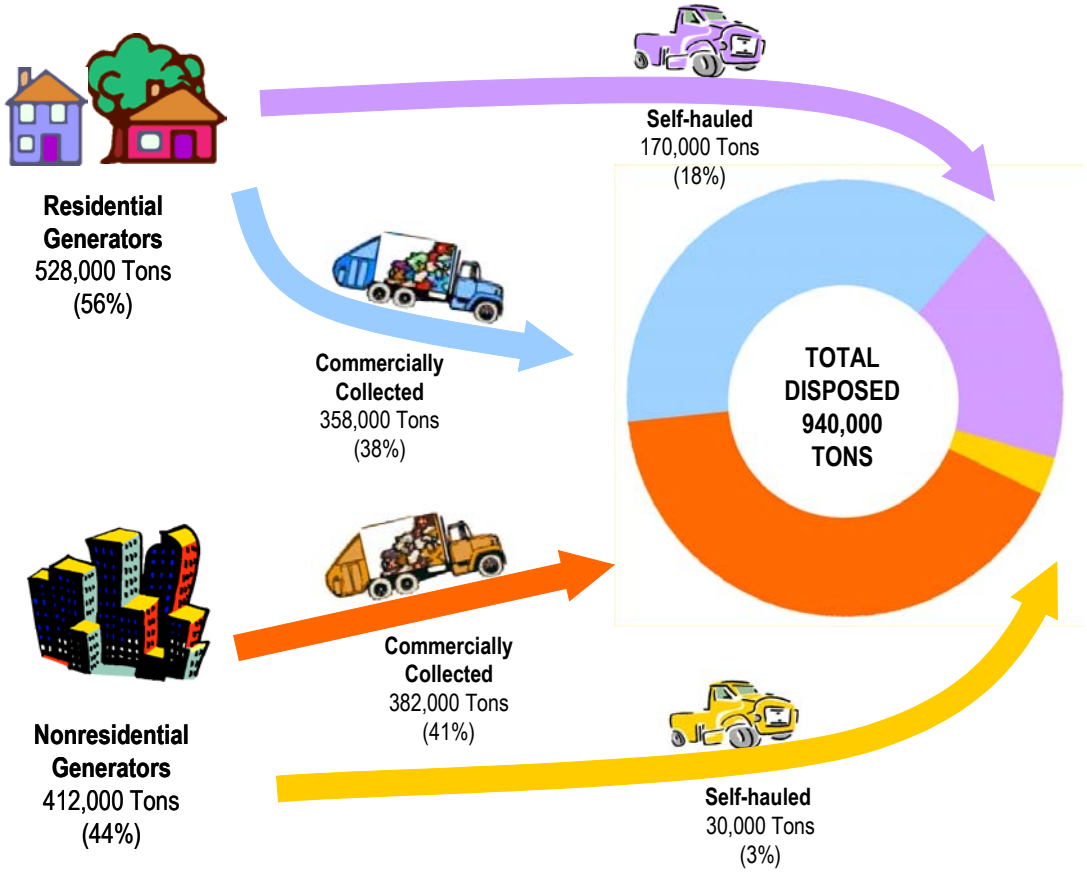
	Commercially Collected	Self-hauled
Residential Waste	Commercially collected waste from residential sources	Self-hauled waste from residential sources
Nonresidential Waste	Commercially collected waste from nonresidential sources	Self-hauled waste from nonresidential sources

[11] The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. In the 2002-2003 study, King County included these waste deliveries with the commercially hauled loads.

[12] Self-hauled loads are categorized as residential or nonresidential according to the source of the load, not the type of hauler. For example, some companies collect waste from homes or businesses, but they are not the franchised haulers that deliver commercially collected waste to transfer stations. These loads are considered self-hauled residential if the waste is produced from homes, even though a company, not the residents, delivers the material to a waste facility.

In this study, the composition of the waste in each substream was analyzed separately. To describe King County's overall waste stream, the waste composition estimates from these substreams were combined and weighted according to each substream's contribution to the total waste stream. Figure 2-2 illustrates how much waste the various substreams – residential and nonresidential, commercially collected and self-hauled – contributed to the 940,000 tons of solid waste disposed in King County in 2002-2003.

Figure 2-2. Waste Substreams & Tonnages in 2002-2003



2.4 INTERPRETING THE RESULTS

Means and Error Ranges

The data from the sorting process were treated with a statistical procedure that provided two kinds of information for each of the material categories:

- the percent-by-weight estimated composition of waste represented by the samples examined in this study, and
- the degree of precision of our composition estimates.

All estimates of precision were calculated at the 90% confidence level. The equations used in these calculations appear in Appendix C.

The example below illustrates how the results can be interpreted. The example indicates that the best estimate of the amount of newspaper present in the universe of waste sampled is 2.7%. The term 0.3% reflects the precision of the estimate. When calculations are performed at the 90% confidence level, we are 90% certain that the mean estimate for newspaper is between 2.7% - 0.3% and 2.7% + 0.3%. In other words, we are 90% certain that the mean lies between 2.4% and 3.0%.

Waste Material	Mean	+ / -
Newspaper	2.7%	0.3%

Rounding

When interpreting the results presented in the tables and figures in this report, it is important to consider the **effect of rounding**.

To keep the waste composition tables and figures readable, estimated tonnages are rounded to the nearest ton, and estimated percentages are rounded to the nearest tenth of a percent. Due to this rounding, the tonnages presented in the report, when added together, may not equal the subtotals and totals shown, which were calculated using more precise percentages. Similarly, the percentages, when added together, may not equal the subtotals or totals shown, which represent the more precise percentages.

It is important to recognize that the tons shown in the report were calculated using the more precise percentages. Therefore, using the rounded percentages to calculate tonnages yields quantities that are less precise than those shown in the report.

An example will help illustrate the effects of rounding in the report. The rounded percentage for *food wastes* used in Table 3-3 and Table 3-4 is shown as 20.0% of the overall waste stream. The more precise percentage was 19.9806363916006%. Thus, adding the rounded percentages in the tables may not yield the subtotals or totals shown, which are based on the more precise percentages.

If the rounded percentage for *food wastes* in Table 3-3 and Table 3-4 were used to calculate the tonnage, it would yield the following: 20.0% x 940,032 (the total tonnage) = 188,006.4 tons. However, if the more precise percentage for this material is used, it yields the following: 19.9806363916006 % x 940,032 (the total tonnage) = 187,824.375884691 tons, or 187,824 tons when rounded to the nearest ton. It is the more precise tonnage of 187,824 that is used in the two tables.

2.5 REPORT OUTLINE

This report on the waste sampling and customer surveys conducted in 2002-2003 is organized as follows:

- **Executive Summary – Chapter 1** provides an overview of study methods and key findings.
- **Introduction – Chapter 2** describes the Waste Monitoring Program's purpose and background, summarizes the study methods, explains the disposed waste streams analyzed in the current study, discusses how to interpret the results, and provides an outline of the report.
- **Waste Composition Results – Chapter 3** summarizes the findings of the waste characterization. Results include both overall tonnages and various substreams, including waste composition tables detailing the amounts of 73 distinct materials, pie charts of key material categories, and "top 10" lists of the major materials disposed.
- **Customer Survey Results – Chapter 4** shows the results of the customer surveys, including vehicle types, waste types, generator types, geographic origins, and other information gathered from waste facility users.
- **Comparisons with Previous Studies – Chapter 5** compares the findings of the current study with the previous study, conducted in 1999-2000, and with results from a decade ago, from the 1993-1994 study.
- **Appendices** present additional information on the waste composition and customer survey studies, including field forms, methodologies, and more detailed data tables.

Chapter 3
Waste Composition Results

3.1 Waste Composition Overview & Key Findings

During the study period from June 2002 to May 2003, King County disposed of about 940,000 tons of mixed municipal solid waste. In the study, the project team collected and sorted 369 randomly selected waste loads from waste facilities in King County. The waste characterization effort divided this overall waste stream into 73 individual materials, grouped into eight main material classes, as follows (see Table 3-4 and Appendix B for a complete listing and description of the materials and classes):[13]

- ***Paper*** – including newspaper, cardboard (OCC), and other paper;
- ***Plastic*** – including plastic bottles, other containers, film, and bags;
- ***Organics (wood/yard/food)*** – including lumber, stumps, yard waste, and food waste;
- ***Other Organics*** – including clothes, carpet, tires, diapers, and animal waste;
- ***Glass*** – including clear, green, and brown containers as well as other glass;
- ***Metal*** – including aluminum cans, tinned food cans, and other metal;
- ***Other Waste*** – including construction and demolition wastes and appliances; and
- ***Household Hazardous*** – including used oil, batteries, paint, solvents, and TVs.

The following chapter presents the major findings of this analysis. Appendix A provides detail on the waste sampling methodology and Appendix C details the waste composition calculations. Appendix D presents detailed composition tables for the substreams presented in the following sections. Appendix E provides waste composition analysis for the commercially collected residential single-family, multifamily, and mixed single-family and multifamily substreams.

The section below describes how the overall waste stream is divided into smaller substreams for additional analysis. Next waste composition results and figures are presented for the overall waste stream as well as for commercially collected and self-hauled waste. Each of these three sections is then divided into residential and nonresidential sources.

Table 3-1[14] shows the amount of waste brought to each of King County eight transfer facilities and two drop boxes during the study period. Of the total tonnage disposed,[15] roughly 671,000 tons were delivered to county facilities while the remaining 269,000 were

[13] Only selected materials are listed here as examples; please see Table 3-4 and Appendix B for more details.

[14] Data in Table 3-1 were obtained from King County solid waste facility transaction data. While this table includes tonnage data for private waste facilities and regional direct waste loads to the Cedar Hills landfill, all other tables in this chapter include waste composition data from only King County's 10 transfer stations and drop boxes.

[15] This study does not include about 4,707 tons of waste self-hauled to the Cedar Hills landfill.

handled by private facilities.[16] Of the county facilities, the Houghton transfer station managed the largest share with 159,000 tons, or 17% of the County's total tonnage. Tons of waste to Skykomish represented the smallest share with 500 tons, or less than 1% of the total King County stream.

Table 3-1. Annual Disposed Tons
June 2002 – May 2003[17]

	Annual Tons	Pct. of Total
Algona	112,828	12%
Bow Lake	150,576	16%
Cedar Falls	4,467	0%
Enumclaw	32,059	3%
Factoria	91,900	10%
First NE	61,828	7%
Houghton	159,007	17%
Renton	54,264	6%
Skykomish	502	0%
Vashon	8,201	1%
Subtotal	**675,632**	**72%**
Private Facilities and Regional Direct	*264,400*	*28%*
Total	**940,032**	**100%**

[16] *Private facilities*, or adjunct transfer stations, refer to privately owned and operated collection and transportation facilities authorized by King County to receive, consolidate and deposit mixed municipal solid waste into larger transfer vehicles for transport to and disposal at County authorized disposal sites. *Regional direct waste* refers to any solid waste generated and collected in King County and transported to the Cedar Hills landfill by conventional long-haul transfer vehicles from solid waste transfer stations or intermediate processing facilities permitted by Public Health – Seattle & King County as provided for in KCC 10.08.090 and the Board of Health's regulation. Both definitions originate from the *King County Comprehensive Solid Waste Management Plan, Glossary.*

[17] Algona was closed for construction from September through November 2002. During this time vehicles were diverted primarily to Bow Lake for disposal. Additionally, First Northeast experienced increased vehicle traffic from mid-March to May 2003 due to the closure of a nearby Snohomish County transfer station.

Table 3-2 summarizes the material components found in King County's waste stream comprising greater than 5% of the overall waste stream or any single substream, by weight. The table lists these largest components for King County's overall waste stream, commercially collected and self-hauled residential substreams, and commercially collected and self-hauled nonresidential substreams.[18]

Food wastes, at about 20%, comprise the largest share of King County's overall waste stream. Similarly, *food wastes* account for an estimated 29% of the commercially collected residential substream and about 19% of the commercially collected nonresidential substream. *Low-grade recyclable paper* and *compostable paper* are also key components of King County's overall waste stream and commercially collected residential and nonresidential substreams.

The largest components of the self-hauled substreams differed from the overall waste stream and commercially collected substreams. In the self-hauled residential substream, *yard wastes* accounted for the largest percentage of waste (13%). In the self-hauled nonresidential substream *small appliances* represented the largest share with 13%.

Table 3-2. Materials Comprising 5% or More of Disposed Waste, by Substream
June 2002 – May 2003

	OVERALL	RESIDENTIAL		NONRESIDENTIAL	
		Commercially Collected	*Self-Hauled*	*Commercially Collected*	*Self-Hauled*
Food wastes	20.0%	29.4%		19.2%	
Low-grade recyclable paper	6.2%	8.0%		6.6%	
Compostable paper	5.5%	6.8%		6.6%	
Plastic film and bags	5.0%	5.5%		6.4%	
Yard wastes	5.0%		12.5%		5.7%
OCC/Kraft paper				5.9%	
Construction/demolition wastes			9.8%		
Dimensional lumber			8.0%		
Furniture/mattresses			7.8%		
Mixed metals/materials			5.5%		
Small appliances					13.4%
Carpet/upholstery/other textiles					11.4%
Roofing/siding					10.7%
Subtotal	**41.8%**	**49.6%**	**43.6%**	**44.7%**	**41.1%**
All other materials combined	*58.2%*	*50.4%*	*56.4%*	*55.3%*	*58.9%*
Tons	**940,032**	**357,914**	**170,353**	**382,422**	**29,342**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

[18] While Table 3-2 presents the materials representing 5% or more of the waste stream, the "Top 10 Materials" tables found in the following sections present the ten materials with the largest percentage of tonnage.

Key Waste Composition Findings

- ***Organics (wood/yard/food)***, comprising more than one-third of the overall waste stream, represented the largest group and an important recycling opportunity. *Food wastes* (20%) represented the largest single material, comprising one-fifth of the waste stream, and *yard wastes* totaled 5%.
- ***Paper*** constituted the second largest group. Much of this material is either recyclable or compostable, with *low-grade recyclable paper* and *compostable paper* each contributing about 6% of total waste.
- ***Plastic***, ***Other Organics***, and ***Other Wastes*** (which includes non-wood construction and demolition debris, electronics, and other materials) comprised the next largest shares of the overall waste stream. *Plastic film and bags* (5%) represented a sizeable portion of the ***Plastic*** group. Viable recycling opportunities continue to emerge for these materials, such as the manufacture of plastic/wood composite materials like lumber and siding.

Waste Characterization Data Presented

The following sections of Chapter 3 present waste composition results for the following waste streams:

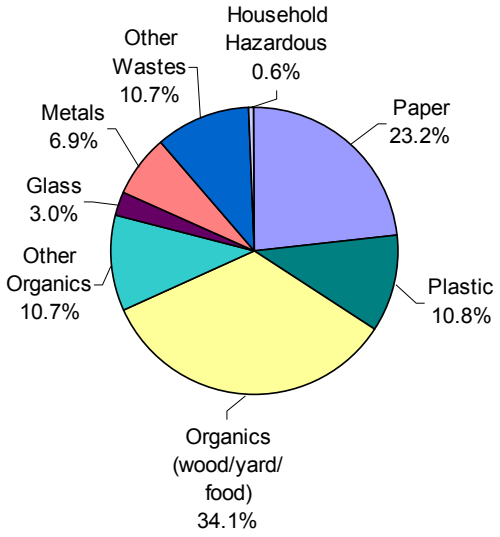
- Overall Disposed Waste
- Residential Substream
- Nonresidential Substream
- Commercially Collected Substream
- Commercially Collected Residential Substream
- Commercially Collected Nonresidential Substream
- Self-hauled Substream
- Self-hauled Residential Substream
- Self-hauled Nonresidential Substream

For each waste stream, the report presents an overview of disposed waste with a pie chart showing the relative proportion of the eight main material classes: paper, plastic, organics (wood/yard/food), other organics, glass, metal, other waste, and household hazardous. Each section also contains a "top 10" list of the individual materials representing the largest percentage of tonnage. For each substream, detailed composition tables can be found in Appendix D.

3.2 OVERALL DISPOSED WASTE

During the study period from June 2002 to May 2003, King County disposed of about 940,000 tons of mixed municipal solid waste. Figure 3-1 shows the proportion of the 8 main classes of material in this overall waste stream, based on their percentage of the overall tonnage. At more than 34%, *organics (wood/yard/food)* made up the largest share of the overall waste stream. *Paper* followed at about 23%.

Figure 3-1. Overview of Waste Composition – Overall Disposed Waste
June 2002 – May 2003 (n=369)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-3 shows the top 10 materials comprising the largest portion of the overall waste stream, arranged in descending order. As shown, *food wastes* totaled nearly 188,000 tons and represented 20% of the overall waste stream. *Low-grade recyclable paper*, *compostable paper*, *plastic film and bags*, and *yard wastes* were also large components of King County's solid waste stream, each accounting for 5% or more, by weight.

Table 3-3. Top 10 Materials with Largest Percentage of Tonnage – Overall Disposed Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	20.0%	20.0%	187,824
Low-grade recyclable paper	6.2%	26.2%	58,606
Compostable paper	5.5%	31.8%	52,054
Plastic film and bags	5.0%	36.8%	47,027
Yard wastes	5.0%	41.8%	47,127
OCC/Kraft paper	4.6%	46.4%	43,338
Construction/demolition wastes	4.1%	50.5%	38,826
Dimensional lumber	3.8%	54.3%	35,741
Mixed metals/materials	3.1%	57.4%	29,180
Disposable diapers	2.7%	60.2%	25,754
Subtotal	**60.2%**		**565,479**
All other materials combined	*39.8%*		*374,553*
Total	**100.0%**		**940,032**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Table 3-4, on the following page, shows the waste composition estimates for all 73 sampled materials and the eight material classes. For each subsequent substream detailed in the report, these detailed composition tables can be found in Appendix D.

Table 3-4. Composition by Weight – Overall Disposed Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**218,453**	**23.2%**	
Newspaper	25,362	2.7%	0.3%
OCC/Kraft paper	43,338	4.6%	0.5%
Low-grade recyclable paper	58,606	6.2%	0.5%
High-grade printing paper	15,277	1.6%	0.3%
Bleached polycoat paper	2,981	0.3%	0.0%
Paper/other materials	15,278	1.6%	0.4%
Compostable paper	52,054	5.5%	0.4%
Gift wrap paper	415	0.0%	0.0%
Other paper	5,141	0.5%	0.2%
Plastic	**101,466**	**10.8%**	
PET #1 plastic bottles	5,981	0.6%	0.1%
HDPE #2 plastic bottles	4,739	0.5%	0.1%
Other plastic containers	6,674	0.7%	0.1%
Polystyrene foam	3,974	0.4%	0.0%
Plastic film and bags	47,027	5.0%	0.5%
Other plastic packaging	5,812	0.6%	0.1%
Plastic products	13,919	1.5%	0.5%
Foam rubber/padding	2,978	0.3%	0.2%
Plastic/other materials	10,361	1.1%	0.2%
Organics (wood/yard/food)	**320,230**	**34.1%**	
Dimensional lumber	35,741	3.8%	0.9%
Treated wood	8,854	0.9%	0.3%
Contaminated wood	17,699	1.9%	0.6%
Roofing/siding	6,045	0.6%	0.6%
Stumps	1,722	0.2%	0.2%
Large prunings	1,847	0.2%	0.1%
Yard wastes	47,127	5.0%	1.0%
Other wood	13,371	1.4%	0.6%
Food wastes	187,824	20.0%	1.3%
Other Organics	**100,341**	**10.7%**	
Textiles/clothes	18,748	2.0%	0.4%
Carpet/upholstery/other textiles	25,192	2.7%	0.8%
Disposable diapers	25,754	2.7%	0.5%
Rubber products	2,379	0.3%	0.1%
Tires	3,553	0.4%	0.3%
Animal carcasses	52	0.0%	0.0%
Animal feces	18,443	2.0%	0.4%
Miscellaneous organics	6,219	0.7%	0.1%
Glass	**28,304**	**3.0%**	
Clear glass containers	9,674	1.0%	0.1%
Green glass containers	4,281	0.5%	0.1%
Brown glass containers	5,057	0.5%	0.1%
Other colored glass containers	45	0.0%	0.0%
Other glass	9,247	1.0%	0.4%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**65,272**	**6.9%**	
Aluminum cans	3,532	0.4%	0.1%
Other aluminum	1,995	0.2%	0.0%
Tinned food cans	6,973	0.7%	0.1%
Other ferrous metal	22,367	2.4%	0.5%
Other nonferrous metal	690	0.1%	0.0%
Mixed metals/materials	29,180	3.1%	0.7%
Gas metal cylinders	534	0.1%	0.1%
Other Wastes	**100,358**	**10.7%**	
Construction/demolition wastes	38,826	4.1%	1.0%
Ashes	1,429	0.2%	0.1%
Nondistinct fines	10,584	1.1%	0.4%
Gypsum wallboard	8,483	0.9%	0.4%
Furniture/mattresses	25,572	2.7%	0.9%
Small appliances	7,765	0.8%	0.5%
Printers/copiers/faxes	1,103	0.1%	0.1%
Office electronics	1,208	0.1%	0.1%
Miscellaneous inorganics	5,388	0.6%	0.3%
Household Hazardous	**5,607**	**0.6%**	
Used oil	411	0.0%	0.1%
Vehicle batteries	0	0.0%	0.0%
Household batteries	238	0.0%	0.0%
Alkaline/button cell batteries	475	0.1%	0.0%
Latex paint	313	0.0%	0.0%
Oil-based paint	105	0.0%	0.0%
Solvents/thinners	44	0.0%	0.0%
Adhesives/glues	478	0.1%	0.1%
Cleaners and corrosives	184	0.0%	0.0%
Pesticides/herbicides	200	0.0%	0.0%
Gas/fuel oil	66	0.0%	0.0%
Antifreeze	35	0.0%	0.0%
Medical waste	481	0.1%	0.0%
Computer monitors	172	0.0%	0.0%
Televisions	1,621	0.2%	0.2%
Cell phones	176	0.0%	0.0%
Laptops/LCD monitors	85	0.0%	0.0%
Other hazardous	523	0.1%	0.0%
Total	**940,032**	**100.0%**	

No. of samples = 369

Error range calculated at a 90% confidence level

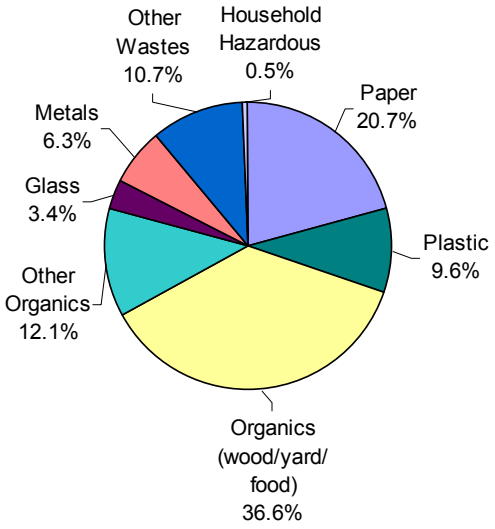
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage and error range are rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Residential Substream

The residential substream includes wastes that are either commercially collected or self-hauled from residential sources (single family or multifamily units). This substream accounted for more than 528,000 tons of King County solid waste.

Figure 3-2 shows the proportion of the 8 main classes of material in the residential substream, based on their percentage of the tonnage for this substream. As shown, *organics (wood/yard/food)* account for nearly 37%, with *paper* following at almost 21% of the substream.

Figure 3-2. Overview of Waste Composition – Residential Waste
June 2002 – May 2003 (n=212)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-5 shows the top 10 materials comprising the largest portion of the residential waste stream, arranged in descending order. The material component *food wastes* accounted for the largest share with more than 113,000 tons (21%). Three other material components, *yard wastes*, *low-grade recyclable paper*, and *compostable paper,* each accounted for 5% or more of the substream. Cumulatively, the top 10 materials accounted for about two thirds of the substream.

Table 3-5. Top 10 Materials with Largest Percentage of Tonnage – Residential Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	21.4%	21.4%	113,125
Yard wastes	6.8%	28.2%	36,095
Low-grade recyclable paper	6.2%	34.5%	32,917
Compostable paper	5.0%	39.5%	26,399
Plastic film and bags	4.3%	43.7%	22,487
Construction/demolition wastes	4.1%	47.8%	21,455
Dimensional lumber	3.8%	51.6%	20,039
OCC/Kraft paper	3.8%	55.4%	19,934
Disposable diapers	3.4%	58.8%	17,939
Furniture/mattresses	3.1%	61.9%	16,611
Subtotal	**61.9%**		**327,000**
All other materials combined	*38.1%*		*201,267*
Total	**100.0%**		**528,267**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

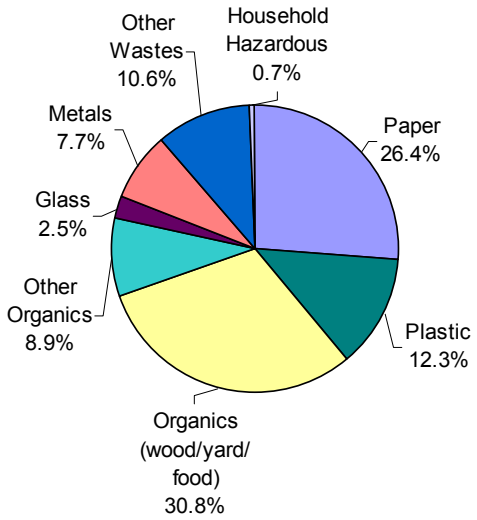
The detailed composition table for this waste stream can be found in Appendix D, on page D-2.

Nonresidential Substream

The nonresidential substream includes wastes that are either commercially collected or self-hauled from nonresidential sources, such as businesses and government establishments. In addition, this substream includes mixed loads that contain both nonresidential waste (usually business waste) and residential waste (usually multifamily waste). Commercial waste haulers typically classify these mixed loads as "nonresidential." To be consistent, mixed loads are included in the nonresidential substream in this study.

Nonresidential waste totaled an estimated 412,000 tons. Figure 3-3 shows the proportion of the 8 main classes of material in the nonresidential substream, based on their percentage of the tonnage for this substream. *Organics (wood/yard/food)* comprised about 31% of the substream and *paper* accounted for more than a quarter, 26%.

Figure 3-3. Overview of Waste Composition – Nonresidential Waste
June 2002 – May 2003 (n=157)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-6 shows the top 10 materials comprising the largest portion of the nonresidential waste stream, arranged in descending order. With almost 75,000 tons (18%) *food wastes* claimed the largest share of the substream. Other large material components included *compostable paper*, *low-grade recyclable paper*, *plastic film and bags*, and *OCC/Kraft paper,* each accounting for about 6% of the nonresidential substream.

Table 3-6. Top 10 Materials with Largest Percentage of Tonnage – Nonresidential Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	18.1%	18.1%	74,700
Compostable paper	6.2%	24.4%	25,655
Low-grade recyclable paper	6.2%	30.6%	25,690
Plastic film and bags	6.0%	36.6%	24,540
OCC/Kraft paper	5.7%	42.3%	23,404
Construction/demolition wastes	4.2%	46.5%	17,370
Dimensional lumber	3.8%	50.3%	15,703
Mixed metals/materials	3.7%	54.0%	15,151
Newspaper	3.2%	57.2%	13,214
Other wood	2.7%	59.9%	11,240
Subtotal	**59.9%**		**246,667**
All other materials combined	*40.1%*		*165,098*
Total	**100.0%**		**411,765**

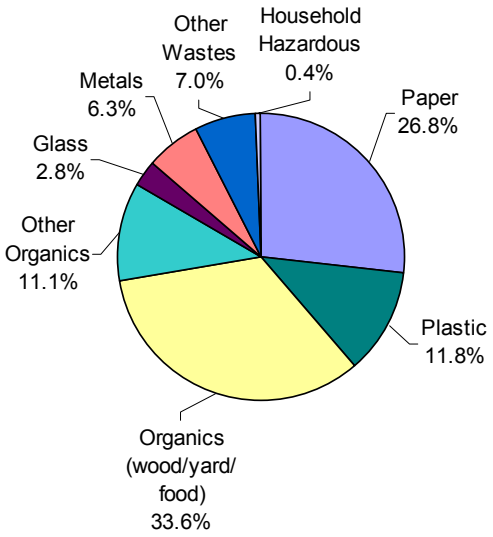
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-3.

3.3 COMMERCIALLY COLLECTED SUBSTREAM

Commercial waste haulers collected more than 740,000 tons of mixed municipal solid waste from King County. Figure 3-4 shows the proportion of the 8 main classes of material in the commercially collected waste substream, based on their percentage of the tonnage for this substream. *Organics (wood/yard/food)* accounted for about a third (34%) of the substream, followed by *paper* (27%), *plastic (12%)*, and *other organics* (11%).

Figure 3-4. Overview of Waste Composition – Commercially Collected Waste June 2002 – May 2003 (n=213)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-7 shows the top 10 materials comprising the largest portion of the commercially collected waste stream, arranged in descending order. *Food wastes* comprised almost one quarter of the commercially collected substream. Additional materials in the top 10 accounting for more than 5% of the substream included *low-grade recyclable paper* (7%), *compostable paper* (7%), *plastic film and bags* (6%), and *OCC/Kraft paper* (5%).

Table 3-7. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	24.1%	24.1%	178,577
Low-grade recyclable paper	7.2%	31.4%	53,550
Compostable paper	6.7%	38.1%	49,610
Plastic film and bags	5.9%	44.0%	43,970
OCC/Kraft paper	5.1%	49.1%	37,633
Yard wastes	3.3%	52.4%	24,235
Newspaper	3.2%	55.6%	24,041
Disposable diapers	3.2%	58.8%	23,986
Dimensional lumber	2.8%	61.7%	21,093
Construction/demolition wastes	2.8%	64.5%	20,701
Subtotal	**64.5%**		**477,396**
All other materials combined	*35.5%*		*262,940*
Total	**100.0%**		**740,336**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

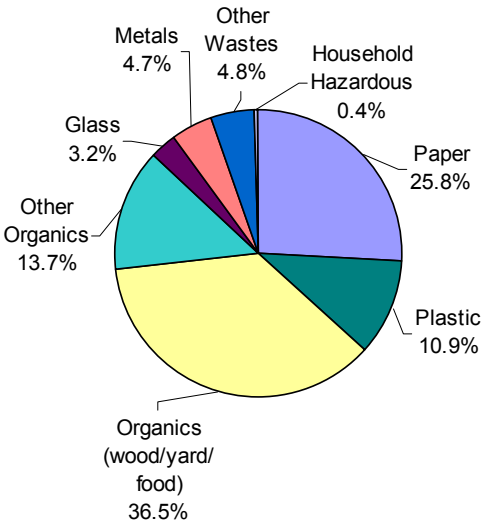
The detailed composition table for this waste stream can be found in Appendix D, on page D-4.

Commercially Collected Residential Substream

The commercially collected residential substream totaled an estimated 358,000 tons. Figure 3-5 shows the proportion of the 8 main classes of material in the commercially collected residential substream, based on their percentage of the tonnage for this substream. Two materials classes - *organics (wood/yard/food)* (37%) and paper (26%) - accounted for more than half of the substream's material.

Figure 3-5. Overview of Waste Composition – Commercially Collected Residential Waste

June 2002 – May 2003 (n=69)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-8 shows the top 10 materials comprising the largest portion of the commercially collected residential waste stream, arranged in descending order. *Food wastes,* with over 105,000 tons (29%) accounted for the largest share of the substream. *Low-grade recyclable paper*, *compostable paper*, and *plastic film and bags* each accounted for at least 5% of the total substream, by weight.

Table 3-8. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Residential Waste
June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	29.4%	29.4%	105,176
Low-grade recyclable paper	8.0%	37.4%	28,597
Compostable paper	6.8%	44.2%	24,248
Plastic film and bags	5.5%	49.6%	19,684
Disposable diapers	4.5%	54.2%	16,171
OCC/Kraft paper	4.2%	58.4%	15,025
Yard wastes	4.2%	62.5%	14,886
Animal feces	3.7%	66.2%	13,312
Newspaper	3.1%	69.3%	10,926
Dimensional lumber	1.8%	71.1%	6,442
Subtotal	**71.1%**		**254,467**
All other materials combined	*28.9%*		*103,446*
Total	**100.0%**		**357,914**

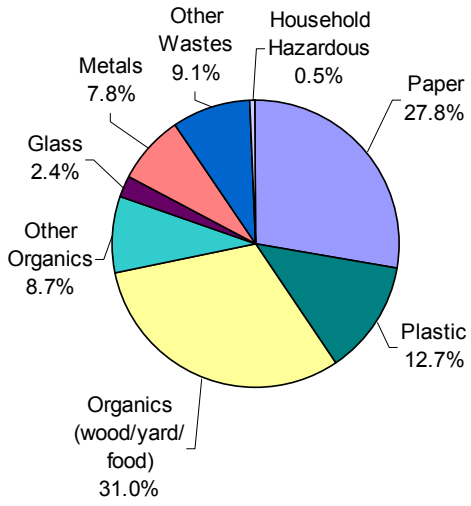
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-5.

Commercially Collected Nonresidential Substream

Commercially collected nonresidential waste totaled approximately 382,000 tons of King County's disposed waste stream. Figure 3-6 shows the proportion of the 8 main classes of material in the commercially collected nonresidential substream, based on their percentage of the tonnage for this substream. Like the previous substream, the commercially collected nonresidential substream consisted largely of *organics (wood/yard/food)* (31%) and *paper* (28%).

Figure 3-6. Overview of Waste Composition – Commercially Collected Nonresidential Waste
June 2002 – May 2003 (n=144)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-9 shows the top 10 materials comprising the largest portion of the commercially collected nonresidential waste stream, arranged in descending order. *Food wastes* was the most prevalent material with more than 73,000 tons (19%) of the substream. Other large components included *compostable paper* and *low-grade recyclable paper* (both accounting for about 7%), and *plastic film and bags and OCC/Kraft paper* (each at about 6%).

Table 3-9. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Nonresidential Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	19.2%	19.2%	73,402
Compostable paper	6.6%	25.8%	25,362
Low-grade recyclable paper	6.5%	32.4%	24,953
Plastic film and bags	6.4%	38.7%	24,286
OCC/Kraft paper	5.9%	44.6%	22,608
Construction/demolition wastes	4.2%	48.8%	15,991
Dimensional lumber	3.8%	52.6%	14,651
Mixed metals/materials	3.7%	56.3%	14,023
Newspaper	3.4%	59.7%	13,115
Other wood	2.9%	62.6%	11,117
Subtotal	**62.6%**		**239,508**
All other materials combined	*37.4%*		*142,914*
Total	**100.0%**		**382,422**

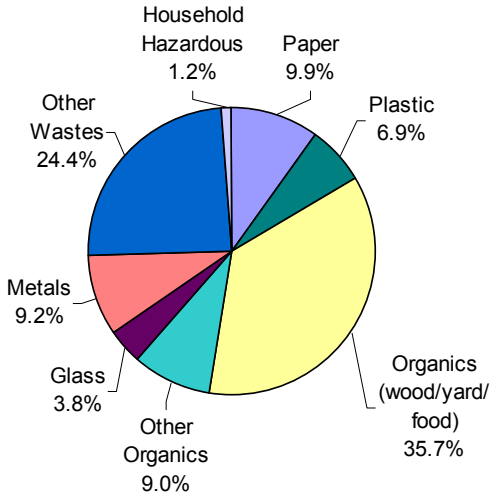
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-6.

3.4 SELF-HAULED SUBSTREAM

Self-hauled waste totaled almost 200,000 tons of MMSW brought to King County's public and private facilities for disposal. This estimate includes material from both residential and nonresidential sources. Figure 3-7 shows the proportion of the 8 main classes of material in the self-hauled substream, based on their percentage of the tonnage for this substream. Like the commercially collected substreams, *organics (wood/yard/food)* (36%) accounted for the largest share of material brought for disposal by self-haulers. Unlike the commercially collected substreams, *paper* accounted for a much smaller portion of the waste brought by self-haulers. Instead, *other wastes* (24%), accounted for the second largest slice of the substream.

Figure 3-7. Overview of Waste Composition – Self-hauled Waste
June 2002 – May 2003 (n=156)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-10 shows the top 10 materials comprising the largest portion of the self-hauled waste stream, arranged in descending order. Unlike the commercially collected substreams, *yard wastes* comprised the largest share (12%), followed by *construction/demolition wastes* (9%), *furniture/mattresses* (7%), and *dimensional lumber* (7%). *Food wastes* comprised less than 5% of the self-hauled substream, compared to 24% of commercially collected materials.

Table 3-10. Top 10 Materials with Largest Percentage of Tonnage – Self-hauled Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Yard wastes	11.5%	11.5%	22,892
Construction/demolition wastes	9.1%	20.5%	18,125
Furniture/mattresses	7.4%	27.9%	14,779
Dimensional lumber	7.3%	35.3%	14,648
Carpet/upholstery/other textiles	5.3%	40.5%	10,493
Mixed metals/materials	5.3%	45.8%	10,540
Food wastes	4.6%	50.4%	9,247
Contaminated wood	4.1%	54.6%	8,233
Other ferrous metal	3.3%	57.9%	6,641
Other glass	3.1%	61.0%	6,175
Subtotal	**61.0%**		**121,774**
All other materials combined	*39.0%*		*77,922*
Total	**100.0%**		**199,696**

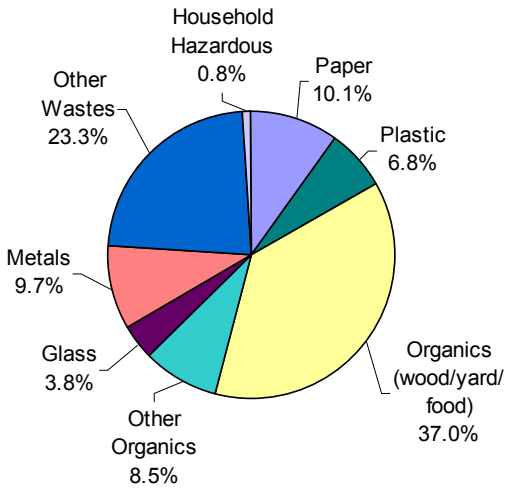
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-7.

Self-hauled Residential Substream

Self-hauled residential waste loads totaled approximately 170,00 tons. Figure 3-8 shows the proportion of the 8 main classes of material in the self-hauled residential substream, based on their percentage of the tonnage for this substream. Like the self-hauled substream, *organics (wood/yard/food)* (37%) accounted for the largest share of the self-hauled residential substream.

Figure 3-8. Overview of Waste Composition – Self-hauled Residential Waste June 2002 – May 2003 (n=143)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-11 shows the top 10 materials comprising the largest portion of the self-hauled residential waste stream, arranged in descending order. *Yard wastes*, the single most prevalent material in the substream, accounted for approximately 21,000 tons (or almost 13%) of the total. Other large components of self-hauled residential waste included *construction/demolition wastes*, *dimensional lumber*, *furniture/mattresses*, and *mixed metals/materials*, each accounting for at least 5% of the total, by weight.

Table 3-11. Top 10 Materials with Largest Percentage of Tonnage – Self-hauled Residential Waste

June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Yard wastes	12.5%	12.5%	21,209
Construction/demolition wastes	9.8%	22.3%	16,745
Dimensional lumber	8.0%	30.3%	13,596
Furniture/mattresses	7.8%	38.1%	13,341
Mixed metals/materials	5.5%	43.6%	9,412
Food wastes	4.7%	48.3%	7,949
Contaminated wood	4.3%	52.6%	7,328
Carpet/upholstery/other textiles	4.2%	56.8%	7,159
Other ferrous metal	3.5%	60.3%	5,916
Treated wood	3.4%	63.7%	5,868
Subtotal	**63.7%**		**108,524**
All other materials combined	*36.3%*		*61,830*
Total	**100.0%**		**170,353**

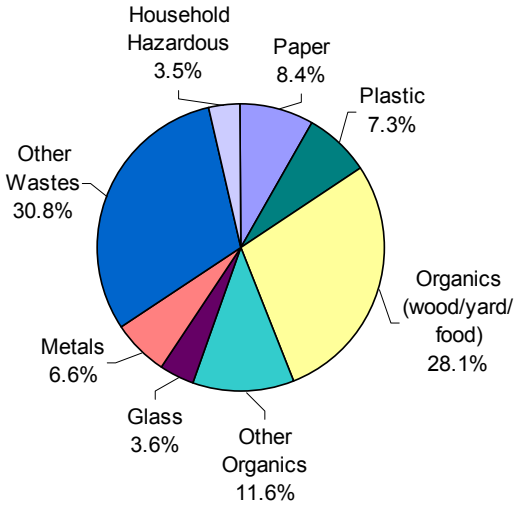
Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-8.

Self-hauled Nonresidential Substream

Representing the smallest substream, self-hauled nonresidential waste totaled approximately 30,000 tons of material. Figure 3-9 shows the proportion of the 8 main classes of material in the self-hauled nonresidential substream, based on their percentage of the tonnage for this substream. Together, *organics (wood/yard/food)* and *other wastes* made up about 60% of this substream.

Figure 3-9. Overview of Waste Composition – Self-hauled Nonresidential Waste June 2002 – May 2003 (n=13)



Note: Estimated percentages are rounded to the nearest tenth of a percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Of the 73 materials sampled, Table 3-12 shows the top 10 materials comprising the largest portion of the self-hauled nonresidential waste stream, arranged in descending order. Unlike any other substream, *small appliances* accounted for more than 13% of the self-hauled nonresidential substream. Each with 11%, *carpet/upholstery/other textiles* and *roofing/siding* accounted for the second and third largest share of the substream.

Table 3-12. Top 10 Materials with Largest Percentage of Tonnage – Self-hauled Nonresidential Waste
June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Small appliances	13.4%	13.4%	3,918
Carpet/upholstery/other textiles	11.4%	24.7%	3,334
Roofing/siding	10.7%	35.4%	3,135
Yard wastes	5.7%	41.1%	1,683
Furniture/mattresses	4.9%	46.0%	1,438
Construction/demolition wastes	4.7%	50.7%	1,380
Miscellaneous inorganics	4.6%	55.4%	1,361
Food wastes	4.4%	59.8%	1,298
Mixed metals/materials	3.8%	63.6%	1,128
Dimensional lumber	3.6%	67.2%	1,052
Subtotal	**67.2%**		**19,728**
All other materials combined	*32.8%*		*9,615*
Total	**100.0%**		**29,342**

Note: Estimated tonnage is rounded to the nearest ton. Estimated mean percentage is rounded to the nearest tenth of a percent. Therefore, the tonnages and mean percentages of the top 10 materials as displayed in the table, when added together, may not equal the subtotals shown, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The detailed composition table for this waste stream can be found in Appendix D, on page D-9.

Chapter 4
Customer Survey Results

4.1 CUSTOMER SURVEY OVERVIEW & KEY FINDINGS

Between June 2002 and May 2003, King County conducted nearly 861,000 transactions at 12 waste facilities. During the customer survey study, the project team conducted 6,381 interviews with customers at those waste facilities to determine who uses the sites and why. During each facility's designated survey days, an interviewer asked the driver of each vehicle entering the site a series of questions.[19]

This chapter presents the findings of these customer surveys, and Appendix G, page G-1, provides additional details on the study methodology and includes examples of the field forms used in the survey. Survey results are presented for commercially collected and self-hauled substreams (see *Understanding the Waste Stream* on page 17 for an explanation of these substreams).

Unless otherwise specified, the figures presented describe the portion of waste transactions (customers, loads, trips, or users) surveyed at waste facilities – *not* the weight or tonnages of the waste they delivered. The percentages reported refer to the portion of drivers surveyed, not necessarily to all waste loads delivered during the study.

Key Customer Survey Findings

- **Self-hauled loads represented 85% of the customers** surveyed at waste facilities, though they brought only 21% of the total waste by weight. Passenger vehicles[20] comprised nearly four-fifths (79%) of the overall surveyed traffic at waste facilities.
- **Mixed garbage accounted for 68% of all loads** that surveyed users brought to waste facilities; yard waste accounted for 13% and construction and demolition for 19%.
- **Self-hauled loads came primarily from residences** (92%), while the majority of commercially collected loads originated from nonresidential sources (57%).
- **Most residential self-haulers subscribed to curbside garbage service** (67%), but the third that did not subscribe brought loads to waste facilities 70% more often than the subscribers.
- **"Cleaning home or workplace"** (22%) was the top reason for self-hauling waste reported for both residential and nonresidential loads.

[19] If traffic became too congested, a few vehicles skipped the survey to avoid traffic flow problems at the site.

[20] Passenger vehicles include autos, sedans, vans, pick-up trucks, and sport-utility vehicles.

4.2 WASTE TRANSACTIONS

Table 4-1 summarizes the total number of transactions at county and private facilities from June 2002 to May 2003.[21] King County's facilities handled almost 861,000 transactions during this time. Bow Lake received the highest volume (about 156,000 transactions), followed by Houghton (143,000 transactions). Skykomish experienced the smallest number of transactions with about 2,300, or less than 1% of all King County transactions. Private facilities and regional direct waste managed about 1% of the County's disposal site traffic flow (approximately 12,700 transactions).[22]

Table 4-1. Annual Number of Transactions
June 2002 – May 2003

	Annual Transactions	Pct. of Total
Algona	114,572	13%
Bow Lake	156,197	18%
Cedar Falls	21,824	3%
Enumclaw	62,910	7%
Factoria	113,547	13%
First NE	130,342	15%
Houghton	142,762	17%
Renton	78,636	9%
Skykomish	2,297	0%
Vashon	24,861	3%
Subtotal	**847,948**	99%
Private Facilities and Regional Direct	*12,720*	*1%*
Total	**860,668**	**100%**

Note: Algona was closed for construction from September to November of 2002. During this time vehicles were diverted primarily to Bow Lake for disposal. First Northeast experienced increased vehicle traffic from mid-March to May 2003 due to the closure of a nearby Snohomish County transfer station.

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

[21] Data in Table 4-1 were obtained from King County solid waste facility transaction data. While this table includes transaction data for private waste facilities and regional direct waste loads to the Cedar Hills landfill, all other tables in this chapter include data from only King County's 10 transfer stations and drop boxes.

[22] *Private facilities* are defined as privately owned and operated collection and transportation facilities authorized by King County to receive, consolidate and deposit mixed municipal solid waste into larger transfer vehicles for transport to and disposal at County authorized disposal sites (King County Comprehensive Solid Waste Management Plan, Glossary). *Regional direct waste* is any solid waste generated and collected in King County and transported to the Cedar Hills landfill by conventional long-haul transfer vehicles from solid waste transfer stations or intermediate processing facilities permitted by Public Health – Seattle and King County as provided for in KCC 10.08.090 and the Board of Health's regulation (King County Comprehensive Solid Waste Management Plan, Glossary).

4.3 VEHICLE TYPE

Based on survey data, Table 4-2 shows the vehicle types for commercial and self-haul customers. Self-haulers accounted for 85% of the transactions at waste facilities, and passenger vehicles (autos, sedans, vans, pick-up trucks, sport-utility vehicles) brought 79% of those waste loads to King County facilities. Commercial customers brought most waste in drop boxes (55%) or packer trucks (44%), and they accounted for only 15% of the vehicle traffic at King County waste facilities.

A detailed *Observed Vehicle Types, by Collection Type and Facility* table can also be found in Appendix H, page H-2.

Table 4-2. Observed Vehicle Types, by Collection Type
June 2002 – May 2003 (n=6,055)

	Commercial	Self-haul	OVERALL
Packer	44%	0%	7%
Drop box	55%	0%	8%
Large other vehicle	1%	6%	6%
Passenger vehicle	0%	93%	79%
Subtotal	**100%**	**100%**	**100%**
No response	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

4.4 WASTE TYPE

Waste Types for Commercially Collected & Self-hauled Loads

Table 4-3 shows the types of wastes hauled by commercial and self-haul customers. For the overall waste stream and for each hauler type, the majority of loads contained *mixed garbage.* Of King County's mixed municipal solid waste stream, 19% of loads contained *construction/demolition* waste, mostly delivered by self-haul customers. Similarly, 13% of the loads contained *yard wastes*, delivered by self-haulers only.

A detailed *Reported Waste Types, by Collection Type and Facility* table can also be found in Appendix H, page H-3.

Table 4-3. Reported Waste Types, by Collection Type
June 2002 – May 2003 (n=6,055)

	Commercial	Self-haul	OVERALL
Mixed garbage	99%	63%	68%
Yard waste	0%	15%	13%
Construction/demolition	1%	22%	19%
Special waste	0%	0%	0%
Subtotal	**100%**	**100%**	**100%**
No response	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

4.5 GENERATOR TYPE

Commercially Collected Loads

Table 4-4 shows the proportion of commercial vehicle traffic arriving at each facility by generator type: *residential*, *nonresidential*, and *mixed residential and nonresidential.* The *residential* generator type is further subdivided into *single-family residential*, *multifamily residential*, and *mixed single-family and multifamily residential* generator types. As shown, the relative proportion of loads by generator type can vary greatly by site. For example, *nonresidential* generators account for 33% of the loads to Vashon and 36% to Renton, compared to 63% to Bow Lake and 62% to Houghton. Of commercially collected loads delivered to the public facilities, the *residential* generator type accounted for 36% of the loads; the *nonresidential* generator type comprised a greater share with 57%; and the mixed generator type totaled only 6%.

Table 4-4. Reported Generator Types for Commercially Collected Loads[23]
June 2002 – May 2003 (n=913)

	Algona	Bow Lake	Enumclaw	Factoria
Residential	**39%**	**28%**	**49%**	**36%**
Single-family residential	27%	19%	22%	27%
Multifamily residential	10%	8%	10%	7%
Mixed single-family & multifamily residential	2%	1%	16%	1%
Nonresidential	**57%**	**63%**	**45%**	**60%**
Mixed residential & nonresidential	**4%**	**9%**	**6%**	**4%**
Subtotal	**100%**	**100%**	**100%**	**100%**
No response	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Residential	**55%**	**32%**	**56%**	**0%**	**67%**	**36%**
Single-family residential	45%	27%	36%	0%	67%	26%
Multifamily residential	0%	5%	18%	0%	0%	8%
Mixed single-family & multifamily residential	10%	0%	2%	0%	0%	2%
Nonresidential	**38%**	**62%**	**36%**	**0%**	**33%**	**57%**
Mixed residential & nonresidential	**7%**	**5%**	**8%**	**100%**	**0%**	**6%**
Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

[23] The only commercial loads accepted at Skykomish are from the Town of Skykomish's trucks, which collect from both residential and nonresidential customers. Commercial customers are not accepted at the Cedar Falls drop box.

Self-hauled Loads

Table 4-5 shows the proportion of self-hauled loads arriving at each facility, by generator type. Unlike commercially collected loads, self-hauled loads largely came from *residential* generators. Only Skykomish (79%), Houghton (87%), and Vashon (88%) reported the percentage of loads attributed to *residential* generators below 90%.

Table 4-5. Reported Generator Types for Self-hauled Loads
June 2002 – May 2003 (n=5,142)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Residential	**93%**	**94%**	**98%**	**92%**	**92%**
Single-family residential	90%	91%	97%	92%	90%
Multifamily residential	3%	2%	0%	1%	2%
Mixed single-family & multifamily residential	0%	0%	1%	0%	0%
Nonresidential	**6%**	**6%**	**1%**	**5%**	**7%**
Mixed residential & nonresidential	**1%**	**1%**	**1%**	**3%**	**0%**
Subtotal	**100%**	**100%**	**100%**	**100%**	**100%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Residential	**95%**	**87%**	**94%**	**79%**	**88%**	**92%**
Single-family residential	91%	84%	93%	79%	88%	90%
Multifamily residential	3%	3%	1%	0%	0%	2%
Mixed single-family & multifamily residential	0%	0%	0%	0%	0%	0%
Nonresidential	**4%**	**12%**	**5%**	**21%**	**8%**	**6%**
Mixed residential & nonresidential	**1%**	**1%**	**1%**	**0%**	**3%**	**1%**
Subtotal	**100%**	**100%**	**100%**	**100%**	**99%**	**100%**
No response	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Contractors & Landscapers (Self-hauled Only)

For this study, the surveyor asked self-haulers that reported bringing loads of yard waste or construction and demolition waste if they were a contractor or landscaper. Table 4-6 shows the proportion of contractors, landscapers, and all other self-haulers that brought waste from the three main generator types. As shown, there were relatively more contractors and landscapers hauling waste from *nonresidential* sources than *residential* or *mixed* sources. Most loads (87%) of yard waste and construction and demolition waste were brought to King County facilities by self-haulers that were not contractors or landscapers.

A detailed R*eported Self-haul Contractors and Landscapers, by Facility and Generator Type* table can also be found in Appendix H, page H-4.

Table 4-6. Reported Contractors & Landscapers, by Generator Type
June 2002 – May 2003 (n=5,142)

	Residential	Nonresidential	Mixed residential & nonresidential	OVERALL
Contractors	10%	24%	15%	**11%**
Landscapers	2%	6%	3%	**2%**
All others	88%	71%	81%	**87%**
Total	**100%**	**100%**	**100%**	**100%**

Note: There were a total of three "no response" replies.

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

4.6 CURBSIDE GARBAGE SUBSCRIPTION LEVELS REPORTED BY RESIDENTIAL SELF-HAULERS

Service Levels

Table 4-7 shows the proportion of self-haulers with residential waste that subscribe and do not subscribe to curbside garbage collection service. The percentage of self-haulers that do not subscribe to curbside garbage collection service is higher at the rural facilities than at the urban locations. For example, self-haul customers without curbside garbage service accounted for the largest share of residential self-haulers at Vashon (84%) and Skykomish (64%) – both rural locations. The proportion of residential self-haulers that subscribed to curbside garbage service was largest at First Northeast and Houghton (both 81%) – and other urban locations. Most residential self-haul customers reported that they subscribe to curbside garbage service (67%); 33% do not subscribe.

Table 4-7. Reported Usage of Curbside Garbage Collection Service by Residential Self-haulers
June 2002 – May 2003 (n=4,104)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe	66%	62%	41%	40%	78%
Do not subscribe	34%	38%	59%	60%	22%
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Subscribe	81%	81%	65%	36%	14%	**67%**
Do not subscribe	19%	19%	35%	64%	84%	**33%**
No response	*0%*	*0%*	*0%*	*0%*	*1%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Effect of Service Levels on Trip Frequency

Table 4-8 shows the annualized average number of trips residential self-haulers took to each King County facility. The table splits the residential self-haulers into two groups, those that subscribed to curbside garbage collection service and those that did not. During the survey, most self-haul customers reported the number of visits on a per day, per week, or per month basis. These responses were then converted to *visits per year* (i.e. "once a month" equals 12 visits per year), which is reflected in the table below.

The data shown include all self-haulers (including contractors, landscapers, and independent haulers) that brought waste from residential sources.

Those customers not subscribing to garbage service made, on average, nearly twice as many trips per year than the subscribers. Skykomish and Vashon reversed the ratio, with subscribers making more trips, on average, than non-subscribers.

Table 4-8. Average Trips per Year by Residential Self-haulers With & Without Curbside Garbage Service

June 2002 – May 2003 (n=4,104)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to garbage service	11.6	8.6	7.7	6.4	8.8
Do not subscribe	13.9	12.7	11.8	13.1	18.8
Combined Average	**12.3**	**10.2**	**10.2**	**10.4**	**10.9**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Subscribe to garbage service	15.5	9.2	7.9	38.0	21.6	**10.5**
Do not subscribe	32.0	19.2	13.3	6.0	6.0	**17.8**
Combined Average	**18.7**	**11.1**	**9.8**	**17.6**	**8.2**	**12.1**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

4.7 REASONS FOR SELF-HAULING WASTE

The surveyor asked each self-hauler the reason for self-hauling waste to the County's transfer stations. For both residential and nonresidential customers, Table 4-8 presents the top five reported reasons for self-hauling by facility. The data for residential generators include subscribers to curbside garbage service as well as non-subscribers.

For both residential and nonresidential customers, the most frequently reported reason for self-hauling was *cleaning home or workplace* (22%). For residential customers, the remaining top 4 reasons for self-hauling included *cheaper/saves money* (13%), *remodeling* (11%), *yard debris* (10%), and *convenience* (8%). The remaining top 4 reasons for nonresidential customers differed slightly, and included *cheaper/saves money* (19%), *large amount of garbage* (11%), *favor for friend/neighbor/family member* (7%), and *items too big to fit in garbage can* (7%).

All reasons for self-hauling waste by residential and nonresidential customers can be viewed in Appendix H, page H-5.

Table 4-9. Top Five Reasons for Self-hauling Waste
June 2002 – May 2003 (n=4,360)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Residential					
Cleaning home or workplace	24%	22%	16%	14%	21%
Cheaper/saves money	14%	17%	21%	26%	5%
Remodeling	9%	9%	7%	6%	13%
Yard debris	7%	13%	4%	5%	13%
Convenience	7%	8%	14%	15%	6%
Subtotal	*62%*	*69%*	*62%*	*67%*	*58%*
All Other Reasons	38%	31%	38%	33%	42%
Total Residential	**100%**	**100%**	**100%**	**100%**	**100%**
Nonresidential					
Cleaning home or workplace	30%	29%	100%	36%	10%
Cheaper/saves money	13%	24%	0%	0%	10%
Large amount of garbage	0%	12%	0%	0%	10%
Favor for friend/neighbor/family member	7%	3%	0%	18%	7%
Items too big to fit into garbage can	0%	6%	0%	0%	14%
Subtotal	*50%*	*74%*	*100%*	*55%*	*52%*
All Other Reasons	50%	26%	0%	45%	48%
Total Nonresidential	**100%**	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Residential						
Cleaning home or workplace	29%	24%	23%	0%	4%	**22%**
Cheaper/saves money	9%	7%	12%	0%	35%	**13%**
Remodeling	13%	18%	10%	9%	10%	**11%**
Yard debris	16%	9%	8%	0%	1%	**10%**
Convenience	5%	6%	9%	0%	25%	**8%**
Subtotal	*73%*	*63%*	*62%*	*9%*	*75%*	***65%***
All Other Reasons	27%	37%	38%	91%	25%	**35%**
Total Residential	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Nonresidential						
Cleaning home or workplace	33%	20%	5%	0%	0%	**22%**
Cheaper/saves money	25%	27%	24%	0%	17%	**19%**
Large amount of garbage	4%	11%	19%	33%	67%	**11%**
Favor for friend/neighbor/family member	4%	7%	14%	0%	0%	**7%**
Items too big to fit into garbage can	4%	11%	5%	33%	0%	**7%**
Subtotal	*71%*	*76%*	*67%*	*67%*	*83%*	***66%***
All Other Reasons	29%	24%	33%	33%	17%	**34%**
Total Nonresidential	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

4.8 CITY OF ORIGIN

Commercially Collected Loads

Table 4-10 shows the reported city of origin for commercially collected loads to each of the County's facilities. With the exception of Vashon,[24] over 90% of the commercially collected loads to each facility originated from incorporated areas. At Factoria, First Northeast, and Skykomish 100% of the loads came from incorporated areas. At 91%, Renton saw the smallest proportion of commercially collected loads from incorporated King County.

[24] Please note that Vashon Island is considered unincorporated King County.

Table 4-10. Reported City of Origin, Commercially Collected Loads June 2002 – May 2003 (n=913)

City	Site									OVERALL
	Algona	Bow Lake	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	
Algona	3%	--	--	--	--	--	--	--	--	1%
Auburn	47%	15%	24%	--	--	--	--	--	--	13%
Bellevue	--	--	--	68%	--	8%	--	--	--	11%
Black Diamond	1%	--	2%	--	--	--	--	--	--	--
Bothell	--	--	--	--	--	11%	--	--	--	3%
Burien	--	1%	--	--	--	--	--	--	--	--
Carnation	--	--	--	--	--	2%	--	--	--	--
Covington	5%	--	--	--	--	--	--	--	--	1%
Des Moines	--	6%	--	--	--	--	--	--	--	2%
Duvall	--	--	--	--	--	1%	--	--	--	--
Enumclaw	1%	--	51%	--	--	--	--	--	--	2%
Federal Way	30%	11%	12%	--	--	--	--	--	--	8%
Issaquah	--	--	--	11%	--	--	2%	--	--	1%
Kenmore	--	--	--	--	3%	--	--	--	--	--
Kent	8%	44%	2%	--	--	--	2%	--	--	14%
Kirkland	--	--	--	--	--	22%	--	--	--	6%
Lake Forest Park	--	--	--	--	3%	--	--	--	--	--
Maple Valley	1%	--	2%	--	--	--	--	--	--	--
Medina	--	--	--	1%	--	--	--	--	--	--
Mercer Island	--	--	--	8%	--	--	--	--	--	1%
Newcastle	--	--	--	3%	--	--	9%	--	--	1%
Normandy Park	--	1%	--	--	--	--	--	--	--	--
North Bend	2%	--	--	3%	--	--	3%	--	--	1%
Pacific	1%	--	--	--	--	--	--	--	--	--
Redmond	--	--	--	--	--	31%	--	--	--	8%
Renton	--	1%	--	--	--	--	74%	--	--	6%
Sammamish	--	--	--	1%	--	2%	--	--	--	1%
SeaTac	--	4%	--	--	--	--	--	--	--	1%
Seattle	--	--	--	--	--	--	2%	--	--	--
Shoreline	--	--	--	--	93%	--	--	--	--	5%
Skykomish	--	--	--	--	--	--	--	100%	--	1%
Snoqualmie	--	--	--	4%	--	--	--	--	--	1%
Tukwila	--	12%	--	--	--	--	--	--	--	3%
Woodinville	--	--	--	--	--	16%	--	--	--	4%
Incorporated	*98%*	*98%*	*94%*	*100%*	*100%*	*94%*	*91%*	100%	--	*96%*
Unincorporated	2%	1%	6%	--	--	5%	9%	--	100%	*3%*
Subtotal King County	**100%**	**99%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Outside King County	--	*1%*	--	--	--	--	--	--	--	--
Multiple King County cities	--	--	--	--	--	--	--	--	--	--
No response	--	--	--	--	--	--	--	--	--	--
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Self-hauled Loads

Table 4-11 shows the origin of self-hauled loads delivered to King County disposal facilities. As shown, about 8% of self-hauled loads originated from outside the county. However, the majority of loads (84%) originated from King County's incorporated cities and 8% originated from unincorporated areas.

Table 4-11. Reported City of Origin, Self-hauled Loads
June 2002 – May 2003 (n=5,142)

City	Site										OVERALL
	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	
Algona	2%	--	--	--	--	--	--	--	--	--	--
Auburn	31%	6%	--	5%	--	--	--	--	--	--	5%
Beaux Arts	--	--	--	--	--	--	--	--	--	--	--
Bellevue	--	--	1%	--	48%	--	10%	--	--	--	8%
Black Diamond	--	--	--	8%	--	--	--	--	--	--	1%
Bothell	--	--	--	--	--	2%	10%	--	--	--	2%
Burien	--	9%	--	--	--	--	--	--	--	--	2%
Carnation	--	--	8%	--	1%	--	2%	--	--	--	1%
Clyde Hill	--	--	--	--	1%	--	1%	--	--	--	--
Covington	4%	1%	1%	7%	--	--	--	1%	--	--	1%
Des Moines	1%	13%	--	--	--	--	--	--	--	--	2%
Duvall	--	--	--	--	--	--	2%	--	--	--	--
Enumclaw	--	--	--	37%	--	--	--	--	--	--	3%
Federal Way	21%	10%	--	1%	--	--	--	--	--	--	5%
Hunts Point	--	--	--	--	--	--	--	--	--	--	--
Issaquah	--	--	3%	--	14%	--	--	4%	--	--	2%
Kenmore	--	--	--	--	--	3%	3%	--	--	--	1%
Kent	9%	27%	--	2%	1%	--	--	4%	--	--	6%
Kirkland	--	--	--	--	--	--	27%	--	--	--	4%
Lake Forest Park	--	--	--	--	--	7%	--	--	--	--	1%
Maple Valley	2%	--	--	15%	--	--	--	6%	--	--	2%
Medina	--	--	--	--	1%	--	1%	--	--	--	--
Mercer Island	--	--	1%	--	11%	--	--	--	--	--	2%
Milton	1%	--	--	--	--	--	--	--	--	--	--
Newcastle	--	--	--	--	2%	--	--	1%	--	--	--
Normandy Park	--	3%	--	--	--	--	--	--	--	--	1%
North Bend	--	--	51%	--	1%	--	--	--	--	--	2%
Pacific	2%	--	--	--	--	--	--	--	--	--	--
Redmond	--	--	--	--	2%	--	16%	--	--	--	3%
Renton	1%	3%	--	--	1%	--	--	65%	--	--	7%
Sammamish	--	--	1%	--	9%	--	2%	--	--	--	2%
SeaTac	--	13%	--	--	--	--	--	--	--	--	2%
Seattle	1%	4%	1%	--	3%	31%	3%	6%	--	1%	7%
Shoreline	--	--	--	--	--	38%	--	--	--	--	6%
Skykomish	--	--	--	--	--	--	--	--	57%	--	--
Snoqualmie	--	--	11%	--	--	--	--	--	--	--	--
Tukwila	--	4%	--	--	--	--	--	--	--	--	1%
Woodinville	--	--	--	--	--	--	13%	--	--	--	2%
Yarrow Point	--	--	--	--	--	--	--	--	--	--	--
Incorporated	*77%*	*95%*	*78%*	*74%*	*94%*	*82%*	*93%*	*89%*	*57%*	*1%*	*84%*
Unincorporated	*3%*	*3%*	*19%*	*10%*	*4%*	*1%*	*4%*	*9%*	*36%*	*97%*	*8%*
Subtotal King County	**79%**	**98%**	**97%**	**84%**	**99%**	**82%**	**96%**	**98%**	**93%**	**98%**	**92%**
Outside King County	*20%*	*2%*	*--*	*16%*	*1%*	*17%*	*3%*	*1%*	*7%*	*1%*	*8%*
Other city	--	--	*3%*	--	--	--	--	--	--	--	--
Multiple King County cities	--	--	--	--	--	--	*1%*	*1%*	--	*1%*	--
No response	--	--	--	--	--	--	--	--	--	--	--
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

The surveyors also asked self-haul customers to identify the zip code where the load came from. The following four pages of Table 4-12 show these results.

Table 4-12. Reported ZIP Code of Origin, Self-hauled Loads
June 2002 – May 2003 (n=5,142)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
98001	11%	4%	--	1%	--	--	--	--	--	--	2%
98002	10%	1%	--	1%	--	--	--	--	--	--	2%
98003	10%	3%	--	--	--	--	--	--	--	--	2%
98004	--	--	--	--	6%	--	3%	--	--	--	1%
98005	--	--	1%	--	5%	--	2%	--	--	--	1%
98006	--	--	--	--	16%	--	--	--	--	--	2%
98007	--	--	--	--	5%	--	1%	--	--	--	1%
98008	--	--	--	--	9%	--	1%	--	--	--	1%
98009	--	--	--	--	--	--	--	--	--	--	--
98010	--	--	--	5%	--	--	--	--	--	--	--
98011	--	--	--	1%	--	1%	6%	--	--	--	1%
98012	--	--	--	--	--	1%	2%	--	--	--	1%
98013	--	--	--	--	--	--	--	--	--	2%	--
98014	--	--	8%	--	1%	--	1%	--	--	--	1%
98018	--	--	--	--	--	--	--	--	--	--	--
98019	--	--	--	--	--	--	2%	--	--	--	--
98020	--	--	--	--	--	3%	--	--	--	--	1%
98021	--	--	--	--	--	1%	2%	--	--	--	--
98022	--	--	--	39%	--	--	--	--	--	--	3%
98023	9%	4%	--	--	--	--	1%	--	--	--	2%
98024	--	--	9%	--	2%	--	--	--	--	--	1%
98025	--	--	1%	1%	--	--	--	--	--	--	--
98026	--	--	--	--	--	5%	--	--	--	--	1%
98027	--	--	3%	--	8%	--	--	4%	--	--	2%
98028	--	--	--	--	--	2%	2%	--	--	--	1%
98029	--	--	1%	--	4%	--	--	--	--	--	1%
98030	2%	3%	--	--	--	--	--	--	--	--	1%
98031	2%	11%	--	1%	--	--	--	2%	--	--	3%
98032	2%	6%	--	--	--	--	--	--	--	--	1%
98033	--	--	--	--	--	--	9%	--	--	--	1%
98034	--	--	--	--	--	--	11%	--	--	--	2%
98035	--	--	--	--	--	--	--	--	--	--	--
98036	--	--	--	--	--	3%	--	--	--	--	--
98037	--	--	--	--	--	2%	--	--	--	--	--
98038	1%	--	--	14%	--	--	--	5%	--	--	2%
98039	--	--	--	--	1%	--	--	--	--	--	--
98040	--	--	--	--	7%	--	--	--	--	--	1%
98042	7%	5%	1%	9%	--	--	--	2%	--	--	3%
98043	--	--	--	--	--	1%	--	--	--	--	--
98044	--	--	--	--	--	--	--	--	--	--	--

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Table 4-12. Reported ZIP Code of Origin, Self-hauled Loads, Contd.
June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
98045	--	--	55%	--	1%	--	--	--	--	--	2%
98047	1%	--	--	--	--	--	--	--	--	--	--
98049	--	--	--	--	--	--	--	--	--	--	--
98050	--	--	2%	--	--	--	--	--	--	--	--
98051	--	--	--	5%	--	--	--	--	--	--	--
98052	--	--	--	--	1%	--	10%	--	--	--	2%
98053	--	--	--	--	1%	--	3%	--	--	--	1%
98054	--	--	--	--	--	--	--	--	--	--	--
98055	--	1%	--	--	--	--	--	10%	--	--	1%
98056	--	--	--	--	1%	--	--	14%	--	--	2%
98057	--	--	--	--	--	--	--	--	--	--	--
98058	--	2%	--	--	1%	--	--	16%	--	--	2%
98059	--	--	--	--	1%	--	--	26%	--	--	3%
98063	--	--	--	--	--	--	--	--	--	--	--
98065	--	--	13%	--	--	--	--	--	--	--	--
98066	--	--	--	--	--	--	--	--	--	--	--
98068	--	--	1%	--	--	--	--	--	--	--	--
98070	--	--	--	--	--	--	--	--	--	93%	3%
98072	--	--	--	--	--	--	10%	--	--	--	2%
98073	--	--	--	--	--	--	--	--	--	--	--
98074	--	--	--	--	4%	--	2%	--	--	--	1%
98075	--	--	1%	--	6%	--	--	--	--	--	1%
98077	--	--	--	--	--	--	--	--	--	--	--
98078	--	--	--	--	--	--	--	--	--	--	--
98092	9%	1%	--	4%	--	--	--	--	--	--	2%
98093	--	--	--	--	--	--	--	--	--	--	--
98095	--	--	--	--	--	--	--	--	--	--	--
98096	--	--	--	--	--	--	--	--	--	--	--
98101	--	--	--	--	--	--	--	--	--	--	--
98102	--	--	--	--	--	--	--	--	--	--	--
98103	--	--	--	--	--	1%	--	--	--	--	--
98104	--	--	--	--	--	--	--	--	--	--	--
98105	--	--	--	--	--	1%	--	--	--	--	--
98106	--	--	--	--	--	--	--	--	--	--	--
98107	--	--	--	--	--	1%	--	--	--	--	--
98108	--	--	--	--	--	--	--	--	--	--	--
98112	--	--	--	--	--	--	--	--	--	--	--
98115	--	--	--	--	--	3%	--	--	--	--	1%
98116	--	--	--	--	--	--	--	--	--	--	--
98117	--	--	--	--	--	3%	--	--	--	--	--

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Table 4-12. Reported ZIP Code of Origin, Self-hauled Loads, Contd.
June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
98118	--	--	--	--	1%	--	--	1%	--	--	--
98119	--	--	--	--	--	--	--	--	--	--	--
98122	--	--	--	--	--	--	--	--	--	--	--
98123	--	--	--	--	--	--	--	--	--	--	--
98124	--	--	--	--	--	--	--	--	--	--	--
98125	--	--	--	--	--	8%	--	--	--	--	1%
98126	--	--	--	--	--	--	--	--	--	--	--
98127	--	--	--	--	--	--	--	--	--	--	--
98131	--	--	--	--	--	--	--	--	--	--	--
98133	--	--	--	--	--	17%	--	--	--	--	3%
98136	--	--	--	--	--	--	--	--	--	--	--
98144	--	--	--	--	--	--	--	--	--	--	--
98146	--	2%	--	--	--	--	--	--	--	--	--
98148	--	2%	--	--	--	--	--	--	--	--	--
98155	--	--	--	--	--	22%	--	--	--	--	4%
98165	--	--	--	--	--	--	--	--	--	--	--
98166	--	7%	--	--	--	--	--	--	--	--	1%
98168	--	7%	--	--	--	--	--	--	--	--	1%
98177	--	--	--	--	--	10%	--	--	--	--	2%
98178	--	1%	--	--	--	--	--	7%	--	--	1%
98188	--	9%	--	--	--	--	--	--	--	--	2%
98193	--	--	--	--	--	--	--	--	--	--	--
98198	1%	13%	--	--	--	--	--	--	--	--	2%
98199	--	--	--	--	--	--	--	--	--	--	--
98203	--	--	--	--	--	--	--	--	--	--	--
98204	--	--	--	--	--	--	--	--	--	--	--
98205	--	--	--	--	--	--	--	--	--	--	--
98206	--	--	--	--	--	--	--	--	--	--	--
98208	--	--	--	--	--	--	--	--	--	--	--
98209	--	--	--	--	--	--	--	--	--	--	--
98210	--	--	--	--	--	--	--	--	--	--	--
98220	--	--	--	--	--	--	--	--	--	--	--
98223	--	--	--	--	--	--	--	--	--	--	--
98224	--	--	--	--	--	--	--	--	14%	--	--
98228	--	--	--	--	--	--	--	--	14%	--	--
98232	--	--	--	--	--	--	--	--	--	--	--
98240	--	--	--	--	--	--	--	--	--	--	--
98248	--	--	--	--	--	--	--	--	--	--	--
98271	--	--	--	--	--	--	--	--	--	--	--
98272	--	--	--	--	--	--	--	--	7%	--	--

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Table 4-12. Reported ZIP Code of Origin, Self-hauled Loads, Contd.
June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
98275	--	--	--	--	--	--	--	--	--	--	--
98288	--	--	--	--	--	--	--	--	64%	--	--
98296	--	--	--	--	--	--	1%	--	--	--	--
98298	--	--	--	--	--	--	--	--	--	--	--
98300	--	--	--	--	--	--	--	--	--	--	--
98302	--	--	--	--	--	--	--	--	--	--	--
98321	--	--	--	7%	--	--	--	--	--	--	1%
98323	--	--	--	1%	--	--	--	--	--	--	--
98324	--	--	--	--	--	--	--	--	--	--	--
98338	--	--	--	--	--	--	--	--	--	--	--
98354	1%	--	--	--	--	--	--	--	--	--	--
98360	1%	--	--	--	--	--	--	--	--	--	--
98370	--	--	--	--	--	--	--	--	--	--	--
98371	2%	--	--	--	--	--	--	--	--	--	--
98372	4%	--	--	--	--	--	--	--	--	--	1%
98373	--	--	--	--	--	--	--	--	--	--	--
98374	--	--	--	--	--	--	--	--	--	--	--
98384	--	--	--	--	--	--	--	--	--	--	--
98385	--	--	--	--	--	--	--	--	--	--	--
98388	--	--	--	--	--	--	--	--	--	--	--
98390	7%	--	--	3%	--	--	--	--	--	--	1%
98391	--	--	--	--	--	--	--	--	--	--	--
98392	--	--	--	--	--	--	--	--	--	--	--
98396	--	--	--	1%	--	--	--	--	--	--	--
98405	--	--	--	--	--	--	--	--	--	--	--
98406	--	--	--	--	--	--	--	--	--	1%	--
98422	1%	--	--	--	--	--	--	--	--	--	--
98424	1%	--	--	--	--	--	--	--	--	--	--
98425	--	--	--	--	--	--	--	--	--	--	--
98439	--	--	--	--	--	--	--	--	--	--	--
98443	--	--	--	--	--	--	--	--	--	--	--
98446	--	--	--	--	--	--	--	--	--	--	--
98498	--	--	--	--	--	--	--	--	--	--	--
98507	--	--	--	--	--	--	--	--	--	--	--
98522	--	--	--	--	--	--	--	--	--	--	--
98612	--	--	--	--	--	--	--	--	--	--	--
98624	--	--	--	--	--	--	--	--	--	--	--
98723	--	--	--	--	--	--	--	--	--	--	--
98732	--	--	--	--	--	--	--	--	--	--	--
98902	--	--	--	--	--	--	--	--	--	--	--
98904	--	--	--	--	--	--	--	--	--	--	--
	90%	**89%**	**96%**	**94%**	**84%**	**88%**	**74%**	**91%**	**100%**	**96%**	**87%**
No response	*10%*	*11%*	*4%*	*6%*	*16%*	*12%*	*26%*	*9%*	*--*	*4%*	*13%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Estimated percentages are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. For more detail, please see Interpreting the Results *on page 19.*

Chapter 5
Comparisons with Previous Studies

5.1 STUDY COMPARISON OVERVIEW & KEY FINDINGS

This chapter compares waste composition results of the current study with the previous study, from 1999-2000, and with a similar study conducted a decade ago, in 1993-1994.

Key Study Comparison Findings

- **Paper materials have decreased in most commercially collected wastes** since 1993-1994, with statistically significant reductions in cardboard and Kraft paper and other curbside paper in both single-family and nonresidential loads. Among nonresidential loads, cardboard and Kraft paper also showed a drop since 1999-2000. In multi-family loads, however, disposal of other curbside paper showed increases in the current study from both the previous figures.
- **Organics show an apparent increase in nonresidential commercially collected** loads since both previous studies.
- **Construction and demolition materials appear to have increased in self-hauled** waste loads since 1999-2000.

5.2 WASTE COMPOSITION COMPARISONS

King County waste composition data collected during previous studies allow for a useful examination of trends and changes in the waste stream. This section presents findings from statistical comparisons between the 2002-2003 waste composition data and the previous study period, 1999-2000. The analysis then examines statistical differences, using *t*-tests, between the 2002-2003 study and a 1993-1994 waste composition study.[25] These comparisons are meant to determine if changes in the composition of King County's disposed waste stream are statistically significant. This report does not attempt to examine potential causes of the changes in waste composition over time.

[25] King County waste composition studies prior to the 1993-1994 study did not use a comparable study methodology and so the results cannot be accurately compared to the 2002-2003 composition analysis.

The year-to-year comparisons were made by examining the changes in the composition percentages for selected material groupings. The material groupings include:

- Newspaper;
- Cardboard and Kraft paper;
- Other curbside paper — low-grade recyclable, high-grade printing, and computer paper;
- Curbside recyclable containers — plastic bottles, glass bottles and containers, aluminum cans, and tin food cans;
- Compostable organics — food and yard wastes, other paper, animal feces and carcasses;
- Construction and demolition wastes;
- Wood waste; and
- Hazardous waste.

Statistical tests were used to analyze differences in the composition percentages between years for the following substreams:

- Commercially collected single-family residential;
- Commercially collected multi-family residential;
- Commercially collected nonresidential; and
- Self-hauled (includes both residential and nonresidential).

More detail regarding the material groupings and the statistical analyses can be found in Appendix F, page F-1.

The differences in material groupings between studies can be grouped into two main categories:

- **Statistically significant** —These findings can be considered true differences because the probability of observing these results if there had been no actual year-to-year change is low.

- **Strong trend** — Although the results did not meet the requirements of the study's conservative statistical tests, the data suggest a possible and noteworthy change.

Comparisons identified as "statistically significant" or "strong trends" are summarized in Table 5-1 for 1993-1994 compared to 2002-2003 and in Table 5-2 for 1999-2000 compared to 2002-2003. Because the waste composition results are expressed as percentages, rather than absolute tonnages, significant changes for one material may affect the percentages for other materials. Accordingly, increases over time in materials recycled may alter the percentages for other materials remaining in the waste stream.

Table 5-1. Waste Composition Changes & General Trends, 1993-1994 to 2002-2003

	MATERIAL GROUPING	MEAN RATIO (Material Wt/Total Wt) 1993/94	MEAN RATIO (Material Wt/Total Wt) 2002/03	STRENGTH OF RESULTS
Commercially Collected				
Single-family	Cardboard and Kraft	6.0%	3.6% ↓	Statistically significant
Single-family	Newspaper	5.5%	2.6% ↓	Statistically significant
Single-family	Other Curbside Paper	12.5%	8.3% ↓	Statistically significant
Multifamily	Other Curbside Paper	9.3%	12.9% ↑	Strong trend
	Wood Waste	6.6%	4.6% ↓	Strong trend
Nonresidential	Cardboard and Kraft	10.6%	6.1% ↓	Statistically significant
Nonresidential	Other Curbside Paper	11.6%	8.6% ↓	Statistically significant
Nonresidential	Construction & Demolition	3.2%	5.8% ↑	Strong trend
Nonresidential	Organics	26.0%	29.8% ↑	Strong trend
Self-hauled				
	Organics	26.1%	19.2% ↓	Strong trend

Table 5-2. Waste Composition Changes & General Trends, 1999-2000 to 2002-2003

	MATERIAL GROUPING	MEAN RATIO (Material Wt/Total Wt) 1999/2000	MEAN RATIO (Material Wt/Total Wt) 2002/03	STRENGTH OF RESULTS
Commercially Collected				
Single-family	Other Curbside Paper	10.0%	8.3% ↓	Strong trend
Multifamily	Other Curbside Paper	8.8%	12.9% ↑	Strong trend
Nonresidential	Cardboard and Kraft	9.2%	6.1% ↓	Statistically significant
Nonresidential	Organics	24.7%	29.8% ↑	Strong trend
Self-hauled				
	Construction & Demolition	9.4%	13.8% ↑	Strong trend
	Curbside Recyclable Containers	2.3%	1.4% ↓	Strong trend
	Hazardous	1.8%	0.5% ↓	Strong trend

APPENDIX A.
Waste Sampling Methodology

This appendix explains the methodology used to create the sampling plan and conduct the waste stream sorting. The objective of the waste stream sampling was to provide statistically valid composition data, by weight, for the King County disposed waste stream. This study includes the mixed municipal solid waste (MMSW) disposed by the commercially collected residential, commercially collected nonresidential, self-hauled residential, and self-hauled nonresidential substreams; it excludes wastes from the construction, demolition and land-clearing (CDL) substream, which are disposed at special facilities designated for the purpose.

To understand the overall solid waste stream better, the total waste can be divided into various **substreams**, according to where the waste comes from and who brings it to the waste facilities. Such analysis is useful because the different substreams often have different waste types, user profiles, and public programs for reaching customers

Substreams are identified according to such factors as the source, or generator, of the waste (residential or nonresidential) as well as how materials are delivered to waste sites (commercially collected or self-hauled).

- **Residential waste** comes from single-family or multifamily dwellings.
- **Nonresidential waste** comes from businesses, schools, government offices, and other institutions that are not residences.
- **Commercial haulers** are firms that contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area.[1]
- **Self-haulers** are residents or businesses that bring waste themselves to transfer stations or drop boxes.[2]

In this study, waste loads and customers surveyed are first divided into residential and nonresidential categories. Then those categories are further divided between commercially collected and self-hauled waste, as shown in Table A-1. In some cases, loads contain a mixture of waste from residential and nonresidential sources, but these "mixed loads" represent only a small portion of the total waste.

[1] The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. In the 2002-2003 study, King County included these waste deliveries with the commercially hauled loads.

[2] Self-hauled loads are categorized as residential or nonresidential according to the source of the load, not the type of hauler. For example, some companies, such as contractors and landscapers, collect waste from homes or businesses. These loads are considered self-hauled residential if the waste is produced from homes, even though the company, not the residents, delivers the material to a waste facility.

Table A-1. Substream Definitions

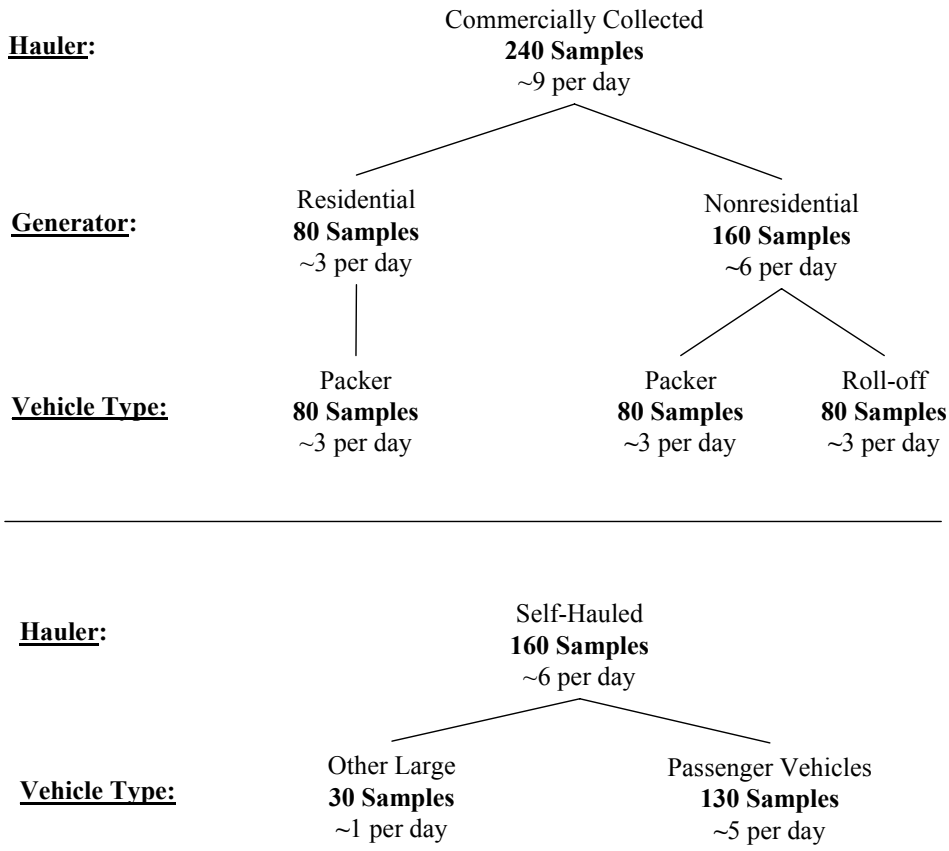
	Commercially Collected	Self-hauled
Residential Waste	Commercially collected waste from residential sources	Self-hauled waste from residential sources
Nonresidential Waste	Commercially collected waste from nonresidential sources	Self-hauled waste from nonresidential sources

The actual make-up of the entire waste stream is not as simple as the table suggests. For example, disposal facilities sometimes receive commercially collected loads that contain a mixture of residential and nonresidential waste. These are referred to as "mixed loads" and are grouped with the nonresidential substream for analysis.

SAMPLE DISTRIBUTION

In order to provide reliable waste composition estimates, the sampling plan allocated specific numbers of samples to different waste streams. Figure A-1 shows the distribution of samples. The sampling plan called for 400 samples collected over 27 sampling days.

Figure A-1. Sample Distribution



As shown, greater numbers of samples were allocated to the commercially hauled nonresidential and self-hauled substreams. The waste found in these streams tends to be more highly variable from load to load. The higher variability means that additional samples were required to provide precision levels comparable to the commercially collected residential substream.

Within the commercially collected nonresidential substream, the samples were equally divided among packer trucks and roll-offs (80 samples for each vehicle type). The self-hauled substream was also divided between passenger vehicles (130 samples) and other large vehicles (30 samples).

A total of 369 samples were sorted during the study period. Fewer samples were sorted than planned largely due to operational difficulties during a scheduled sorting day at Houghton and the arrival of only one load during a sampling day at Third and Lander. However, the total number of samples produced acceptable precision estimates for the overall waste stream and each substream. For this reason, and due to the cost of adding additional sampling days, 369 samples were considered adequate. Figure A-2 shows the difference in the number of planned samples versus actual samples obtained.

Figure A-2. Planned versus Actual Samples Obtained

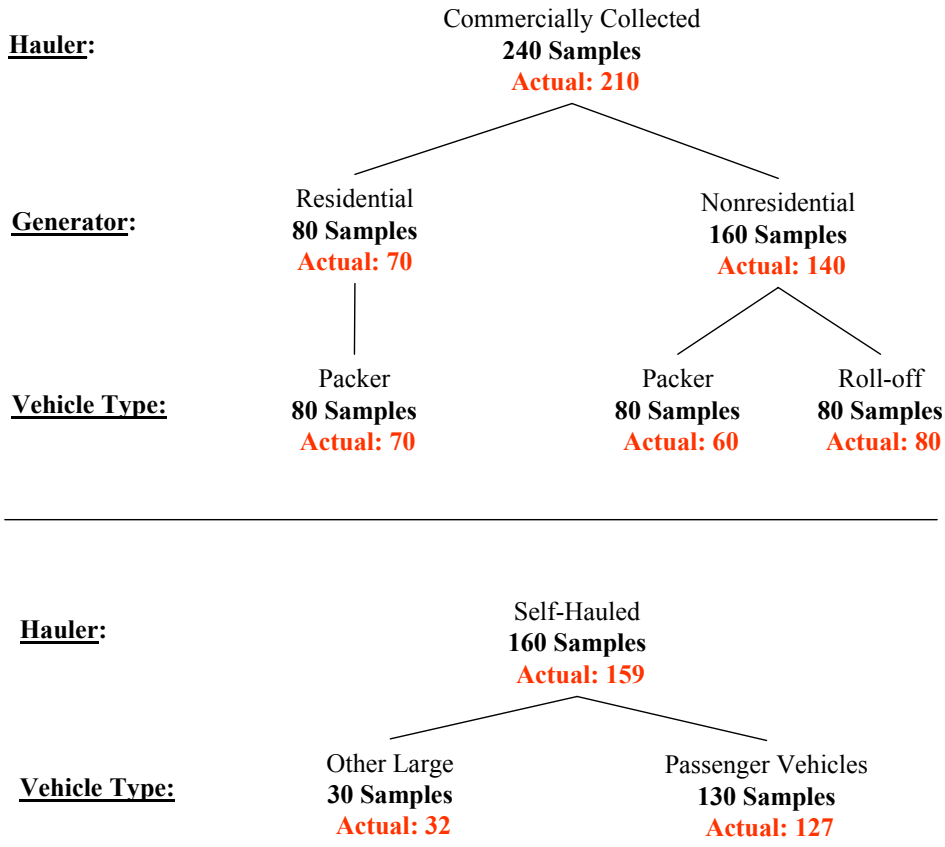


Table A-2 shows the number of waste samples collected per month at each of the 10 county transfer facilities. Seventy-one additional samples were taken from waste loads entering the county's two private facilities, Eastmont and Third & Lander.

Table A-2. Number of Waste Samples, by Facility*
June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE
June	--	--	--	15	--	--
July	15	--	1	--	14	--
August	--	--	--	--	--	--
September	--	15	--	--	--	--
October	--	--	--	--	--	15
November	--	15	--	--	14	--
December	15	--	--	15	--	--
January	--	--	--	--	--	15
February	--	--	--	--	--	--
March	13	--	--	--	15	--
April	--	15	--	--	--	--
May	--	--	--	--	--	13
Total	**43**	**45**	**1**	**30**	**43**	**43**

	Houghton	Renton	Skykomish	Vashon	Private Facilities	OVERALL
June	15	--	--	--	--	**30**
July	--	--	--	--	1	**31**
August	15	14	--	--	--	**29**
September	--	--	--	15	--	**30**
October	--	--	--	--	15	**30**
November	--	--	--	--	11	**40**
December	--	--	--	--	--	**30**
January	--	--	--	--	15	**30**
February	3	--	1	15	--	**19**
March	--	--	--	--	14	**42**
April	--	15	--	--	--	**30**
May	--	--	--	--	15	**28**
Total	**33**	**29**	**1**	**30**	**71**	**369**

Note: The Skykomish drop box was sampled at Houghton and the Cedar Falls drop box was sampled at Factoria.

APPORTION SAMPLING DAYS

A total of 27 sampling days were scheduled for the 2002-2003 study, divided into monthly sampling events lasting 2 or 3 days each. Waste was sampled from 10 King County facilities (including 8 transfer stations and 2 drop boxes) and 2 private facilities (Eastmont and Third & Lander). Black River, a privately owned site, was excluded since this facility accepts construction and demolition waste only.

Three days were allocated to the sites receiving the most residential, commercial, and self-haul waste based on historical tonnage: Algona, Bow Lake, Eastmont, Factoria, First Northeast, Houghton, and Third and Lander. Two sampling days were allocated to Enumclaw, Renton, and Vashon. The Skykomish and Cedar Falls drop boxes were sampled at Houghton and Factoria, respectively.

ASSIGN FACILITIES TO SAMPLING DATES

Two or three facilities were sampled each month from June 2002 through May 2003. In order to account for seasonal variations, the sampling days occurred in 6-month or 4-month intervals, depending on whether the site was sampled two or three times during the study period. Algona, Bow Lake, Eastmont, Factoria, First Northeast, Houghton, and Third & Lander were sampled three times during the study period while Enumclaw, Renton, and Vashon were sampled twice. The following 11 steps were taken to randomly select sampling dates for each facility.

1. Assign a random number to each facility using the Microsoft Excel formula "=rand()."
2. Sort facilities in ascending order according to their random number, with 3-day facilities and 2-day facilities kept separate.
3. Assign a random number to each of the first 6 months of study period using the Microsoft Excel formula "=rand()."
4. Assign each 2-day facility (Renton, Vashon and Enumclaw) to the 3 months with the lowest random number.
5. Assign each 2-day facility a second sampling month 6 months after the first assigned month.
6. Assign the 3-day facility with the lowest random number to the first sampling month, June.
7. Assign the 3-day facility with the next lowest random number to the second sampling month, July, and so on until all 3-day facilities are assigned a month.
8. Assign each 3-day facility two more sampling days (for a total of 3 for the year) in 4-month intervals from the first assigned month.
9. To select the sampling days within each month, assign a random number to each of the possible sampling days, eliminating holidays and days that the sampling crew is not available.

10. Sort the available days by their random number.
11. For each month, assign the facilities to be sampled to the two or three days with the lowest random numbers.

Table A-3 shows the results of this process, the sampling dates for each facility.

Table A-3. Sampling Schedule

	Sun	Mon	Tue	Wed	Thurs	Fri	Sat
Jun: 11, 12			Enumclaw	Houghton			
Jul: 11, 12, 13					Algona	Factoria	3rd & L
Aug: 26, 27		Bow Lake	Vashon				
Sept: 17, 18			Eastmont	1st NE			
Oct: 16, 17				Houghton	Renton		
Nov: 19, 20, 21			Bow Lake	Factoria	3rd & L		
Dec: 8, 9	Algona	Enumclaw					
Jan: 16, 17					Eastmont	1st NE	
Feb: 16, 17	Houghton	Vashon					
Mar: 7, 8, 9	Algona					3rd & L	Factoria
Apr: 4, 5						Renton	Bow Lake
May: 28, 29				Eastmont	1st NE		
# of Days	3	3	4	5	5	4	3

Determine Sampling Frequency

Sampling frequency refers to the process by which particular vehicles were chosen to be sampled. Vehicles were selected for sampling through a randomizing process that involved systematic selection of vehicles as they arrived at each facility during a sampling day. A staff member designated, as the "gatekeeper" interviewed and counted incoming vehicles and applied the process described below to select the loads from which samples were extracted.

1. For each sampling day and each waste stream, the expected number, *L*, of arriving loads from each stream was estimated. The number *L* was then reduced by one-fifth (producing 0.8 x *L*). This was done in order to ensure that the targeted number of loads for each waste stream was selected on each sampling day.
2. Next, the interval *n* was determined to insure systematic sampling of vehicles. If *r* represents the number of samples needed for the waste stream, and .8 x *L* represents the number of expected loads from the waste stream, then *n* is calculated by dividing .8 x *L* by *r*. To facilitate this process, a *vehicle selection sheet* was constructed for each day and every *nth* vehicle was selected for sampling. A sample vehicle selection sheet appears in Appendix J.

FIELD PROCEDURES

At the scale house, the Gatekeeper interviewed each driver to determine the appropriate waste stream and then selected vehicles for sampling according to the prepared vehicle selection sheet. If the vehicle was to be sampled, the Gatekeeper placed a highly visible large fluorescent "SAMPLE" placard and a vehicle identification card on the windshield. The Sort Crew Manager retrieved the ID tag and recorded the ID number on the sample tally sheet. The ID number linked the Gatekeeper's survey data with the sample tally sheet data during the analysis.

Commercially collected loads that were designated for sorting and delivered in compactors or roll-off containers were dumped in an elongated pile. The sample was selected using an imaginary 16-cell grid superimposed over the dumped material. The Sort Crew Manager identified a randomly pre-selected cell to be sorted. If the designated cell was blocked due to site constraints, an alternate cell was randomly selected. Then, approximately 200 to 300 pounds of waste was extracted by machine or hand from the designated cell and placed on a tarp.

Samples from large (greater than 500 pounds) self-hauled loads were selected in much the same manner as commercially collected loads, using a random and/or representative cell selection. If the self-hauled load weighed less than 300 pounds, the entire load was sorted as a sample.

After the extracted material was deposited on the tarp, the Sort Crew Manager checked the weight of each sample manually. If judged to be too light, additional material was pulled from the same cell area until the desired weight was achieved. Samples judged to be excessively heavy were pared down by removing a homogenous slice of material from the tarp.

Once a sample had been selected, extracted from the load, and placed on a clean tarp, it was sorted by hand into the 73 material categories (Appendix B). Components were placed in plastic laundry baskets to be weighed and recorded.

The Sort Crew Manager monitored the homogeneity of the component baskets as material accumulated, rejecting items, which may be improperly classified. Open laundry baskets allowed the Sort Crew Manager to see the material at all times. The Sort Crew Manager also verified the purity of each component as it was weighed, before recording the weight on the sampling form.

After the departing vehicle crossed the scale, the Gatekeeper collected the "SAMPLE" placard. The absence of an ID tag informed the Gatekeeper that the sampling crew successfully captured the load for sampling.

All sampling records were checked for accuracy, completeness, and legibility, then entered into a Microsoft Access database customized for this study.

APPENDIX B.
Sampling Material Definitions

Waste samples were sorted to the greatest reasonable detail by hand. The sorting categories used in the 2002-2003 study were similar to those used in the 1999-2000 study. Sampling material definitions that were added, or modified, to the 2002-2003 sampling definitions are as follows:

Paper

- **Compostable Paper** — category added in 2002-2003; material considered *other paper* in previous studies.
- **Gift Paper** — category added in 2002-2003; material considered *other paper* in previous studies.

Plastics

- **Expanded Polystyrene** — category name clarified in 2002-2003; material called *polystyrene foam* in previous studies, with an identical definition.
- **Foam Rubber and Padding** — category added in 2002-2003; material considered *rubber products* in previous studies.

Metals

- **Compressed Gas Cylinders** — category added in 2002-2003; material considered *other ferrous* in previous studies.

Organics (Wood, Yard, and Food Wastes)

- **Dimensional Lumber/Engineered Wood** — category name and definition clarified but not substantially altered in 2002-2003; material called *dimension lumber* in previous studies.
- **Other Textiles** — category name clarified in 2002-2003; material called *textiles* in previous studies with an identical definition.

Other Wastes

- **Household Appliances** — category name clarified in 2002-2003; material called *small appliances* in previous studies.
- **Printers/Copiers/Fax Machines** — category added in 2002-2003; material considered *plastic and other materials* in previous studies.
- **Office Electronics** — category added in 2002-2003; material considered *plastic and other materials* in previous studies.

Household Hazardous/Special Wastes

- **Alkaline/Button Cell Batteries** — category added in 2002-2003; material considered *household batteries* in previous studies.
- **Antifreeze/Brake Fluid** — category name clarified in 2002-2003; material called *antifreeze* in previous studies.
- **Computer Monitors** — category added in 2002-2003; material considered *mixed metals and other materials* in previous studies.
- **Televisions** — category added in 2002-2003; material considered *mixed metals and other materials* in previous studies.
- **Cell Phones** — category added in 2002-2003; material considered *plastic and other materials* in previous studies.
- **Laptops/LCD Monitors** — category added in 2002-2003; material considered *plastic and other materials* in previous studies.

A defined list of all component categories follow:

Paper

Old Newspaper (ONP)—printed groundwood newsprint and other minimally bleached groundwood. This category also includes some glossy paper typically used in newspaper insert advertisements, unless found separately.

Corrugated Cardboard (OCC/Kraft Bags)—Kraft linerboard, containerboard cartons, and shipping boxes with corrugated paper medium (unwaxed). This category also includes Kraft (brown) paper bags. Excludes waxed and plastic-coated cardboard, solid boxboard, and bags that are not pure unbleached Kraft.

Low Grade Recyclable—magazines, phone books, junk mail, used envelopes, other material with sticky labels, construction paper, blueprint and thermal copy paper (NCR paper), fax paper, bright-dyed paper (fiesta or neon colors), paperback books, colored manila envelopes, and groundwood catalogues. This category also includes other low-grade recyclable papers used in packaging, including chipboard and other solid boxboard (not polycoated) such as for beer and soda cans, clothing forms, egg cartons (molded pulp), and other boxes.

High Grade—printing and writing papers, primarily thermo-chemical pulps. This category is composed of high-grade paper, which includes white ledger, colored ledger, computer cards, bond, copy machine paper, manila envelopes and continuous-feed computer printouts and forms of various types. Excludes glossy coated paper such as magazines, bright papers, groundwood publications such as catalogs.

Bleached Polycoated Paperboard—polycoated bleached paperboard cartons used for milk, ice cream, and juice (including aseptic packaging). Does not include frozen food packaging, microwave boxes, cups, or other non-food packaging.

Paper and Other Materials—items that are primarily paper, but combined with other materials. Includes juice cans, oil cans, paper or boxboard with foil laminates, foil-lined papers, notebooks, aluminum foil boxes, and other similar packages or products.

Compostable Paper—includes tissues and paper soiled with food, such as paper plates, pizza boxes, and paper towels.

Gift Paper—gift wrapping paper.

Other Paper—paper not included above that is not easily recyclable. Includes carbon paper, photographs, waxed cardboard, poly-lined chipboard, microwave containers, frozen food boxes, wet strength boxboard, and hardcover books.

Plastics

PET Bottles—all bottles made from polyethylene terephthalate (PET), consisting of pop, oil, liquor, and other types of bottles (SPI code 1).

HDPE Bottles—all bottles made of high-density polyethylene (HDPE), such as milk, juice, detergent, and other bottles (SPI code 2).

Other Containers—all other rigid containers with SPI codes 3 through 7, and PET and HDPE containers other than bottles.

Expanded Polystyrene—expanded polystyrene packaging, food trays, cups, plates, clamshells, and other packaging.

Plastic Film and Bags—all film, bags and thin plastic packaging, including wrappings, vacuum-formed packaging, bubble packs, and other films, as well as plastic strapping and other thin flexible plastic packaging. Also includes shower curtains, plastic sheeting, trash bags, and other thin plastic products.

Other Packaging—all other non-film packaging that does not fit into the above categories including caps, closures, and other miscellaneous items.

Plastic Products—primarily rigid or solid consumer items including dishware, utensils and other household items, vinyl products, all-plastic furniture and toys, car parts, and hangers. Also includes thermoset plastics such as formica, fiberglass, and other related products.

Foam Rubber and Padding—foam materials, consisting primarily of polyurethane, used for carpet padding, packaging, and other applications (not including insulation).

Plastic and Other Materials—items that are predominantly made of plastic, but are combined with other material, such as kitchenware and car parts with wood or metal components.

Organics (Wood, Yard, and Food Wastes)

Dimensional Lumber/Engineered Wood—both clean and painted wood commonly used in construction for framing and related uses, including 2 x 4's, 2 x 6's, and sheets of plywood, strandboard, and particle board. Includes pallets and crates.

Treated Wood—wood treated with preservatives such as creosote, including dimension lumber. This category may also include some treated plywood, strandboard, chemically treated wood, and other wood.

Contaminated Wood—wood contaminated with other wastes in such a way that they cannot easily be separated, but consisting primarily (over 50 percent) of wood. Examples include wood with sheetrock attached.

Roofing and Siding Wood—painted or unpainted wood from demolition or construction waste that is commonly used for siding or roofing of buildings. This category includes only wood products, such as cedar shingles or shakes.

Stumps—stumps of trees and shrubs, with any adhering soil.

Large Prunings—other natural woods, such as logs and branches in excess of four inches in diameter (four inches is the limit used for defining prunings as yard wastes).

Yard Wastes—leaves, grass clippings, garden wastes, and brush up to four inches in diameter.

Other Wood—other types of wood including wood products that do not fit into the above categories.

Food Wastes—leftovers and wastes from food preparation. Includes food in the original or another container when the container weight is less than 10% of the total weight.

Other Organics

Textiles: Clothes & Other Recyclables—fabric materials including natural and man-made textile materials such as cottons, wools, silks, woven nylon, rayon, polyesters and other materials. This category includes clothing, rags, curtains, and other fabrics.

Other Textiles—carpets/upholstery, shoes, and other nonrecyclable products including leather products.

Disposable Diapers—diapers and similar products made from a combination of fibers, synthetic, and/or natural, and made for the purpose of a single use. Diapers that are all cloth and not originally intended for single use will be classified as a textile. This category includes fecal matter contained within, sanitary napkins and tampons, and adult disposable protective undergarments.

Rubber Products (except tires and foam rubber)—items made of natural and synthetic rubber, including door mats, car parts, hoses, toys, and other products.

Tires—whole tires from automobiles, trucks, motorcycles, bicycles, and other vehicles.

Animal Carcasses—carcasses of small animals and pieces of larger animals, unless the waste is the result of food storage or preparation.

Animal Feces—feces from animals including kitty litter and bedding.

Miscellaneous Organics—hair, wax, soap, and other organics not otherwise classified.

Glass

Clear Containers—bottles and jars that are clear in color; used for food, soft drinks, beer, and wine.

Green Containers—bottles and jars that are green in color; used for food, soft drinks, beer, and wine.

Brown Containers—bottles and jars that are brown in color; used for food, soft drinks, beer, and wine.

Other Glass—window glass, mirrors, light bulbs, cooking wear, and other glass and ceramic products that are not easily recyclable.

Metals

Aluminum Cans—beverage cans composed of aluminum only.

Other Aluminum—other types of aluminum containers such as pans and trays; includes foil and foil products or packages and all other aluminum materials including furniture, house siding, cookware, and scrap.

Tinned Food Cans—tin-plated steel cans (food cans), does not include other bi-metals, paint cans, or other types of steel cans.

Other Ferrous—ferrous and alloyed ferrous scrap materials derived from iron, including household, industrial, and commercial products including other cans and containers. This category includes scrap iron and steel to which a magnet adheres.

Other Non-Ferrous—metals that are not materials derived from iron, including copper, brass, bronze, aluminum bronze, lead, pewter, zinc, and other metals to which a magnet will not adhere. Metals that are significantly contaminated are not included.

Mixed Metals and Other Materials—composite metal products and metals combined with other materials, such as engines, electric motors, umbrellas, coated wire, and aerosol cans.

Compressed Gas Cylinders—metal gas tanks and cylinders most often used to contain propane or butane.

Other Wastes

Construction/Demolition Waste (except wood)—construction, demolition, or land clearing waste that cannot be placed into one of the above categories, such as concrete, plaster, rocks, gravel, bricks, asphalt shingles and non-wood roofing materials, and insulation of various types (including foam, fiberglass etc.).

Ashes—material remaining after the combustion process, present in the waste stream as ash from fireplaces and wood stoves, used charcoal from grills, and similar materials.

Nondistinct Fines—soil, sand, dirt, and similar nondistinct materials.

Gypsum Wallboard—calcium sulfate dihydrate sandwiched between heavy layers of Kraft-type paper.

Furniture/Mattresses—furniture and mattresses made of mixed materials and in any condition.

Household Appliances—small household appliances such as, stereos, radios, toasters, broilers, can openers, and blenders.

Printers/Copiers/Fax Machines—computer printers (both inkjet and laser), facsimile machines, and photo copying machines.

Office Electronics—items such as computer central processing units (CPUs), scanners, personal digital assistants (PDAs), and computer peripherals including keyboards and mouses.

Miscellaneous Inorganics—non-construction, demolition and landclearing, plaster of paris, concrete items, and materials not otherwise classified.

Household Hazardous/Special Waste

Used Oil—used lubricating oils, primarily used in cars but including other types with similar characteristics and oil filters.

Vehicle Batteries—car, motorcycle, and other lead-acid batteries used for motorized vehicles.

Household Batteries—batteries of various sizes and types, as commonly used in households, excluding alkaline and button cell batteries.

Alkaline/Button Cell Batteries—alkaline and button cell batteries.

Latex Paint—water-based paints and similar products.

Oil-Based Paint—solvent-based paints, varnishes, and similar products.

Solvents and Thinners—various solvents, including chlorinated and flammable solvents, paint strippers, solvents contaminated with other products such as paints, degreasers and some other cleaners if the primary ingredient is (or was) a solvent, and alcohols such as methanol and isopropanol.

Adhesives and Glue—glues and adhesives of various sorts, including rubber cement, wood putty, glazing and spackling compounds, caulking compounds, grout, and joint and auto body fillers.

Cleaners and Corrosives—various acids and bases whose primary purpose is to clean surfaces, unclog drains, or perform other actions.

Pesticides and Herbicides—variety of chemicals whose purpose is to discourage or kill pests, weeds, or microorganisms. Fungicides and wood preservatives, such as pentachlorophenol, are also included.

Gasoline and Fuel Oil—gasoline, diesel fuel, and fuel oils.

Antifreeze/Brake Fluid—automobile and other antifreeze mixtures based on ethylene or propylene glycol; also brake and other automotive fluids (except motor oil)

Medical Waste—wastes related to medical activities, including syringes, intravenous (I.V.) tubing, bandages, medications, and other wastes.

Computer Monitors—computer monitors.

Televisions—televisions.

Cell Phones—cellular telephones.

Laptops/LCD Monitors—Liquid crystal display (LCD) and flat-screen monitors, and laptop and notebook computers that contain these types of monitors.

Other Hazardous Waste—asbestos-containing wastes if this is the primary hazard associated with the waste; gunpowder, unspent ammunition, picric acid and other potentially explosive chemicals; radioactive materials (but smoke alarms are classified as "other plastic"); items that contain mercury, such as thermometers, thermostats, fluorescent lamps and tubes, jewelry and mercury switches (alkaline and button cell batteries, which also contain mercury, are covered as a separate category of “Household Batteries”); and other hazardous wastes that do not fit into the above categories.

APPENDIX C.
Waste Composition Calculations

Cascadia estimated the waste composition and annual tonnage through analyses of the waste sort data, customer surveys, and disposal tonnage data provided by King County Solid Waste Division. This Appendix details each step of the calculation process.

Composition Calculations

The composition estimates represent the **ratio of the components' weight to the total sample weight** for each noted substream. They are derived by summing each component's weight across all of the selected records and dividing by the sum of the total sample weight, as shown in the following equation:

$$r_j = \frac{\sum_i c_{ij}}{\sum_i w_i}$$

where: r = ratio of components' weight to the total sample weight

c = weight of particular component

w = sum of all component weights

for i 1 to n

where n = number of selected samples

for j 1 to m

where m = number of components

The confidence interval for this estimate is derived in two steps. First, the variance around the estimate is calculated, accounting for the fact that the ratio includes two random variables (the component and total sample weights). The **variance of the ratio estimator** equation follows:

$$\hat{V}_{r_j} = \left(\frac{1}{n}\right) \cdot \left(\frac{1}{\overline{w}^2}\right) \cdot \left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1}\right)$$

where:

$$\overline{w} = \frac{\sum_i w_i}{n}$$

Second, **precision levels** at the 90% confidence interval are calculated for a component's mean as follows:

$$r_j \pm \left(t \cdot \sqrt{\hat{V}_{r_j}} \right)$$

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level

For more detail, please refer to Chapter 6 "Ratio, Regression and Difference Estimation" of *Elementary Survey Sampling* by R.L. Scheaffer, W. Mendenhall and L. Ott (PWS Publishers, 1986).

Tonnage Estimates

The estimated 940,000 tons of MMSW disposed in King County includes municipal solid waste received at the eight county operated transfer stations, two county-operated drop boxes, and two privately owned transfer stations between June 2002 and May 2003.[3] The Solid Waste Division provided the total tonnage estimate, as well as the tonnage split between the commercially collected and self-hauled substreams. The tonnages allocated to all other substreams (i.e. commercially collected residential) were calculated using customer survey data.

[3] A small amount of waste is hauled to the Cedar Hills Regional Landfill directly (about 4,707 tons). Because the landfill was not sampled or surveyed, this tonnage was excluded from the universe of waste examined in this study.

Weighted Averages

Cascadia calculated the overall waste composition estimates and the composition estimates for each substream by performing a weighted average by hauler type, generator type, and vehicle type. Cascadia calculated weighted averages using customer survey data and the tonnage estimates for each substream.

The **weighted average for an overall composition estimate** is performed as follows:

$$O_j = \left(p_1 \cdot r_{j1}\right) + (p_2 \cdot r_{j2}) + (p_3 \cdot r_{j3}) + \ldots$$

where:

p = proportion of tonnage contributed by the noted substream

r = ratio of component weight to total sample weight in the noted substream

for j 1 to m

where m = number of components

The **variance of the weighted average** is calculated:

$$VarO_j = (p_1^{\,2} \cdot \hat{V}_{r_{j1}}) + (p_2^{\,2} \cdot \hat{V}_{r_{j2}}) + (p_3^{\,2} \cdot \hat{V}_{r_{j3}}) + \ldots$$

where:

V = ratio estimator's variance in the noted substream

APPENDIX D.
Detailed Waste Composition Results

This appendix contains detailed waste composition results not found in the main body of the report. Detailed *Composition by Weight* tables are presented for the following substreams:

Residential

Table D-1. Composition by Weight – Residential Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**109,552**	**20.7%**	
Newspaper	12,147	2.3%	0.3%
OCC/Kraft paper	19,934	3.8%	0.7%
Low-grade recyclable paper	32,917	6.2%	0.6%
High-grade printing paper	6,458	1.2%	0.3%
Bleached polycoat paper	1,598	0.3%	0.1%
Paper/other materials	7,881	1.5%	0.5%
Compostable paper	26,399	5.0%	0.4%
Gift wrap paper	286	0.1%	0.0%
Other paper	1,931	0.4%	0.1%
Plastic	**50,642**	**9.6%**	
PET #1 plastic bottles	2,738	0.5%	0.1%
HDPE #2 plastic bottles	2,812	0.5%	0.1%
Other plastic containers	4,350	0.8%	0.1%
Polystyrene foam	2,216	0.4%	0.1%
Plastic film and bags	22,487	4.3%	0.5%
Other plastic packaging	3,070	0.6%	0.1%
Plastic products	5,138	1.0%	0.2%
Foam rubber/padding	2,295	0.4%	0.3%
Plastic/other materials	5,536	1.0%	0.2%
Organics (wood/yard/food)	**193,565**	**36.6%**	
Dimensional lumber	20,039	3.8%	1.2%
Treated wood	6,736	1.3%	0.5%
Contaminated wood	9,317	1.8%	0.6%
Roofing/siding	2,878	0.5%	0.5%
Stumps	1,722	0.3%	0.4%
Large prunings	1,522	0.3%	0.2%
Yard wastes	36,095	6.8%	1.6%
Other wood	2,131	0.4%	0.2%
Food wastes	113,125	21.4%	1.5%
Other Organics	**63,728**	**12.1%**	
Textiles/clothes	10,605	2.0%	0.5%
Carpet/upholstery/other textiles	14,017	2.7%	0.8%
Disposable diapers	17,939	3.4%	0.6%
Rubber products	1,200	0.2%	0.1%
Tires	1,323	0.3%	0.3%
Animal carcasses	0	0.0%	0.0%
Animal feces	14,128	2.7%	0.7%
Miscellaneous organics	4,516	0.9%	0.2%
Glass	**17,925**	**3.4%**	
Clear glass containers	5,314	1.0%	0.2%
Green glass containers	2,736	0.5%	0.2%
Brown glass containers	2,954	0.6%	0.1%
Other colored glass containers	33	0.0%	0.0%
Other glass	6,888	1.3%	0.6%
Metal	**33,456**	**6.3%**	
Aluminum cans	1,729	0.3%	0.1%
Other aluminum	1,313	0.2%	0.1%
Tinned food cans	4,428	0.8%	0.1%
Other ferrous metal	11,203	2.1%	0.6%
Other nonferrous metal	515	0.1%	0.1%
Mixed metals/materials	14,029	2.7%	0.6%
Gas metal cylinders	239	0.0%	0.0%
Other Wastes	**56,626**	**10.7%**	
Construction/demolition wastes	21,455	4.1%	1.1%
Ashes	333	0.1%	0.1%
Nondistinct fines	6,822	1.3%	0.6%
Gypsum wallboard	5,252	1.0%	0.5%
Furniture/mattresses	16,611	3.1%	1.1%
Small appliances	2,218	0.4%	0.2%
Printers/copiers/faxes	664	0.1%	0.1%
Office electronics	963	0.2%	0.1%
Miscellaneous inorganics	2,307	0.4%	0.2%
Household Hazardous	**2,773**	**0.5%**	
Used oil	8	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	190	0.0%	0.0%
Alkaline/button cell batteries	331	0.1%	0.0%
Latex paint	173	0.0%	0.0%
Oil-based paint	35	0.0%	0.0%
Solvents/thinners	31	0.0%	0.0%
Adhesives/glues	165	0.0%	0.0%
Cleaners and corrosives	107	0.0%	0.0%
Pesticides/herbicides	180	0.0%	0.0%
Gas/fuel oil	62	0.0%	0.0%
Antifreeze	35	0.0%	0.0%
Medical waste	305	0.1%	0.1%
Computer monitors	172	0.0%	0.1%
Televisions	233	0.0%	0.0%
Cell phones	176	0.0%	0.0%
Laptops/LCD monitors	85	0.0%	0.0%
Other hazardous	486	0.1%	0.1%
Total	**528,267**	**100.0%**	

No. of samples = 212

Error range calculated at a 90% confidence level

Nonresidential

Table D-2. Composition by Weight – Nonresidential Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**108,902**	**26.4%**	
Newspaper	13,214	3.2%	0.6%
OCC/Kraft paper	23,404	5.7%	0.8%
Low-grade recyclable paper	25,690	6.2%	0.8%
High-grade printing paper	8,819	2.1%	0.5%
Bleached polycoat paper	1,383	0.3%	0.1%
Paper/other materials	7,397	1.8%	0.6%
Compostable paper	25,655	6.2%	0.9%
Gift wrap paper	129	0.0%	0.0%
Other paper	3,211	0.8%	0.4%
Plastic	**50,824**	**12.3%**	
PET #1 plastic bottles	3,243	0.8%	0.3%
HDPE #2 plastic bottles	1,927	0.5%	0.2%
Other plastic containers	2,324	0.6%	0.1%
Polystyrene foam	1,757	0.4%	0.1%
Plastic film and bags	24,540	6.0%	0.8%
Other plastic packaging	2,742	0.7%	0.3%
Plastic products	8,781	2.1%	1.1%
Foam rubber/padding	684	0.2%	0.1%
Plastic/other materials	4,825	1.2%	0.4%
Organics (wood/yard/food)	**126,665**	**30.8%**	
Dimensional lumber	15,703	3.8%	1.4%
Treated wood	2,119	0.5%	0.3%
Contaminated wood	8,381	2.0%	1.0%
Roofing/siding	3,166	0.8%	1.3%
Stumps	0	0.0%	0.0%
Large prunings	325	0.1%	0.1%
Yard wastes	11,032	2.7%	1.0%
Other wood	11,240	2.7%	1.3%
Food wastes	74,700	18.1%	2.3%
Other Organics	**36,613**	**8.9%**	
Textiles/clothes	8,143	2.0%	0.8%
Carpet/upholstery/other textiles	11,175	2.7%	1.5%
Disposable diapers	7,816	1.9%	0.7%
Rubber products	1,178	0.3%	0.1%
Tires	2,230	0.5%	0.6%
Animal carcasses	52	0.0%	0.0%
Animal feces	4,315	1.0%	0.4%
Miscellaneous organics	1,703	0.4%	0.1%
Glass	**10,379**	**2.5%**	
Clear glass containers	4,360	1.1%	0.2%
Green glass containers	1,545	0.4%	0.1%
Brown glass containers	2,103	0.5%	0.1%
Other colored glass containers	12	0.0%	0.0%
Other glass	2,359	0.6%	0.4%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**31,816**	**7.7%**	
Aluminum cans	1,803	0.4%	0.1%
Other aluminum	683	0.2%	0.0%
Tinned food cans	2,545	0.6%	0.1%
Other ferrous metal	11,164	2.7%	0.9%
Other nonferrous metal	175	0.0%	0.0%
Mixed metals/materials	15,151	3.7%	1.4%
Gas metal cylinders	295	0.1%	0.1%
Other Wastes	**43,732**	**10.6%**	
Construction/demolition wastes	17,370	4.2%	1.9%
Ashes	1,096	0.3%	0.3%
Nondistinct fines	3,762	0.9%	0.6%
Gypsum wallboard	3,231	0.8%	0.5%
Furniture/mattresses	8,961	2.2%	1.5%
Small appliances	5,547	1.3%	1.2%
Printers/copiers/faxes	439	0.1%	0.1%
Office electronics	245	0.1%	0.1%
Miscellaneous inorganics	3,081	0.7%	0.6%
Household Hazardous	**2,835**	**0.7%**	
Used oil	403	0.1%	0.1%
Vehicle batteries	0	0.0%	0.0%
Household batteries	48	0.0%	0.0%
Alkaline/button cell batteries	143	0.0%	0.0%
Latex paint	139	0.0%	0.0%
Oil-based paint	70	0.0%	0.0%
Solvents/thinners	14	0.0%	0.0%
Adhesives/glues	313	0.1%	0.1%
Cleaners and corrosives	77	0.0%	0.0%
Pesticides/herbicides	20	0.0%	0.0%
Gas/fuel oil	4	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	176	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	1,388	0.3%	0.4%
Cell phones	0	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	37	0.0%	0.0%
Total	**411,765**	**100.0%**	

No. of samples = 157

Error range calculated at a 90% confidence level

Commercially Collected

Table D-3. Composition by Weight – Commercially Collected Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**198,758**	**26.8%**	
Newspaper	24,041	3.2%	0.4%
OCC/Kraft paper	37,633	5.1%	0.6%
Low-grade recyclable paper	53,550	7.2%	0.6%
High-grade printing paper	13,945	1.9%	0.4%
Bleached polycoat paper	2,838	0.4%	0.1%
Paper/other materials	12,192	1.6%	0.3%
Compostable paper	49,610	6.7%	0.6%
Gift wrap paper	349	0.0%	0.0%
Other paper	4,600	0.6%	0.2%
Plastic	**87,724**	**11.8%**	
PET #1 plastic bottles	5,639	0.8%	0.2%
HDPE #2 plastic bottles	4,345	0.6%	0.1%
Other plastic containers	6,056	0.8%	0.1%
Polystyrene foam	3,623	0.5%	0.1%
Plastic film and bags	43,970	5.9%	0.6%
Other plastic packaging	4,798	0.6%	0.1%
Plastic products	10,965	1.5%	0.6%
Foam rubber/padding	1,129	0.2%	0.1%
Plastic/other materials	7,199	1.0%	0.2%
Organics (wood/yard/food)	**248,993**	**33.6%**	
Dimensional lumber	21,093	2.8%	1.0%
Treated wood	2,978	0.4%	0.2%
Contaminated wood	9,466	1.3%	0.6%
Roofing/siding	311	0.0%	0.0%
Stumps	57	0.0%	0.0%
Large prunings	774	0.1%	0.1%
Yard wastes	24,235	3.3%	0.9%
Other wood	11,502	1.6%	0.7%
Food wastes	178,577	24.1%	1.7%
Other Organics	**82,404**	**11.1%**	
Textiles/clothes	16,406	2.2%	0.5%
Carpet/upholstery/other textiles	14,699	2.0%	0.6%
Disposable diapers	23,986	3.2%	0.6%
Rubber products	2,069	0.3%	0.1%
Tires	2,234	0.3%	0.3%
Animal carcasses	52	0.0%	0.0%
Animal feces	17,627	2.4%	0.6%
Miscellaneous organics	5,330	0.7%	0.1%
Glass	**20,697**	**2.8%**	
Clear glass containers	9,004	1.2%	0.1%
Green glass containers	3,997	0.5%	0.1%
Brown glass containers	4,613	0.6%	0.1%
Other colored glass containers	11	0.0%	0.0%
Other glass	3,072	0.4%	0.2%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**46,823**	**6.3%**	
Aluminum cans	3,177	0.4%	0.1%
Other aluminum	1,721	0.2%	0.0%
Tinned food cans	6,541	0.9%	0.1%
Other ferrous metal	15,726	2.1%	0.6%
Other nonferrous metal	535	0.1%	0.0%
Mixed metals/materials	18,640	2.5%	0.8%
Gas metal cylinders	483	0.1%	0.1%
Other Wastes	**51,687**	**7.0%**	
Construction/demolition wastes	20,701	2.8%	1.1%
Ashes	1,360	0.2%	0.2%
Nondistinct fines	8,161	1.1%	0.5%
Gypsum wallboard	4,356	0.6%	0.4%
Furniture/mattresses	10,793	1.5%	0.9%
Small appliances	1,957	0.3%	0.1%
Printers/copiers/faxes	912	0.1%	0.1%
Office electronics	452	0.1%	0.0%
Miscellaneous inorganics	2,998	0.4%	0.2%
Household Hazardous	**3,248**	**0.4%**	
Used oil	404	0.1%	0.1%
Vehicle batteries	0	0.0%	0.0%
Household batteries	173	0.0%	0.0%
Alkaline/button cell batteries	417	0.1%	0.0%
Latex paint	136	0.0%	0.0%
Oil-based paint	96	0.0%	0.0%
Solvents/thinners	23	0.0%	0.0%
Adhesives/glues	455	0.1%	0.1%
Cleaners and corrosives	115	0.0%	0.0%
Pesticides/herbicides	91	0.0%	0.0%
Gas/fuel oil	66	0.0%	0.0%
Antifreeze	35	0.0%	0.0%
Medical waste	312	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	383	0.1%	0.1%
Cell phones	171	0.0%	0.0%
Laptops/LCD monitors	85	0.0%	0.0%
Other hazardous	287	0.0%	0.0%
Total	**740,336**	**100.0%**	

No. of samples = 213

Error range calculated at a 90% confidence level

Commercially Collected Residential

Table D-4. Composition by Weight – Commercially Collected Residential Waste June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**92,321**	**25.8%**	
Newspaper	10,926	3.1%	0.5%
OCC/Kraft paper	15,025	4.2%	0.9%
Low-grade recyclable paper	28,597	8.0%	0.8%
High-grade printing paper	5,542	1.5%	0.5%
Bleached polycoat paper	1,475	0.4%	0.1%
Paper/other materials	4,867	1.4%	0.2%
Compostable paper	24,248	6.8%	0.6%
Gift wrap paper	231	0.1%	0.0%
Other paper	1,411	0.4%	0.1%
Plastic	**39,048**	**10.9%**	
PET #1 plastic bottles	2,475	0.7%	0.1%
HDPE #2 plastic bottles	2,439	0.7%	0.1%
Other plastic containers	3,750	1.0%	0.2%
Polystyrene foam	1,891	0.5%	0.1%
Plastic film and bags	19,684	5.5%	0.6%
Other plastic packaging	2,810	0.8%	0.1%
Plastic products	2,510	0.7%	0.1%
Foam rubber/padding	445	0.1%	0.1%
Plastic/other materials	3,046	0.9%	0.2%
Organics (wood/yard/food)	**130,568**	**36.5%**	
Dimensional lumber	6,442	1.8%	1.2%
Treated wood	868	0.2%	0.1%
Contaminated wood	1,989	0.6%	0.3%
Roofing/siding	280	0.1%	0.1%
Stumps	57	0.0%	0.0%
Large prunings	485	0.1%	0.2%
Yard wastes	14,886	4.2%	1.5%
Other wood	384	0.1%	0.1%
Food wastes	105,176	29.4%	2.2%
Other Organics	**49,200**	**13.7%**	
Textiles/clothes	8,264	2.3%	0.7%
Carpet/upholstery/other textiles	6,859	1.9%	0.4%
Disposable diapers	16,171	4.5%	0.9%
Rubber products	898	0.3%	0.1%
Tires	4	0.0%	0.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	13,312	3.7%	1.0%
Miscellaneous organics	3,693	1.0%	0.3%
Glass	**11,388**	**3.2%**	
Clear glass containers	4,767	1.3%	0.2%
Green glass containers	2,451	0.7%	0.3%
Brown glass containers	2,510	0.7%	0.2%
Other colored glass containers	4	0.0%	0.0%
Other glass	1,656	0.5%	0.3%
Metal	**16,945**	**4.7%**	
Aluminum cans	1,403	0.4%	0.1%
Other aluminum	1,044	0.3%	0.0%
Tinned food cans	4,046	1.1%	0.2%
Other ferrous metal	5,286	1.5%	0.7%
Other nonferrous metal	360	0.1%	0.1%
Mixed metals/materials	4,617	1.3%	0.4%
Gas metal cylinders	188	0.1%	0.1%
Other Wastes	**17,007**	**4.8%**	
Construction/demolition wastes	4,710	1.3%	0.6%
Ashes	264	0.1%	0.1%
Nondistinct fines	4,694	1.3%	0.7%
Gypsum wallboard	1,784	0.5%	0.6%
Furniture/mattresses	3,270	0.9%	0.8%
Small appliances	328	0.1%	0.1%
Printers/copiers/faxes	472	0.1%	0.2%
Office electronics	207	0.1%	0.1%
Miscellaneous inorganics	1,278	0.4%	0.2%
Household Hazardous	**1,436**	**0.4%**	
Used oil	0	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	125	0.0%	0.0%
Alkaline/button cell batteries	280	0.1%	0.0%
Latex paint	8	0.0%	0.0%
Oil-based paint	25	0.0%	0.0%
Solvents/thinners	9	0.0%	0.0%
Adhesives/glues	142	0.0%	0.0%
Cleaners and corrosives	38	0.0%	0.0%
Pesticides/herbicides	71	0.0%	0.0%
Gas/fuel oil	62	0.0%	0.0%
Antifreeze	35	0.0%	0.0%
Medical waste	136	0.0%	0.1%
Computer monitors	0	0.0%	0.0%
Televisions	0	0.0%	0.0%
Cell phones	171	0.0%	0.1%
Laptops/LCD monitors	85	0.0%	0.0%
Other hazardous	250	0.1%	0.1%
Total	**357,914**	**100.0%**	

No. of samples = 69

Error range calculated at a 90% confidence level

Commercially Collected Nonresidential

Table D-5. Composition by Weight – Commercially Collected Nonresidential Waste June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**106,437**	**27.8%**	
Newspaper	13,115	3.4%	0.6%
OCC/Kraft paper	22,608	5.9%	0.9%
Low-grade recyclable paper	24,953	6.5%	0.9%
High-grade printing paper	8,403	2.2%	0.5%
Bleached polycoat paper	1,363	0.4%	0.1%
Paper/other materials	7,325	1.9%	0.6%
Compostable paper	25,362	6.6%	0.9%
Gift wrap paper	119	0.0%	0.0%
Other paper	3,190	0.8%	0.4%
Plastic	**48,676**	**12.7%**	
PET #1 plastic bottles	3,164	0.8%	0.3%
HDPE #2 plastic bottles	1,906	0.5%	0.2%
Other plastic containers	2,306	0.6%	0.1%
Polystyrene foam	1,733	0.5%	0.1%
Plastic film and bags	24,286	6.4%	0.9%
Other plastic packaging	1,988	0.5%	0.1%
Plastic products	8,455	2.2%	1.2%
Foam rubber/padding	684	0.2%	0.1%
Plastic/other materials	4,153	1.1%	0.4%
Organics (wood/yard/food)	**118,426**	**31.0%**	
Dimensional lumber	14,651	3.8%	1.5%
Treated wood	2,110	0.6%	0.3%
Contaminated wood	7,476	2.0%	1.1%
Roofing/siding	31	0.0%	0.0%
Stumps	0	0.0%	0.0%
Large prunings	289	0.1%	0.1%
Yard wastes	9,349	2.4%	0.9%
Other wood	11,117	2.9%	1.3%
Food wastes	73,402	19.2%	2.5%
Other Organics	**33,204**	**8.7%**	
Textiles/clothes	8,142	2.1%	0.9%
Carpet/upholstery/other textiles	7,841	2.1%	1.0%
Disposable diapers	7,815	2.0%	0.8%
Rubber products	1,171	0.3%	0.1%
Tires	2,230	0.6%	0.7%
Animal carcasses	52	0.0%	0.0%
Animal feces	4,315	1.1%	0.4%
Miscellaneous organics	1,637	0.4%	0.1%
Glass	**9,308**	**2.4%**	
Clear glass containers	4,236	1.1%	0.2%
Green glass containers	1,545	0.4%	0.1%
Brown glass containers	2,103	0.5%	0.1%
Other colored glass containers	7	0.0%	0.0%
Other glass	1,416	0.4%	0.2%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**29,878**	**7.8%**	
Aluminum cans	1,774	0.5%	0.1%
Other aluminum	677	0.2%	0.0%
Tinned food cans	2,495	0.7%	0.1%
Other ferrous metal	10,439	2.7%	1.0%
Other nonferrous metal	175	0.0%	0.0%
Mixed metals/materials	14,023	3.7%	1.5%
Gas metal cylinders	295	0.1%	0.1%
Other Wastes	**34,681**	**9.1%**	
Construction/demolition wastes	15,991	4.2%	2.0%
Ashes	1,096	0.3%	0.3%
Nondistinct fines	3,466	0.9%	0.6%
Gypsum wallboard	2,571	0.7%	0.5%
Furniture/mattresses	7,523	2.0%	1.6%
Small appliances	1,629	0.4%	0.2%
Printers/copiers/faxes	439	0.1%	0.1%
Office electronics	245	0.1%	0.1%
Miscellaneous inorganics	1,720	0.4%	0.2%
Household Hazardous	**1,813**	**0.5%**	
Used oil	403	0.1%	0.1%
Vehicle batteries	0	0.0%	0.0%
Household batteries	48	0.0%	0.0%
Alkaline/button cell batteries	137	0.0%	0.0%
Latex paint	128	0.0%	0.0%
Oil-based paint	70	0.0%	0.0%
Solvents/thinners	14	0.0%	0.0%
Adhesives/glues	313	0.1%	0.1%
Cleaners and corrosives	77	0.0%	0.0%
Pesticides/herbicides	20	0.0%	0.0%
Gas/fuel oil	4	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	176	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	383	0.1%	0.2%
Cell phones	0	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	37	0.0%	0.0%
Total	**382,422**	**100.0%**	

No. of samples = 144

Error range calculated at a 90% confidence level

Self-hauled

Table D-6. Composition by Weight – Self-hauled Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**19,695**	**9.9%**	
Newspaper	1,321	0.7%	0.2%
OCC/Kraft paper	5,705	2.9%	0.6%
Low-grade recyclable paper	5,057	2.5%	0.6%
High-grade printing paper	1,332	0.7%	0.2%
Bleached polycoat paper	143	0.1%	0.0%
Paper/other materials	3,087	1.5%	1.1%
Compostable paper	2,444	1.2%	0.4%
Gift wrap paper	65	0.0%	0.0%
Other paper	541	0.3%	0.2%
Plastic	**13,741**	**6.9%**	
PET #1 plastic bottles	342	0.2%	0.0%
HDPE #2 plastic bottles	394	0.2%	0.1%
Other plastic containers	618	0.3%	0.1%
Polystyrene foam	350	0.2%	0.0%
Plastic film and bags	3,057	1.5%	0.5%
Other plastic packaging	1,015	0.5%	0.6%
Plastic products	2,954	1.5%	0.6%
Foam rubber/padding	1,850	0.9%	0.7%
Plastic/other materials	3,162	1.6%	0.6%
Organics (wood/yard/food)	**71,237**	**35.7%**	
Dimensional lumber	14,648	7.3%	2.2%
Treated wood	5,877	2.9%	1.4%
Contaminated wood	8,233	4.1%	1.6%
Roofing/siding	5,734	2.9%	2.9%
Stumps	1,665	0.8%	1.0%
Large prunings	1,073	0.5%	0.3%
Yard wastes	22,892	11.5%	3.5%
Other wood	1,869	0.9%	0.6%
Food wastes	9,247	4.6%	1.2%
Other Organics	**17,937**	**9.0%**	
Textiles/clothes	2,342	1.2%	0.5%
Carpet/upholstery/other textiles	10,493	5.3%	3.2%
Disposable diapers	1,768	0.9%	0.5%
Rubber products	309	0.2%	0.1%
Tires	1,319	0.7%	0.8%
Animal carcasses	0	0.0%	0.0%
Animal feces	816	0.4%	0.3%
Miscellaneous organics	889	0.4%	0.2%
Glass	**7,607**	**3.8%**	
Clear glass containers	670	0.3%	0.1%
Green glass containers	284	0.1%	0.1%
Brown glass containers	444	0.2%	0.1%
Other colored glass containers	34	0.0%	0.0%
Other glass	6,175	3.1%	1.7%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**18,449**	**9.2%**	
Aluminum cans	355	0.2%	0.1%
Other aluminum	274	0.1%	0.1%
Tinned food cans	432	0.2%	0.1%
Other ferrous metal	6,641	3.3%	1.0%
Other nonferrous metal	155	0.1%	0.0%
Mixed metals/materials	10,540	5.3%	1.6%
Gas metal cylinders	51	0.0%	0.0%
Other Wastes	**48,671**	**24.4%**	
Construction/demolition wastes	18,125	9.1%	2.8%
Ashes	69	0.0%	0.0%
Nondistinct fines	2,424	1.2%	0.8%
Gypsum wallboard	4,128	2.1%	1.1%
Furniture/mattresses	14,779	7.4%	2.5%
Small appliances	5,808	2.9%	2.5%
Printers/copiers/faxes	192	0.1%	0.1%
Office electronics	756	0.4%	0.3%
Miscellaneous inorganics	2,390	1.2%	1.2%
Household Hazardous	**2,359**	**1.2%**	
Used oil	8	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	65	0.0%	0.0%
Alkaline/button cell batteries	57	0.0%	0.0%
Latex paint	177	0.1%	0.1%
Oil-based paint	10	0.0%	0.0%
Solvents/thinners	22	0.0%	0.0%
Adhesives/glues	23	0.0%	0.0%
Cleaners and corrosives	69	0.0%	0.0%
Pesticides/herbicides	109	0.1%	0.1%
Gas/fuel oil	0	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	169	0.1%	0.1%
Computer monitors	172	0.1%	0.1%
Televisions	1,238	0.6%	0.8%
Cell phones	5	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	236	0.1%	0.1%
Total	**199,696**	**100.0%**	

No. of samples = 156

Error range calculated at a 90% confidence level

Self-hauled Residential

Table D-7. Composition by Weight – Self-hauled Residential Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**17,231**	**10.1%**	
Newspaper	1,221	0.7%	0.3%
OCC/Kraft paper	4,909	2.9%	0.7%
Low-grade recyclable paper	4,320	2.5%	0.7%
High-grade printing paper	916	0.5%	0.2%
Bleached polycoat paper	123	0.1%	0.0%
Paper/other materials	3,014	1.8%	1.3%
Compostable paper	2,151	1.3%	0.4%
Gift wrap paper	56	0.0%	0.0%
Other paper	520	0.3%	0.3%
Plastic	**11,594**	**6.8%**	
PET #1 plastic bottles	263	0.2%	0.0%
HDPE #2 plastic bottles	373	0.2%	0.1%
Other plastic containers	600	0.4%	0.1%
Polystyrene foam	326	0.2%	0.1%
Plastic film and bags	2,803	1.6%	0.6%
Other plastic packaging	261	0.2%	0.1%
Plastic products	2,628	1.5%	0.7%
Foam rubber/padding	1,850	1.1%	0.8%
Plastic/other materials	2,490	1.5%	0.6%
Organics (wood/yard/food)	**62,997**	**37.0%**	
Dimensional lumber	13,596	8.0%	2.5%
Treated wood	5,868	3.4%	1.7%
Contaminated wood	7,328	4.3%	1.9%
Roofing/siding	2,598	1.5%	1.4%
Stumps	1,665	1.0%	1.1%
Large prunings	1,038	0.6%	0.4%
Yard wastes	21,209	12.5%	4.0%
Other wood	1,746	1.0%	0.7%
Food wastes	7,949	4.7%	1.4%
Other Organics	**14,528**	**8.5%**	
Textiles/clothes	2,341	1.4%	0.5%
Carpet/upholstery/other textiles	7,159	4.2%	2.4%
Disposable diapers	1,767	1.0%	0.6%
Rubber products	302	0.2%	0.1%
Tires	1,319	0.8%	1.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	816	0.5%	0.3%
Miscellaneous organics	823	0.5%	0.2%
Glass	**6,537**	**3.8%**	
Clear glass containers	547	0.3%	0.1%
Green glass containers	284	0.2%	0.1%
Brown glass containers	444	0.3%	0.1%
Other colored glass containers	29	0.0%	0.0%
Other glass	5,232	3.1%	1.8%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**16,511**	**9.7%**	
Aluminum cans	326	0.2%	0.1%
Other aluminum	268	0.2%	0.1%
Tinned food cans	382	0.2%	0.1%
Other ferrous metal	5,916	3.5%	1.1%
Other nonferrous metal	155	0.1%	0.1%
Mixed metals/materials	9,412	5.5%	1.8%
Gas metal cylinders	51	0.0%	0.0%
Other Wastes	**39,619**	**23.3%**	
Construction/demolition wastes	16,745	9.8%	3.1%
Ashes	69	0.0%	0.1%
Nondistinct fines	2,128	1.2%	0.9%
Gypsum wallboard	3,468	2.0%	1.1%
Furniture/mattresses	13,341	7.8%	2.8%
Small appliances	1,890	1.1%	0.5%
Printers/copiers/faxes	192	0.1%	0.1%
Office electronics	756	0.4%	0.4%
Miscellaneous inorganics	1,028	0.6%	0.5%
Household Hazardous	**1,337**	**0.8%**	
Used oil	8	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	65	0.0%	0.0%
Alkaline/button cell batteries	51	0.0%	0.0%
Latex paint	166	0.1%	0.1%
Oil-based paint	10	0.0%	0.0%
Solvents/thinners	22	0.0%	0.0%
Adhesives/glues	23	0.0%	0.0%
Cleaners and corrosives	69	0.0%	0.0%
Pesticides/herbicides	109	0.1%	0.1%
Gas/fuel oil	0	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	169	0.1%	0.2%
Computer monitors	172	0.1%	0.2%
Televisions	233	0.1%	0.1%
Cell phones	5	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	236	0.1%	0.2%
Total	**170,353**	**100.0%**	

No. of samples = 143

Error range calculated at a 90% confidence level

Self-hauled Nonresidential

Table D-8. Composition by Weight – Self-hauled Nonresidential Waste
June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**2,465**	**8.4%**	
Newspaper	100	0.3%	0.3%
OCC/Kraft paper	796	2.7%	1.0%
Low-grade recyclable paper	737	2.5%	0.7%
High-grade printing paper	416	1.4%	0.2%
Bleached polycoat paper	20	0.1%	0.0%
Paper/other materials	72	0.2%	0.1%
Compostable paper	293	1.0%	0.1%
Gift wrap paper	10	0.0%	0.0%
Other paper	21	0.1%	0.0%
Plastic	**2,147**	**7.3%**	
PET #1 plastic bottles	79	0.3%	0.1%
HDPE #2 plastic bottles	21	0.1%	0.0%
Other plastic containers	18	0.1%	0.0%
Polystyrene foam	25	0.1%	0.0%
Plastic film and bags	254	0.9%	0.4%
Other plastic packaging	754	2.6%	4.0%
Plastic products	325	1.1%	1.0%
Foam rubber/padding	0	0.0%	0.0%
Plastic/other materials	672	2.3%	2.4%
Organics (wood/yard/food)	**8,239**	**28.1%**	
Dimensional lumber	1,052	3.6%	4.7%
Treated wood	8	0.0%	0.0%
Contaminated wood	905	3.1%	2.1%
Roofing/siding	3,135	10.7%	18.1%
Stumps	0	0.0%	0.0%
Large prunings	36	0.1%	0.2%
Yard wastes	1,683	5.7%	6.9%
Other wood	122	0.4%	0.6%
Food wastes	1,298	4.4%	0.6%
Other Organics	**3,409**	**11.6%**	
Textiles/clothes	1	0.0%	0.0%
Carpet/upholstery/other textiles	3,334	11.4%	16.8%
Disposable diapers	1	0.0%	0.0%
Rubber products	7	0.0%	0.0%
Tires	0	0.0%	0.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	0	0.0%	0.0%
Miscellaneous organics	66	0.2%	0.0%
Glass	**1,071**	**3.6%**	
Clear glass containers	123	0.4%	0.4%
Green glass containers	0	0.0%	0.0%
Brown glass containers	0	0.0%	0.0%
Other colored glass containers	5	0.0%	0.0%
Other glass	943	3.2%	5.0%

WASTE MATERIAL	TONS	MEAN	+/-
Metal	**1,938**	**6.6%**	
Aluminum cans	29	0.1%	0.1%
Other aluminum	6	0.0%	0.0%
Tinned food cans	50	0.2%	0.2%
Other ferrous metal	725	2.5%	3.0%
Other nonferrous metal	0	0.0%	0.0%
Mixed metals/materials	1,128	3.8%	2.8%
Gas metal cylinders	0	0.0%	0.0%
Other Wastes	**9,052**	**30.8%**	
Construction/demolition wastes	1,380	4.7%	6.6%
Ashes	0	0.0%	0.0%
Nondistinct fines	296	1.0%	1.6%
Gypsum wallboard	659	2.2%	3.9%
Furniture/mattresses	1,438	4.9%	4.3%
Small appliances	3,918	13.4%	16.8%
Printers/copiers/faxes	0	0.0%	0.0%
Office electronics	0	0.0%	0.0%
Miscellaneous inorganics	1,361	4.6%	7.6%
Household Hazardous	**1,022**	**3.5%**	
Used oil	0	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	0	0.0%	0.0%
Alkaline/button cell batteries	6	0.0%	0.0%
Latex paint	11	0.0%	0.1%
Oil-based paint	0	0.0%	0.0%
Solvents/thinners	0	0.0%	0.0%
Adhesives/glues	0	0.0%	0.0%
Cleaners and corrosives	0	0.0%	0.0%
Pesticides/herbicides	0	0.0%	0.0%
Gas/fuel oil	0	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	0	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	1,005	3.4%	5.4%
Cell phones	0	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	0	0.0%	0.0%
Total	**29,342**	**100.0%**	

No. of samples = 13

Error range calculated at a 90% confidence level

APPENDIX E.
Waste Composition Results — Commercially Collected Residential Substreams

This appendix includes waste composition results for the following three substreams of commercially collected residential waste:

- Residential single-family
- Residential multifamily
- Residential mixed single-family and multifamily

Data and analysis of the following three substreams are not included in the main body of the report. For this reason, *Overview of Waste Composition* figures and *Top 10* tables, in addition to detailed *Composition by Weight* tables are included below.

Commercially Collected Residential Single-family

Figure E-1. Overview of Waste Composition – Commercially Collected Residential Single-family Waste (n=36) June 2002 – May 2003

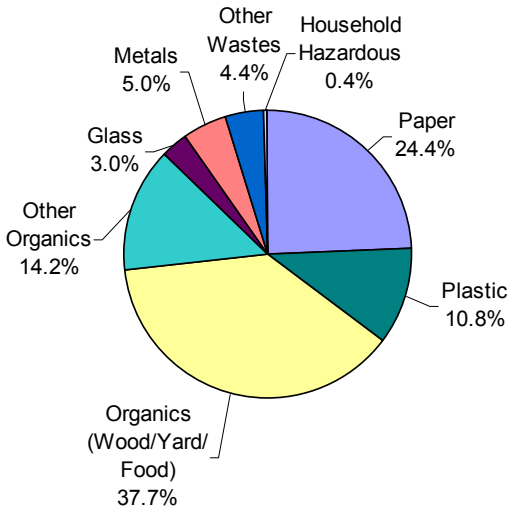


Table E-1. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Residential Single-family Waste June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	31.2%	31.2%	86,449
Low-grade recyclable paper	7.5%	38.7%	20,833
Compostable paper	7.4%	46.0%	20,424
Plastic film and bags	5.6%	51.6%	15,431
Disposable diapers	4.8%	56.4%	13,288
Animal feces	4.0%	60.4%	11,207
Yard wastes	4.1%	64.6%	11,461
OCC/Kraft paper	3.6%	68.2%	10,089
Newspaper	2.6%	70.8%	7,160
Textiles/clothes	2.3%	73.0%	6,263
Subtotal	**73.0%**		**202,604**
All other materials combined	*27.0%*		*74,755*
Total	**100.0%**		**277,359**

Table E-2. Composition by Weight – Commercially Collected Residential Single-family Waste June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**67,650**	**24.4%**	
Newspaper	7,160	2.6%	0.5%
OCC/Kraft paper	10,089	3.6%	1.1%
Low-grade recyclable paper	20,833	7.5%	0.8%
High-grade printing paper	3,219	1.2%	0.5%
Bleached polycoat paper	1,131	0.4%	0.1%
Paper/other materials	3,542	1.3%	0.3%
Compostable paper	20,424	7.4%	0.7%
Gift wrap paper	201	0.1%	0.1%
Other paper	1,051	0.4%	0.2%
Plastic	**30,090**	**10.8%**	
PET #1 plastic bottles	1,797	0.6%	0.1%
HDPE #2 plastic bottles	1,884	0.7%	0.1%
Other plastic containers	3,051	1.1%	0.2%
Polystyrene foam	1,527	0.6%	0.1%
Plastic film and bags	15,431	5.6%	0.8%
Other plastic packaging	2,307	0.8%	0.1%
Plastic products	1,435	0.5%	0.1%
Foam rubber/padding	114	0.0%	0.0%
Plastic/other materials	2,543	0.9%	0.3%
Organics (wood/yard/food)	**104,513**	**37.7%**	
Dimensional lumber	3,347	1.2%	0.9%
Treated wood	596	0.2%	0.2%
Contaminated wood	1,611	0.6%	0.4%
Roofing/siding	254	0.1%	0.1%
Stumps	0	0.0%	0.0%
Large prunings	485	0.2%	0.2%
Yard wastes	11,461	4.1%	1.9%
Other wood	309	0.1%	0.1%
Food wastes	86,449	31.2%	2.6%
Other Organics	**39,498**	**14.2%**	
Textiles/clothes	6,263	2.3%	0.7%
Carpet/upholstery/other textiles	5,067	1.8%	0.5%
Disposable diapers	13,288	4.8%	1.1%
Rubber products	604	0.2%	0.1%
Tires	0	0.0%	0.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	11,207	4.0%	1.3%
Miscellaneous organics	3,070	1.1%	0.3%
Glass	**8,437**	**3.0%**	
Clear glass containers	3,359	1.2%	0.3%
Green glass containers	1,983	0.7%	0.3%
Brown glass containers	1,771	0.6%	0.2%
Other colored glass containers	0	0.0%	0.0%
Other glass	1,325	0.5%	0.4%
Metal	**13,930**	**5.0%**	
Aluminum cans	1,005	0.4%	0.1%
Other aluminum	875	0.3%	0.1%
Tinned food cans	3,090	1.1%	0.2%
Other ferrous metal	4,788	1.7%	0.9%
Other nonferrous metal	258	0.1%	0.1%
Mixed metals/materials	3,736	1.3%	0.4%
Gas metal cylinders	177	0.1%	0.1%
Other Wastes	**12,214**	**4.4%**	
Construction/demolition wastes	3,288	1.2%	0.6%
Ashes	237	0.1%	0.1%
Nondistinct fines	4,085	1.5%	0.9%
Gypsum wallboard	1,619	0.6%	0.8%
Furniture/mattresses	1,256	0.5%	0.7%
Small appliances	224	0.1%	0.1%
Printers/copiers/faxes	471	0.2%	0.2%
Office electronics	16	0.0%	0.0%
Miscellaneous inorganics	1,019	0.4%	0.3%
Household Hazardous	**1,027**	**0.4%**	
Used oil	0	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	111	0.0%	0.0%
Alkaline/button cell batteries	245	0.1%	0.0%
Latex paint	0	0.0%	0.0%
Oil-based paint	0	0.0%	0.0%
Solvents/thinners	0	0.0%	0.0%
Adhesives/glues	55	0.0%	0.0%
Cleaners and corrosives	28	0.0%	0.0%
Pesticides/herbicides	71	0.0%	0.0%
Gas/fuel oil	62	0.0%	0.0%
Antifreeze	35	0.0%	0.0%
Medical waste	136	0.0%	0.1%
Computer monitors	0	0.0%	0.0%
Televisions	0	0.0%	0.0%
Cell phones	57	0.0%	0.0%
Laptops/LCD monitors	0	0.0%	0.0%
Other hazardous	227	0.1%	0.1%
Total	**277,359**	**100.0%**	

No. of samples = 36

Error range calculated at a 90% confidence level

Commercially Collected Residential Multifamily

Figure E-2. Overview of Waste Composition – Commercially Collected Residential Multifamily Waste (n=24) June 2002 – May 2003

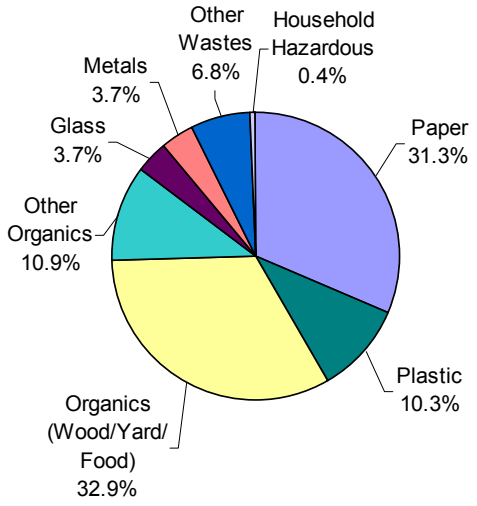


Table E-3. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Residential Multifamily Waste June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	23.1%	23.1%	14,474
Low-grade recyclable paper	9.6%	32.7%	6,020
OCC/Kraft paper	6.7%	39.4%	4,202
Newspaper	4.9%	44.2%	3,044
Dimensional lumber	4.6%	48.8%	2,899
Plastic film and bags	4.6%	53.4%	2,894
Yard wastes	4.5%	57.9%	2,817
Compostable paper	4.5%	62.4%	2,801
Disposable diapers	4.0%	66.4%	2,501
High-grade printing paper	3.2%	69.6%	2,023
Subtotal	**69.6%**		**43,674**
All other materials combined	*30.4%*		*19,081*
Total	**100.0%**		**62,754**

Table E-4. Composition by Weight – Commercially Collected Residential Multifamily Waste June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**19,629**	**31.3%**	
Newspaper	3,044	4.9%	1.6%
OCC/Kraft paper	4,202	6.7%	1.5%
Low-grade recyclable paper	6,020	9.6%	2.4%
High-grade printing paper	2,023	3.2%	1.6%
Bleached polycoat paper	236	0.4%	0.2%
Paper/other materials	1,000	1.6%	0.5%
Compostable paper	2,801	4.5%	0.8%
Gift wrap paper	29	0.0%	0.0%
Other paper	275	0.4%	0.2%
Plastic	**6,455**	**10.3%**	
PET #1 plastic bottles	502	0.8%	0.2%
HDPE #2 plastic bottles	373	0.6%	0.1%
Other plastic containers	472	0.8%	0.3%
Polystyrene foam	266	0.4%	0.1%
Plastic film and bags	2,894	4.6%	0.9%
Other plastic packaging	399	0.6%	0.2%
Plastic products	861	1.4%	0.5%
Foam rubber/padding	312	0.5%	0.7%
Plastic/other materials	377	0.6%	0.2%
Organics (wood/yard/food)	**20,646**	**32.9%**	
Dimensional lumber	2,899	4.6%	5.8%
Treated wood	222	0.4%	0.3%
Contaminated wood	162	0.3%	0.2%
Roofing/siding	6	0.0%	0.0%
Stumps	0	0.0%	0.0%
Large prunings	0	0.0%	0.0%
Yard wastes	2,817	4.5%	1.8%
Other wood	66	0.1%	0.1%
Food wastes	14,474	23.1%	3.9%
Other Organics	**6,819**	**10.9%**	
Textiles/clothes	1,045	1.7%	0.6%
Carpet/upholstery/other textiles	1,606	2.6%	1.3%
Disposable diapers	2,501	4.0%	1.1%
Rubber products	74	0.1%	0.1%
Tires	0	0.0%	0.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	1,089	1.7%	0.8%
Miscellaneous organics	504	0.8%	0.4%
Glass	**2,305**	**3.7%**	
Clear glass containers	1,031	1.6%	0.4%
Green glass containers	347	0.6%	0.2%
Brown glass containers	670	1.1%	0.6%
Other colored glass containers	1	0.0%	0.0%
Other glass	257	0.4%	0.3%
Metal	**2,343**	**3.7%**	
Aluminum cans	304	0.5%	0.1%
Other aluminum	114	0.2%	0.1%
Tinned food cans	730	1.2%	0.4%
Other ferrous metal	376	0.6%	0.3%
Other nonferrous metal	102	0.2%	0.1%
Mixed metals/materials	717	1.1%	0.5%
Gas metal cylinders	0	0.0%	0.0%
Other Wastes	**4,288**	**6.8%**	
Construction/demolition wastes	1,367	2.2%	1.6%
Ashes	0	0.0%	0.0%
Nondistinct fines	467	0.7%	0.9%
Gypsum wallboard	165	0.3%	0.2%
Furniture/mattresses	1,985	3.2%	3.0%
Small appliances	57	0.1%	0.1%
Printers/copiers/faxes	2	0.0%	0.0%
Office electronics	187	0.3%	0.4%
Miscellaneous inorganics	59	0.1%	0.1%
Household Hazardous	**268**	**0.4%**	
Used oil	0	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	11	0.0%	0.0%
Alkaline/button cell batteries	32	0.1%	0.0%
Latex paint	8	0.0%	0.0%
Oil-based paint	25	0.0%	0.0%
Solvents/thinners	0	0.0%	0.0%
Adhesives/glues	0	0.0%	0.0%
Cleaners and corrosives	9	0.0%	0.0%
Pesticides/herbicides	0	0.0%	0.0%
Gas/fuel oil	0	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	0	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	0	0.0%	0.0%
Cell phones	115	0.2%	0.3%
Laptops/LCD monitors	45	0.1%	0.1%
Other hazardous	23	0.0%	0.0%
Total	**62,754**	**100.0%**	

No. of samples = 24

Error range calculated at a 90% confidence level

Commercially Collected Residential Mixed Single-family and Multifamily

Figure E-3. Overview of Waste Composition – Commercially Collected Residential Mixed Single-family and Multifamily Waste (n=9) June 2002 – May 2003

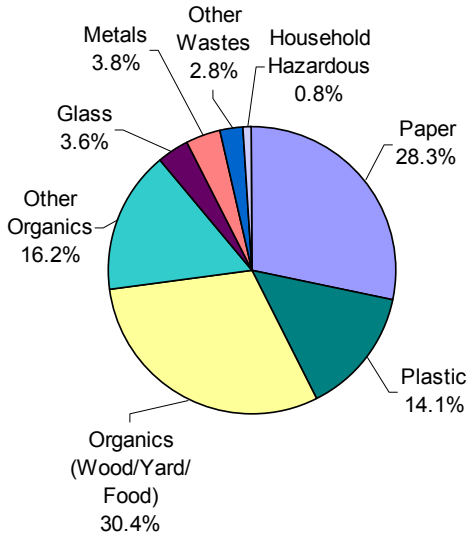


Table E-5. Top 10 Materials with Largest Percentage of Tonnage – Commercially Collected Residential Mixed Single-family and Multifamily Waste June 2002 – May 2003

WASTE MATERIAL	MEAN	CUM. %	TONS
Food wastes	23.9%	23.9%	4,252
Low-grade recyclable paper	9.8%	33.7%	1,744
Plastic film and bags	7.6%	41.3%	1,359
Compostable paper	5.7%	47.1%	1,023
Animal feces	5.7%	52.8%	1,017
Textiles/clothes	5.4%	58.2%	956
OCC/Kraft paper	4.1%	62.3%	734
Newspaper	4.1%	66.3%	723
Yard wastes	3.4%	69.8%	608
Disposable diapers	2.1%	71.9%	382
Subtotal	**71.9%**		**12,799**
All other materials combined	*28.1%*		*5,002*
Total	**100.0%**		**17,800**

Table E-6. Overview of Waste Composition – Commercially Collected Residential Mixed Single-family and Multifamily Waste June 2002 – May 2003

WASTE MATERIAL	TONS	MEAN	+/-
Paper	**5,042**	**28.3%**	
Newspaper	723	4.1%	1.3%
OCC/Kraft paper	734	4.1%	1.6%
Low-grade recyclable paper	1,744	9.8%	1.6%
High-grade printing paper	300	1.7%	0.6%
Bleached polycoat paper	108	0.6%	0.2%
Paper/other materials	325	1.8%	0.7%
Compostable paper	1,023	5.7%	1.3%
Gift wrap paper	1	0.0%	0.0%
Other paper	84	0.5%	0.5%
Plastic	**2,503**	**14.1%**	
PET #1 plastic bottles	176	1.0%	0.1%
HDPE #2 plastic bottles	181	1.0%	0.3%
Other plastic containers	227	1.3%	0.5%
Polystyrene foam	98	0.6%	0.2%
Plastic film and bags	1,359	7.6%	1.2%
Other plastic packaging	104	0.6%	0.1%
Plastic products	213	1.2%	0.9%
Foam rubber/padding	18	0.1%	0.1%
Plastic/other materials	126	0.7%	0.4%
Organics (wood/yard/food)	**5,408**	**30.4%**	
Dimensional lumber	197	1.1%	0.8%
Treated wood	49	0.3%	0.4%
Contaminated wood	216	1.2%	0.9%
Roofing/siding	20	0.1%	0.2%
Stumps	57	0.3%	0.6%
Large prunings	0	0.0%	0.0%
Yard wastes	608	3.4%	3.3%
Other wood	9	0.0%	0.0%
Food wastes	4,252	23.9%	9.0%
Other Organics	**2,883**	**16.2%**	
Textiles/clothes	956	5.4%	6.8%
Carpet/upholstery/other textiles	186	1.0%	0.6%
Disposable diapers	382	2.1%	1.3%
Rubber products	220	1.2%	1.6%
Tires	4	0.0%	0.0%
Animal carcasses	0	0.0%	0.0%
Animal feces	1,017	5.7%	5.3%
Miscellaneous organics	118	0.7%	0.4%
Glass	**646**	**3.6%**	
Clear glass containers	378	2.1%	0.7%
Green glass containers	122	0.7%	0.7%
Brown glass containers	69	0.4%	0.1%
Other colored glass containers	3	0.0%	0.0%
Other glass	74	0.4%	0.3%
Metal	**672**	**3.8%**	
Aluminum cans	94	0.5%	0.2%
Other aluminum	55	0.3%	0.1%
Tinned food cans	225	1.3%	0.3%
Other ferrous metal	123	0.7%	0.4%
Other nonferrous metal	0	0.0%	0.0%
Mixed metals/materials	164	0.9%	0.5%
Gas metal cylinders	11	0.1%	0.1%
Other Wastes	**505**	**2.8%**	
Construction/demolition wastes	56	0.3%	0.4%
Ashes	27	0.1%	0.2%
Nondistinct fines	142	0.8%	1.3%
Gypsum wallboard	1	0.0%	0.0%
Furniture/mattresses	29	0.2%	0.2%
Small appliances	47	0.3%	0.3%
Printers/copiers/faxes	0	0.0%	0.0%
Office electronics	4	0.0%	0.0%
Miscellaneous inorganics	200	1.1%	1.2%
Household Hazardous	**141**	**0.8%**	
Used oil	0	0.0%	0.0%
Vehicle batteries	0	0.0%	0.0%
Household batteries	2	0.0%	0.0%
Alkaline/button cell batteries	2	0.0%	0.0%
Latex paint	0	0.0%	0.0%
Oil-based paint	0	0.0%	0.0%
Solvents/thinners	9	0.1%	0.1%
Adhesives/glues	87	0.5%	0.8%
Cleaners and corrosives	0	0.0%	0.0%
Pesticides/herbicides	0	0.0%	0.0%
Gas/fuel oil	0	0.0%	0.0%
Antifreeze	0	0.0%	0.0%
Medical waste	0	0.0%	0.0%
Computer monitors	0	0.0%	0.0%
Televisions	0	0.0%	0.0%
Cell phones	0	0.0%	0.0%
Laptops/LCD monitors	40	0.2%	0.4%
Other hazardous	0	0.0%	0.0%
Total	**17,800**	**100.0%**	

No. of samples = 9

Error range calculated at a 90% confidence level

APPENDIX F.
Waste Composition Comparisons to Previous Studies

BACKGROUND

King County has performed waste characterization studies periodically over the last decade in an ongoing effort to monitor the types and amounts of materials disposed locally. Differences are often apparent between project years. In this appendix, selected results from the current 2002-2003 study are compared to findings from 1993-1994 and 1999/2000 studies. The purpose of this comparison is to identify changes in the composition of waste streams over time. The reasons why or how these changes occurred are not investigated. Future studies could be designed to identify the potential causes of these variations.

In order to control for population changes and other factors that may influence the total amount of waste disposed from year to year, the tests described in this appendix measure waste proportions, not tonnage. For example, say newspaper accounts for 5% of disposed waste totaling 1,000 tons during one study period and 5% of waste totaling 1,200 tons during another. While the amount of newspaper in terms of total tons has increased, the proportion of newspaper, 5%, in the waste stream has not. The tests would indicate no change in newspaper.

The statistical tests used assume the hypothesis that there is no change. For example, "There is no statistically significant difference, between the 1993-1994 and 2002-2003 study periods, in the proportion of newspaper disposed by the single-family substream."

Statistics are then employed to look for evidence disproving the hypothesis. A "significant" result means that there is enough evidence to disprove the hypothesis and it can be concluded that there is a true difference in composition over time. "Insignificant" results indicate that either 1) there is no true difference, or 2) even though there may be a difference, there is not enough evidence to prove it because the findings are limited by sample size. It is also possible that changes occurred in waste categories that were not considered in this part of this analysis.

Table F-1 lists the eight waste categories chosen for analysis. Composition variations were measured for the following substreams:

- Commercially collected waste from single-family residences
- Commercially collected waste from multifamily residences
- Commercially collected waste from nonresidential sources
- Self-hauled waste (from both residential and nonresidential sources)

Table F-1. Material Groupings Used for Comparisons

Comparison Label	Sampling Components
Newspaper	Newspaper
Cardboard & Kraft	OCC/Kraft
Other Curbside Paper	Low Grade Recyclable High Grade Printing Computer Paper
Curbside Containers	PET # Plastic Bottles HDPE #2 Plastic Bottles Clear Glass Containers Green Glass Containers Brown Glass Containers Refillable Beer Aluminum Cans Tinned Food Cans
Compostable Organics	Food Waste Yard Waste Large Prunings Other Paper Animal Feces Animal Carcasses
Construction & Demolition	Roofing/Siding Const/Demo Wastes Gypsum Wallboard
Wood Waste	Dimension Lumber Treated Wood Contaminated Wood Other Wood
Hazardous Wastes	Used Oil Vehicle Batteries Household Batteries Latex Paint Oil-based Paint Solvents/Thinners Adhesives/Glue Cleaners and Corrosives Pesticides/Herbicides Gas/Fuel/Oil Antifreeze Medical Wastes Other Hazardous

MAIN FINDINGS

Several differences are evident when comparing the results of the 2002-2003 study with the 1993-1994 and 1999-2000 waste composition studies. These differences can be grouped into three main categories:

- **Statistically significant.** These findings can be considered true differences. The probability of observing these results if there had been no actual year-to-year change is low (10% for all tests within each substream).
- **Strong trends.** Although the results did not meet the requirements of the study's conservative statistical tests, there does seem to be a possible indication of change.
- **Statistically insignificant.** Although there may be an observed difference across the study periods, there is no evidence that these results are due to a true change rather than chance.

The statistically significant differences between 1993-1994 and the 2002-2003 study periods, along with the trend indicators, are summarized in Table F-2. The differences are presented in Table F-3 for comparison between the 1999-2000 and the 2002-2003 study.

Table F-2. Waste Composition Changes and General Trends, 1993-1994 to 2002-2003 Study Periods

	MATERIAL GROUPING	MEAN RATIO (Material Wt/Total Wt) 1993/94	MEAN RATIO (Material Wt/Total Wt) 2002/03	STRENGTH OF RESULTS
Commercially Collected				
Single-family	Cardboard and Kraft	6.0%	3.6% ↓	Statistically significant
Single-family	Newspaper	5.5%	2.6% ↓	Statistically significant
Single-family	Other Curbside Paper	12.5%	8.3% ↓	Statistically significant
Multifamily	Other Curbside Paper	9.3%	12.9% ↑	Strong trend
	Wood Waste	6.6%	4.6% ↓	Strong trend
Nonresidential	Cardboard and Kraft	10.6%	6.1% ↓	Statistically significant
Nonresidential	Other Curbside Paper	11.6%	8.6% ↓	Statistically significant
Nonresidential	Construction & Demolition	3.2%	5.8% ↑	Strong trend
Nonresidential	Organics	26.0%	29.8% ↑	Strong trend
Self-hauled				
	Organics	26.1%	19.2% ↓	Strong trend

Table F-3. Waste Composition Changes and General Trends, 1999-2000 to 2002-2003 Study Periods

	MATERIAL GROUPING	MEAN RATIO (Material Wt/Total Wt) 1999/2000	MEAN RATIO (Material Wt/Total Wt) 2002/03	STRENGTH OF RESULTS
Commercially Collected				
Single-family	Other Curbside Paper	10.0%	8.3% ↓	Strong trend
Multifamily	Other Curbside Paper	8.8%	12.9% ↑	Strong trend
Nonresidential	Cardboard and Kraft	9.2%	6.1% ↓	Statistically significant
Nonresidential	Organics	24.7%	29.8% ↑	Strong trend
Self-hauled				
	Construction & Demolition	9.4%	13.8% ↑	Strong trend
	Curbside Containers	2.3%	1.4% ↓	Strong trend
	Hazardous	1.8%	0.5% ↓	Strong trend

STATISTICAL CONSIDERATIONS

The analyses are based on the component percentages, by weight, for each selected substream. These percentages are calculated by dividing the sum of the selected component weights by the sum of the corresponding sample weights. T-tests (modified for ratio estimation) were used to examine the study year-to-study year variation.

NORMALITY

The distribution of some of the waste categories (particularly the hazardous materials) are skewed and may not follow a normal distribution. Although t-tests assume a normal distribution, they are very robust to departures from this assumption, particularly with large sample sizes. In addition, most of the selected categories are sums of several individual waste components, which improves our ability to meet the assumptions of normality.

DEPENDENCE

There may be dependence between waste types (if a person disposes of material A, they always dispose of material B at the same time).

There is certainly a degree of dependence between the calculated percentages. (Since the percentages sum to 100, if the percentage of material A increases, the percentage of some other material must decrease). This type of dependence is somewhat controlled by choosing only a portion of the waste categories for the analyses.

Future studies might be merited to examine these two types of dependence explicitly.

MULTIPLE T-TESTS

In all statistical tests, there is a chance of incorrectly concluding that a result is significant. The year-to-year comparison required conducting several t-tests, (one for each waste category within each set of substreams) **each** of which carries that risk. However, we were willing to accept only a 10% chance, **overall**, of making an incorrect conclusion. Therefore, each test was adjusted by setting the significance threshold to $\frac{0.10}{w}$ (*w* = the number of t-tests).

The adjustment can be explained as follows:

For each test, we set a $1-\frac{0.10}{w}$ chance of not making a mistake, which results in a $\left(1-\frac{0.10}{w}\right)^{w}$ chance of not making a mistake during all *w* tests.

Since one minus the chance of not making a mistake equals the chance of making a mistake, by making this adjustment, we have set the overall risk of making a wrong conclusion during any one of the tests at $\left(1-\left(1-\frac{0.10}{w}\right)^{w}\right)=0.10$.

The chance of a "false positive" for this study is restricted to 10% overall, or 1.25% for each test (10% divided by the eight tests within each substream equals 1.25%).

For more detail regarding this issue, please refer to Section 11.2 "The Multiplicity Problem and the Bonferroni Inequality" of *An Introduction to Contemporary Statistics* by L.H. Koopmans (Duxbury Press, 1981).

POWER ANALYSIS

The greater the number of samples, the greater the ability to detect differences. In the future, an *a priori* power analysis might benefit this research by determining how many samples would be required to detect a particular minimum difference of interest.

INTERPRETING THE CALCULATION RESULTS

The following tables include detailed calculation results. An asterisk notes the statistically significant differences.

For the purposes of this study, only those calculation results with a p-value of less than 1.25% are considered to be statistically significant. As described above, the threshold for determining statistically significant results (the "alpha-level") is conservative, accounting for the fact that so many individual tests were calculated.

The t-statistic is calculated from the data: according to statistical theory, the larger the absolute value of the t-statistic, the less likely that the two populations have the same mean. The p-value describes the probability of observing the calculated t-statistic if there were no true difference between the population means.

For example, in Table F-4, the proportion of cardboard and Kraft paper in the single-family substream dropped from 6.02% to 3.61% across the study periods. The t-statistic is relatively large (3.5082) and the probability (p-value) of observing that t-statistic if there had been no true difference between years is just 0.06%. This value is less than the study's pre-determined threshold for statistically significant results (alpha-level of 1.25%); thus the decrease in cardboard and Kraft is considered to be a true difference. On the other hand, the p-value corresponding to the increase in single-family hazardous materials is very large. The chance of observing the 0.38% to 5.16% increase when the actual proportion had not changed is 50.88%—much too high to be considered a true difference.

Table F-4. Comparison of Selected Composition Results, 1993-1994 to 2002-2003 Commercially Collected Single-family

	MEAN RATIO *(Material Wt/Total Wt)*		**T-STATISTIC**	**P-VALUE** *(Cut-off for statistically valid difference = 0.0125)*
	1993/94	*2002/03*		
Cardboard and Kraft	0.0602	0.0361	3.5082	0.0006 *
Construction & Demolition	0.0228	0.0335	0.6622	0.5088
Curbside Containers	0.0612	0.0516	1.5650	0.1197
Hazardous	0.0038	0.0034	0.2568	0.7977
Newspaper	0.0554	0.0257	4.6249	0.0000 *
Organics	0.4199	0.4528	1.4630	0.1456
Other Curbside Paper	0.1246	0.0829	3.3726	0.0009 *
Wood Waste	0.0223	0.0382	1.0425	0.2988
Number of Samples	*116*	*36*		

Table F-5. Comparison of Selected Composition Results, 1993-1994 to 2002-2003 Commercially Collected Multi-Family

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1993/94	*2002/03*		
Cardboard and Kraft	0.0646	0.0646	0.0001	0.9999
Construction & Demolition	0.0502	0.0292	0.5918	0.5560
Curbside Containers	0.0642	0.0618	0.2512	0.8024
Hazardous	0.0057	0.0017	0.9473	0.3470
Newspaper	0.0541	0.0429	1.0866	0.2812
Organics	0.3074	0.3642	1.4435	0.1537
Other Curbside Paper	0.0926	0.1287	1.9572	0.0546
Wood Waste	0.0656	0.0460	0.6650	0.5084
Number of Samples	*43*	*24*		

Table F-6. Comparison of Selected Composition Results, 1993-1994 to 2002-2003 Commercially Collected Nonresidential

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1993/94	*2002/03*		
Cardboard and Kraft	0.1058	0.0611	4.0776	0.0001 *
Construction & Demolition	0.0317	0.0576	1.8884	0.0598
Curbside Containers	0.0434	0.0436	0.0335	0.9733
Hazardous	0.0040	0.0037	0.1766	0.8599
Newspaper	0.0298	0.0339	0.9247	0.3557
Organics	0.2596	0.2984	1.6574	0.0983
Other Curbside Paper	0.1164	0.0863	2.6264	0.0090 *
Wood Waste	0.1217	0.0961	1.1354	0.2570
Number of Samples	*210*	*144*		

Table F-7. Comparison of Selected Composition Results, 1993-1994 to 2002-2003 Self-hauled

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1993/94	*2002/03*		
Cardboard and Kraft	0.0389	0.0278	1.8527	0.0648
Construction & Demolition	0.1401	0.1377	0.0806	0.9358
Curbside Containers	0.0178	0.0145	0.9153	0.3607
Hazardous	0.0072	0.0049	0.7769	0.4378
Newspaper	0.0095	0.0067	1.0420	0.2981
Organics	0.2612	0.1919	1.8585	0.0639
Other Curbside Paper	0.0390	0.0320	0.8660	0.3871
Wood Waste	0.2079	0.1588	1.5643	0.1186
Number of Samples	*199*	*156*		

Table F-8. Comparison of Selected Composition Results, 1999-2000 to 2002-2003 Commercially Collected Single-family

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1999/2000	*2002/03*		
Cardboard and Kraft	0.0352	0.0361	0.1382	0.8904
Compostable Organics	0.4207	0.4528	1.1123	0.2688
Construction & Demolition	0.0154	0.0335	0.1699	0.8654
Curbside Containers	0.0526	0.0516	0.0680	0.9459
Hazardous	0.0034	0.0034	1.4270	0.1568
Newspaper	0.0382	0.0257	1.0293	0.3059
Other Curbside Paper	0.0995	0.0829	1.8974	0.0608
Wood Waste	0.0256	0.0382	0.6023	0.5484
Number of Samples	*62*	*36*		

Table F-9. Comparison of Selected Composition Results, 1999-2000 to 2002-2003 Commercially Collected Multifamily

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1999/2000	*2002/03*		
Cardboard and Kraft	0.0792	0.0646	0.5700	0.5717
Construction & Demolition	0.0164	0.0292	0.8017	0.4272
Curbside Containers	0.0688	0.0618	0.6073	0.5469
Hazardous	0.0019	0.0017	0.1576	0.8755
Newspaper	0.0507	0.0429	0.6180	0.5398
Organics	0.3425	0.3642	0.5230	0.6036
Other Curbside Paper	0.0881	0.1287	1.8435	0.0721
Wood Waste	0.0122	0.0460	1.2596	0.2146
Number of Samples	*21*	*24*		

Table F-10. Comparison of Selected Composition Results, 1999-2000 to 2002-2003 Commercially Collected Nonresidential

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1999/2000	*2002/03*		
Cardboard and Kraft	0.0915	0.0611	2.6417	0.0087 *
Construction & Demolition	0.0422	0.0576	0.8792	0.3800
Curbside Containers	0.0409	0.0436	0.4442	0.6572
Hazardous	0.0039	0.0037	0.1107	0.9120
Newspaper	0.0323	0.0339	0.2859	0.7751
Organics	0.2468	0.2984	1.8327	0.0679
Other Curbside Paper	0.0853	0.0863	0.0915	0.9272
Wood Waste	0.1155	0.0961	0.8081	0.4197
Number of Samples	*145*	*144*		

Table F-11. Comparison of Selected Composition Results, 1999-2000 to 2002-2003 Self-hauled

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.0125)
	1999/2000	*2002/03*		
Cardboard and Kraft	0.0307	0.0278	0.5110	0.6097
Construction & Demolition	0.0937	0.1377	1.6914	0.0917
Curbside Containers	0.0233	0.0145	2.2256	0.0267
Hazardous	0.0184	0.0049	2.1458	0.0326
Newspaper	0.0087	0.0067	0.8514	0.3952
Organics	0.2091	0.1919	0.5204	0.6031
Other Curbside Paper	0.0364	0.0320	0.6968	0.4864
Wood Waste	0.1826	0.1588	0.7816	0.4350
Number of Samples	*187*	*156*		

APPENDIX G.
Survey Methodology

The customer survey was administered to vehicles entering 10 public and two private waste facilities in King County between June 2002 and May 2003. Copies of the data collection forms are included in Appendix J.

Sampling Plan

Transfer stations, except for the Vashon facility, were surveyed one day per quarter. Vashon and each drop box were each surveyed two days, for a total of 42 survey days during the study period. Survey days were identified through a systematic process designed to ensure that over the yearlong study period all facilities would be surveyed throughout the week.

To create an unbiased and representative survey schedule, facilities were assigned to specific dates using a random process. First, facilities were randomly assigned to a month during the first quarter of the study. Surveying at transfer stations was then scheduled every three months; surveying at drop boxes was scheduled six months out from the first month. A start date for each month was randomly selected, eliminating holidays or other events such as construction that would impact the normal traffic patterns at facilities scheduled for surveying.[4] Generally survey days were scheduled to occur on consecutive days each month.

[4] Precautions were also taken to ensure that surveying and waste sorting activities were not scheduled to occur at the same facility on the same day.

Table G-1. Customer Survey Schedule
June 2002 – May 2003

Survey Date	Facility	Survey Date	Facility
June		**January**	
24-Jun-02	Renton	9-Jan-03	Skykomish
25-Jun-02	Enumclaw	10-Jan-03	First NE
26-Jun-02	Factoria	11-Jan-03	Private
July		12-Jan-03	Bow Lake
17-Jul-02	Skykomish	**February**	
18-Jul-02	Algona	25-Feb-03	Private
20-Jul-02	First NE	26-Feb-03	Houghton
29-Jul-02	Private	27-Feb-03	Vashon
August		28-Feb-03	Algona
13-Aug-02	Houghton	**March**	
14-Aug-02	Private	17-Mar-03	Enumclaw
16-Aug-02	Vashon	18-Mar-03	Renton
September		20-Mar-03	Factoria
12-Sep-02	Bow Lake	**April**	
13-Sep-02	Enumclaw	13-Apr-03	First NE
14-Sep-02	Renton	17-Apr-03	Houghton
15-Sep-02	Factoria	19-Apr-03	Bow Lake
October		21-Apr-03	Private
23-Oct-02	Private	**May**	
24-Oct-02	First NE	5-May-03	Private
25-Oct-02	Bow Lake	6-May-03	Algona
November		14-May-03	Cedar Falls
8-Nov-02	Houghton		
9-Nov-02	Private		
17-Nov-02	Cedar Falls		
December			
18-Dec-02	Enumclaw		
19-Dec-02	Renton		
20-Dec-02	Factoria		
21-Dec-02	Algona		

Conducting Customer Surveys

With the exception of Vashon, Cedar Falls, and Skykomish, two surveyors were assigned to each survey day[5]. The first surveyor administered the questionnaire to vehicles entering the facility, and the second recorded the vehicle's ticket number as it exited. (Ticket numbers are used for determining the vehicle's net weight at the end of the study.)

[5] With less traffic flow at these three facilities, one surveyor was able to interview incoming drivers and obtain ticket numbers from exiting vehicles.

To link the vehicle's ticket number to the survey information, the first surveyor placed a uniquely numbered identification card on the vehicle's dashboard and recorded the ID number on the questionnaire. The second surveyor obtained this card as the vehicle exited the facility and recorded the ID number and the vehicle's ticket number on a separate form. At the end of the project, the ticket numbers are used to obtain vehicle net weights from King County records. The net weights are then linked to the survey data using the ID number.

The surveyors administered the questionnaire to every vehicle entering the facility during their shift, except in rare instances when the traffic became so congested that the surveyor needed to wave some of the vehicles past to avoid further delays.

Before the surveying took place, all surveyors attended a training session at the Factoria transfer station in Bellevue. As part of the training they conducted mock interviews using the customer survey field form (see Appendix H for a copy). The surveys were then checked for accuracy, completeness, and legibility. Any record that did not meet all three criteria was corrected or dropped from the sample.

The protocol used by the surveyors is described in more detail below.

Information Collected on the Survey Form

AS THE VEHICLE APPROACHED

1. The surveyor determined whether the approaching vehicle was a commercial garbage truck or a self-hauler. (Surveyors were provided with a list of all companies licensed to haul municipal solid waste; please see coding sheet in Appendix H.)
2. The surveyor recorded the vehicle type, according to the nine categories listed below:
    1. Rear packer
    2. Front packer
    3. Side packer
    4. Drop box, loose
    5. Drop box, compacted
    6. Pick-up, van, sport-utility vehicle
    7. Large other (large truck, flatbed truck)
    8. Car
    9. Semi truck
3. The surveyor also noted whether the vehicle was pulling a trailer.
4. The surveyor let the driver know that the King County Solid Waste Division was conducting a customer survey. The surveyor placed a numbered card on the

windshield and explained that the card keeps the driver anonymous, and would be collected when the driver left the facility.

5. The surveyor first asked the driver from which city the load originated. The surveyor was given a list of King County cities and other areas. If the driver's response was not on the list, the surveyor asked whether the location was a rural area within King County or a city outside King County. If waste came from multiple areas in the County, "all over King County" was recorded. Other possible answers included "Skykomish drop box" and "Cedar Falls drop box."
6. The surveyor asked the driver to describe the type of waste brought to the facility, according to the four categories below:
    - Yard waste
    - Construction or demolition debris
    - Special waste (petroleum-contaminated soil, sludge, or asbestos)
    - Mixed garbage
7. If the waste type was yard waste or construction/demolition waste, the surveyor asked if the driver was a contractor/builder or a landscaper respectively.
8. From the following list, the drivers were asked to pick the category that best described the source of their load:
    - Single-family
    - Multifamily
    - Both single-family and multifamily (mixed residential)
    - Residential and nonresidential (business)
    - Nonresidential (business)
9. In addition to the questions listed above, self-haulers were also asked the following questions:
    - How often does the driver visit any transfer station? The surveyor recorded the number of visits per day, week, month, or year (or ever).
    - What is the ZIP code corresponding to the area this waste is from?
    - Does the driver subscribe to curbside garbage collection? (This question was not asked if the driver was a contractor/builder or a landscaper.)
    - Why is the driver self-hauling waste today? (This question was not asked if the driver was a contractor/builder or a landscaper.)

AS THE VEHICLE EXITED THE FACILITY

When departing the facility, the vehicle was stopped a second time. The surveyor retrieved the numbered card, requested to see the customer's receipt, and then recorded the ticket number from the receipt.

APPENDIX H.
Detailed Customer Survey Results

Chapter 4 of the report presented customer survey results for analyzed survey components but excluded *detailed* customer survey tables. This appendix presents the following tables:

- Observed Vehicle Types, by Collection Type and Facility
- Reported Waste Types, by Collection Type and Facility
- Reported Self-hauled Contractors and Landscapers, by Facility and Generator Type
- Reported Reasons for Self-hauling Waste from Residential Generators
- Reported Reasons for Self-hauling Waste from Nonresidential Generators, by Facility

Vehicle Type

Figure H-1. Observed Vehicle Types, by Collection Type and Facility (n=6,055) June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Commercial					
Packer	8%	6%	0%	7%	3%
Drop box	10%	11%	0%	5%	6%
Large other vehicle	0%	0%	0%	0%	0%
Passenger vehicle	0%	0%	0%	0%	0%
Subtotal	**18%**	**17%**	**0%**	**12%**	**10%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Self-haul					
Packer	0%	0%	0%	1%	0%
Drop box	0%	0%	0%	0%	1%
Large other vehicle	5%	4%	1%	5%	6%
Passenger vehicle	77%	78%	99%	82%	83%
Subtotal	**82%**	**83%**	**100%**	**88%**	**90%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Commercial						
Packer	2%	15%	5%	0%	3%	7%
Drop box	1%	17%	5%	0%	0%	8%
Large other vehicle	0%	0%	0%	7%	0%	0%
Passenger vehicle	0%	0%	0%	0%	0%	0%
Subtotal	**3%**	**32%**	**10%**	**7%**	**3%**	**15%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Self-haul						
Packer	0%	0%	0%	0%	0%	0%
Drop box	0%	1%	0%	0%	0%	0%
Large other vehicle	6%	8%	4%	13%	9%	5%
Passenger vehicle	91%	60%	85%	80%	88%	79%
Subtotal	**97%**	**68%**	**90%**	**93%**	**97%**	**85%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Waste Type

Figure H-2. Reported Waste Types, by Collection Type and Facility (n=6,055) June 2002 – May 2003

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Commercial					
Mixed garbage	18%	17%	0%	11%	9%
Yard waste	0%	0%	0%	0%	0%
Construction/demolition	0%	0%	0%	0%	0%
Special waste	0%	0%	0%	0%	0%
Subtotal	**18%**	**17%**	**0%**	**11%**	**10%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Self-haul					
Mixed garbage	61%	54%	75%	70%	49%
Yard waste	7%	15%	10%	6%	16%
Construction/demolition	14%	13%	15%	13%	26%
Special waste	0%	0%	0%	0%	0%
Subtotal	**82%**	**83%**	**100%**	**89%**	**90%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**

	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Commercial						
Mixed garbage	3%	32%	10%	0%	3%	14%
Yard waste	0%	0%	0%	0%	0%	0%
Construction/demolition	0%	0%	0%	0%	0%	0%
Special waste	0%	0%	0%	0%	0%	0%
Subtotal	**3%**	**32%**	**10%**	**0%**	**3%**	**15%**
No response	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Self-haul						
Mixed garbage	52%	34%	63%	100%	61%	53%
Yard waste	22%	8%	11%	0%	4%	13%
Construction/demolition	23%	26%	15%	0%	29%	19%
Special waste	0%	0%	0%	0%	1%	0%
Subtotal	**97%**	**68%**	**90%**	**100%**	**95%**	**85%**
No response	*0%*	*0%*	*0%*	*0%*	*2%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Contractors & Landscapers (Self-hauled Only)

Figure H-3. Reported Self-hauled Contractors and Landscapers, by Facility and Generator Type (n=5,142)*

	Algona			Bow Lake			Cedar Falls			Enumclaw		
	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential
Contractors	7%	21%	0%	7%	20%	29%	4%	0%	0%	4%	18%	10%
Landscapers	0%	2%	9%	2%	5%	0%	1%	0%	0%	0%	12%	0%
All Others	93%	77%	91%	91%	75%	71%	95%	100%	100%	96%	71%	90%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

	Factoria			First NE			Houghton			Renton		
	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential
Contractors	12%	27%	0%	10%	11%	23%	23%	33%	22%	4%	23%	40%
Landscapers	3%	6%	0%	4%	17%	0%	3%	4%	11%	1%	0%	0%
All Others	86%	67%	100%	86%	72%	77%	74%	63%	67%	95%	77%	60%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

	Skykomish			Vashon			Total			OVERALL
	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	Residential	Nonresidential	Mixed Residential & Nonresidential	
Contractors	0%	0%	0%	21%	25%	0%	**10%**	**24%**	**15%**	**11%**
Landscapers	0%	0%	0%	1%	0%	0%	**2%**	**6%**	**3%**	**2%**
All Others	100%	100%	0%	78%	75%	100%	**88%**	**71%**	**81%**	**87%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

**There were a total of three "no response" replies.*

Figure H-4. Reported Reasons for Self-hauling Waste from Residential Generators, by Facility (n=4,156)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Residential											
Cheaper/saves money	14%	17%	21%	26%	5%	9%	7%	12%	0%	35%	**13%**
Cleaning home or workplace	24%	22%	16%	14%	21%	29%	24%	23%	0%	4%	**22%**
Convenience	7%	8%	14%	15%	6%	5%	6%	9%	0%	25%	**8%**
Disaster-related (flood, mudslide, etc.)	0%	0%	1%	0%	0%	0%	0%	1%	9%	0%	**0%**
Dissatisfied with regular collection service	2%	3%	4%	1%	2%	2%	0%	2%	0%	0%	**2%**
Do not have garbage service	1%	0%	4%	3%	1%	0%	0%	1%	45%	1%	**1%**
Dogs get into garbage if left on curb	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%	**0%**
Favor for friend/neighbor/family member	4%	3%	0%	2%	3%	4%	4%	3%	0%	3%	**3%**
Forgot or missed the regular collection service	1%	0%	1%	0%	1%	0%	0%	1%	0%	0%	**1%**
Garbage hauler will not pick up this type of waste	4%	3%	2%	4%	7%	4%	7%	5%	0%	0%	**5%**
Habit	2%	2%	2%	4%	0%	1%	1%	2%	9%	3%	**2%**
Independent hauler	0%	0%	0%	0%	2%	1%	3%	0%	0%	0%	**1%**
Items too big to fit into garbage can	5%	3%	2%	3%	5%	2%	6%	5%	0%	1%	**4%**
Large amount of garbage	7%	4%	3%	5%	8%	4%	3%	5%	0%	1%	**5%**
Moving home or workplace	10%	8%	3%	4%	9%	6%	10%	7%	0%	4%	**8%**
Remodeling	9%	9%	7%	6%	13%	13%	18%	10%	9%	10%	**11%**
Self-sufficiency/do not like government	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Small amount of garbage/recycle almost everything	1%	2%	4%	4%	2%	1%	0%	2%	0%	3%	**2%**
Waste is from vacation home	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Yard debris	7%	13%	4%	5%	13%	16%	9%	8%	0%	1%	**10%**
Subtotal	**98%**	**98%**	**90%**	**97%**	**97%**	**98%**	**99%**	**97%**	**73%**	**93%**	**98%**
Other	*2%*	*2%*	*9%*	*3%*	*2%*	*1%*	*0%*	*3%*	*27%*	*7%*	*2%*
No response	*0%*	*0%*	*1%*	*0%*	*0%*	*1%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Figure H-5. Reported Reasons for Self-hauling Waste from Nonresidential Generators, by Facility (n=204)

	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	First NE	Houghton	Renton	Skykomish	Vashon	OVERALL
Nonresidential											
Cheaper/saves money	13%	24%	0%	0%	10%	25%	27%	24%	0%	17%	**19%**
Cleaning home or workplace	30%	29%	100%	36%	10%	33%	20%	5%	0%	0%	**22%**
Convenience	7%	3%	0%	0%	7%	8%	2%	0%	0%	17%	**4%**
Favor for friend/neighbor/family member	7%	3%	0%	18%	7%	4%	7%	14%	0%	0%	**7%**
Garbage hauler will not pick up this type of waste	7%	12%	0%	0%	10%	0%	9%	0%	0%	0%	**7%**
Habit	0%	0%	0%	9%	0%	0%	0%	0%	0%	0%	**1%**
Independent hauler	7%	0%	0%	9%	3%	0%	7%	0%	0%	0%	**4%**
Items too big to fit into garbage can	0%	6%	0%	0%	14%	4%	11%	5%	0%	0%	**7%**
Large amount of garbage	0%	12%	0%	0%	10%	4%	11%	19%	33%	67%	**11%**
Moving home or workplace	7%	0%	0%	0%	0%	0%	2%	0%	0%	0%	**1%**
Remodeling	0%	0%	0%	0%	3%	13%	0%	0%	0%	0%	**2%**
Roadside litter removal	13%	6%	0%	0%	0%	0%	2%	24%	33%	0%	**5%**
Small amount of garbage/recycle almost everything	3%	3%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Yard debris	3%	3%	0%	0%	14%	4%	0%	0%	0%	0%	**3%**
Subtotal	**97%**	**100%**	**100%**	**73%**	**90%**	**96%**	**98%**	**90%**	**67%**	**100%**	**94%**
Other	*3%*	*0%*	*0%*	*27%*	*10%*	*4%*	*2%*	*10%*	*33%*	*0%*	*6%*
No response	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

APPENDIX I.
Quality Control Plan

QUALITY CONTROL PLAN: WASTE SAMPLING & CUSTOMER SURVEYS

Execution of this quality control plan throughout the 2002-2003 King County Waste Monitoring study helped to ensure quality and consistency during fieldwork, data entry, and reporting.

TASK 1 – WASTE COMPOSITION SORTS

Train Sorting Crew

To provide consistent sorting, the same crewmembers trained at the onset of the study continued to work until the study's completion in May 2003. All sorting crewmembers spent time in the field studying the components and practicing the sampling protocol. The training focused on the precise definitions for each waste component category and also covered safety procedures, sorting techniques, and quality control procedures.

The gatekeeper (the person who selected vehicles for sampling) was typically a member of the regular survey crew and therefore familiar with transfer station protocol, safety procedures, identifying vehicle types, administering the customer survey, and obtaining vehicle net weights. However, the gatekeeper also received training in selecting vehicles for sampling.

Select Vehicles

For each sampling day, the gatekeeper tallied vehicles as they entered the transfer station on a "Vehicle Selection" form. The form indicated the sampling frequency and the total number of vehicles needed for each substream and vehicle type. For each vehicle selected for sampling, the gatekeeper placed a fluorescent pink "Sample" card and a fluorescent green "Sample ID" card on the windshield and directed the vehicle to the sorting crew. The brightly colored cards enabled the sorting crew to identify the selected vehicle easily.

The gatekeeper assigned each vehicle a unique identification number and recorded it on both the pink and green cards. When the driver proceeded to the sorting area, the Sort Crew Manager collected the green "Sample ID" card. The pink card remained on the vehicle's dashboard so that the gatekeeper could identify the vehicle on the outgoing scale. After the vehicle had weighed out, the gatekeeper took the pink card off the windshield and recorded the vehicle ticket number and net weight. If both sample cards remained on the dashboard as the vehicle weighs out, the gatekeeper knew that the sorting crew did not sample the vehicle's load and selected the next vehicle of that

substream for sampling. During analysis, the unique identification number linked the driver's customer survey information with the waste sort data and the vehicle's net weight.

Sample Waste

The crew sorted the waste samples by hand into plastic laundry baskets until only a small amount of homogeneous fine material ("supermix") remained. To ensure consistency among the samples, sorting crewmembers specialized in groups of materials, such as papers or plastics. The open laundry baskets allowed the Sort Crew Manager to observe the material at all times and to monitor the homogeneity of the components as they accumulated in the baskets.

Record and Review Data

The Sort Crew Manager recorded the composition weight information on a specially designed tally sheet. Cascadia designed the tally sheet, database, and corresponding electronic data-entry forms together to ensure accuracy, consistency among forms, and efficient recording of data.

After each month's sampling event, a designated Cascadia staff member or agent entered the tally sheet data, and the sampling task manager reviewed the entered results to ensure accuracy and reliability.

TASK 2 – CUSTOMER SURVEYS

Train Crews

Cascadia trained all surveyors on-site at a waste facility. The training consisted of a review of the survey form and possible responses, and it included a practice session in which surveyors administered the questionnaire to customers. A debriefing of the training occurred immediately following the practice surveys to discuss any issues that arose.

To promote consistency, a small team of regular surveyors conducted the questionnaire throughout the project. Cascadia trained any additional surveyors on-site, using the same process.

Administering the Surveys

Each surveyor received a packet of materials, including photos of various vehicle types, a list of all commercial haulers within King County, and a brief methodology explaining how to collect the information in the survey. The brief methodology included a verbatim script of how to ask each question.

The packet of materials also included a list of all cities in King County. If the respondent's waste was from a city or neighborhood not on the list, the surveyor would clarify whether the location was within incorporated King County, in unincorporated King County, outside King County, or from throughout King County. These steps reduced the number of misspelled or unknown cities of origin.

The survey crew posted a "Survey in Progress" sign in front of the gatehouse to alert drivers to the survey. Surveyors also wore hard hats and safety vests for their protection and to ensure that vehicles recognized them and stopped to answer the questionnaire.

Verify the Accuracy of the Surveys Collected

During the surveyor's first day, the survey task manager was on-site to check the survey process and ensure that the recorded information was complete and accurate. Cascadia dedicated a cell phone for the surveyor to call the task manager if any issues arose after the training and field check.

After each monthly survey period, the task manager reviewed the data to ensure accuracy, completeness, and legibility before data entry. Inaccurate, incomplete, or illegible records were discarded.

Enter Survey Data

A designated Cascadia staff member or agent entered the survey data into the database using electronic data-entry forms. To increase accuracy, the data-entry forms included validation rules that prevented "out of range" values. For example, the database would only allow the numbers 1 through 9 to be entered as the vehicle type, since only this range corresponded to specific vehicle types on the survey form.

Other validation rules prevented extraneous information. For example, surveyors asked only self-haul drivers how often they visited the transfer station, if they subscribed to garbage service, and why they were self-hauling their load. These fields only appeared on the data-entry form if staff entered "self-haul" as the collection type.

TASK 3 – INTEGRATION OF TASKS 1 & 2 (REPORT PREPARATION)

Cascadia calculated waste composition estimates using automated analytical tools, which Cascadia staff developed. These automated tools reduced the possibility for human error and could be tailored, as required, to meet the needs of the study.

The automated calculation tools provided basic information that Cascadia used as a checkpoint to help ensure valid and correct data analysis. For example, the analysis tools showed the total number of samples and the average net weight of the samples when computing composition estimates. Additionally, the user selected what statistical procedures were applied.

A user's guide for the analytical tools provided new project staff with ongoing references and instructions.

APPENDIX J.
Field Forms

Waste Sampling Field Forms

- Facility Reminder Memo
- Sampling Fact Sheet
- Gatekeeper Interview Form
- Vehicle Selection Sheet
- Sampling Cards
- Sorting Tally Sheet

Customer Survey Field Forms

- Facility Reminder Memo
- Survey Fact Sheet
- Survey Instruction Sheet
- Survey Interview Form
- Coding Forms

Waste Sampling Field Forms

Figure J-1. Facility Reminder Memo

Please Post Until June 2, 2003
(at the request of King County Solid Waste Division)

CASCADIA
CONSULTING GROUP

Fax

Date: May 20, 2003

To: Scale Operators
Transfer Station Operators

From: Tanya Tarnecki, Waste Sampling Manager

Pages: 1

Re: King County Transfer Station Waste Sampling

Jim Lindler, project manager for the Waste Monitoring Program of the Solid Waste Division, has asked us to send you this memo for posting as a reminder that we will be conducting waste sampling on behalf of your Division at your facility next week. The waste sampling helps the Solid Waste Division make tonnage forecasts, project revenue, and plan for the future. It also helps develop a better understanding of customers and how best to serve them.

Our staff will be sampling waste on the date and at the facility listed below:

Thursday, May 29 First Northeast

In addition to the sampling crew, one surveyor will be present to select the vehicles that will be sampled. Here's a list of the members of the crew:

Cascadia Consulting Group	**Sky Valley Associates**
Charlie Scott	Brad Anderson
Tanya Tarnecki	Matt Tracy
Mike Lennon	Nan Hage
	Patricia Daniels
	Kyle Anderson
	Ron Turner
	Kyle Cagley

Thank you for your cooperation and help throughout this study. The upcoming dates will be the last sampling day for First Northeast. Please call me at 206-343-9759 x117 (or by cell phone on the sampling days at 206-295-6783) if you have any questions. Jim Lindler, your Division's project manager, is also available at 206-296-4348.

Figure J-2. Sampling Fact Sheet (front)

Waste Sampling At Transfer Stations

The King County Solid Waste Division is sampling waste at transfer stations in King County to update information about the type of waste disposed in the County. The sampling will place between June 2002 and May 2003.

Why does the County sample the waste?
The County samples waste to better understand what is being disposed at transfer stations and the Cedar Hills Regional Landfill in Maple Valley. This information helps the County anticipate changes in the composition of the waste so it can manage it effectively. One way it uses the information is to identify new materials that might be recycled rather than disposed.

Why was I selected for the sampling?
You were randomly selected by the surveyor in front of the scale house. Today, we will be sampling up to 14 other vehicles from residences, businesses and the commercial haulers who pick up curbside and business waste. By randomly selecting you and other customers for sampling, we will be able to make sure we obtain data that will allow us to draw meaningful conclusions.

-over-

Figure J-3. Sampling Fact Sheet (back)

Who is doing the sampling?
Staff from Cascadia Consulting Group and Sky Valley Associates, on behalf of King County.

How do I get more information?
Call Jim Lindler, King County Solid Waste Division, 206-296-4348; 711 (TTY Relay). He is the County's program manager for the waste sampling.

Thank you for participating in today's waste sampling.

This material will be provided in alternate formats upon request.

Printed on recycled paper

Figure J-4. Gatekeeper Interview Form (front)

		Record			*Ask All Vehicles*			*Self-Haul Only*		
Net Weight	Sample Number	Collection Type	Vehicle Type	Trailer	City	Waste Type	House/ Business	ZIP Code	Net Weight	Comments
Obtain from "Exit Form"	Res (1-3) DB (1-3) Com (1-3) SH (1-5) SHO (1)	C com. S self-haul make sure S has material to dispose not recycle	1 Rear Packer 2 Front Packer 3 Side Packer 4 Drop Box, Loose 5 Drop Box, Compacted 6 Pick-up, Van, Sport Ut. 7 Large Other 8 Car 9 Semi Truck	X if yes	If city is not on the list of King County cities, clarify whether it is a rural area inside King County or a city outside King County	**Y Yard Waste** **C Construct/ Demolition** **M Mixed Garbage** **S Special Waste**	1 single family 2 multi-family 3 both SF and MF 4 res and biz 5 non-residential		in tons	

Figure J-5. Gatekeeper Interview Form (back)

Complete this section for every page

Page _____ of _____

Date _____

Gatekeeper _____

Circle the site:

Public		*Private*
Algona	First NE	Eastmont
Bow Lake	Houghton	Third & Lander
Cedar Falls	Renton	
Enumclaw	Skykomish	
Factoria	Vashon Island	

Complete this section for first page only

Inclement Weather? _____

Start Time _____ Stop Time _____

Start Ticket _____ End Ticket _____

Other Notes about Today's Sampling:

If found, please call Cascadia Consulting Group at 206/343-9759. Reward offered.

Figure J-6. Vehicle Selection Sheet (Eastmont)

King County Waste Monitoring Study
Vehicle Selection Form

Site: EASTMONT

Date: May 28, 2003

EXCLUDE C&D LOADS
EXCLUDE SEATTLE LOADS

We want to sample every vehilce that comes to Eastmont that is from King County, excluding Seattle, and is NOT brining C&D materials. Included is a list of what to expect. Ultimately we want 15 samples regardless of substream. As a vehicle is selected for sampling, cross off a number to track the number of samples by substream.

FRANCHISED RESIDENTIAL: (Res 1-??)

WE EXPECT **ABOUT EIGHT** FRANCHISED RESIDENTIAL LOADS, GRAB EVERY VEHICLE

(1) (2) (3) (4) (5) (6) (7) (8) 9 10

FRANCHISED COMMERCIAL DROPBOX: (DB 1-??)

WE EXPECT **ABOUT FIVE** GRAB EVERY VEHICLE

(1) (2) (3) (4) (5) 6 7

FRANCHISED COMMERCIAL PACKER: (Com 1-??)

WE EXPECT **ABOUT TWO,** GRAB EVERY VEHICLE

(1) (2) 3 4

Figure J-7. Vehicle Selection Sheet (First Northeast)

King County Waste Monitoring Study
Vehicle Selection Form

Site: FIRST NORTHEAST

Date: May 29, 2003

GOAL: 15 SAMPLES

Cross off one number for each type of vehicle entering the station.

When you reach the number circled, this vehicle should be asked to go to the sorting area to dump its load for sampling.

Continue for each block, beginning at #1, on the next line until the required number of vehicles is sampled.

FRANCHISED RESIDENTIAL: (Res 1-7) **NEED 7 TOTAL - SAMPLE EVERY VEHICLE**

1 2 3 4 5 6 7

packer trucks or drop boxes

FRANCHISED COMMERCIAL DROPBOX: (DB 1-5) **NEED 5 TOTAL - SAMPLE EVERY VEHICLE**

1 2 3 4 5

both compacting and loose drop boxes

FRANCHISED COMMERCIAL PACKER: (Com 1-3) **NEED 3 TOTAL - SAMPLE EVERY VEHICLE**

1 2 3

Figure J-8. Sampling Cards

Sample ID:	**Sample ID:**	**Sample ID:**
_____	_____	_____
Date:	**Date:**	**Date:**
_____	_____	_____

Figure J-9. Sorting Tally Sheet

Paper				
Corrugated Cardboard (OCC)				
Newspaper (ONP)				
High Grade				
Low Grade Recyclable				
Paper and Other Materials				
Bleached Polycoated Paperboard				
COMPOSTABLE PAPER				
Gift Paper				
Other Paper				
Plastic				
PET Bottles				
HDPE Bottles				
Other Containers				
Expanded Polystyrene				
Plastic Film and Bags				
Other Rigid Packaging				
Plastic Products				
Foam Rubber and Padding				
Plastic and Other Materials				
Organics (wood, yard, food)				
Food Wastes				
Yard Wastes				
Large Prunings				
Stumps				
Dimensional Lumber/Plywood				
Treated Wood				
Other Wood				
Roofing and Siding Wood				
Contaminated Wood				
Other Organics				
Textiles:Clothes & Other Recyclables				
Other Textiles				
Disposable Diapers				
Rubber Products				
Tires				
Animal Carcasses				
ANIMAL FECES				
Miscellaneous Organics				

Notes/Supermix:

Glass				
Clear Containers				
Green Containers				
Brown Containers				
Other Colored Containers				
Other				
Metals				
Aluminum Cans				
Other Aluminum				
Tinned Food Cans				
Other Ferrous				
Other Non-Ferrous				
Mixed Metals and Other Materials				
Compressed Gas Cylinders				
Other Wastes				
Construction/Demolition Wastes				
Gypsum Wallboard				
Furniture/Mattresses				
Household Appliances				
Printers/Copiers/Fax Machines				
Office Electronics				
Ashes				
Nondistinct Fines				
Miscellaneous Inorganics				
Household Hazardous Waste				
Household Batteries				
Alkaline/Button Cell Batteries				
Computer Monitors				
Televisions				
Cell Phones				
Laptops/LCD Monitors				
Latex Paint				
Oil-based Paint				
Solvents and Thinners				
Adhesives and Glue				
Cleaners and Corrosives				
Pesticides and Herbicides				
Used Oil				
Gasoline and Fuel Oil				
Antifreeze/Brake Fluid				
Vehicle Batteries				
MEDICAL WASTES				
Mercury-Containing Waste				
Other Household Hazardous Wastes				

Location: _____

Date: _____

Sample: _____

Customer Survey Field Forms

Figure J-10. Facility Reminder Memo

Please Post Until March 21, 2003
(at the request of King County Solid Waste Division)

CASCADIA
CONSULTING GROUP

Fax

Date: March 6, 2003

To: Scale Operators
Transfer Station Operators

From: Amity Lumper, Customer Load Survey Manager

Pages: 1

Re: King County Transfer Station Customer Load Surveys

Jim Lindler, project manager for the Waste Monitoring Program of the Solid Waste Division, has asked us to send you this memo for posting as a reminder that we will be conducting customer load surveys on behalf of your Division at your facility in two weeks. The customer load surveys help the Solid Waste Division make tonnage forecasts, project revenue, and plan for the future. It also helps develop a better understanding of customers and how best to serve them.

Our staff will be conducting customer load surveys on the dates and at the facilities listed below:

Monday, March 17	**Enumclaw**
Tuesday, March 18	**Renton**
Thursday, March 20	**Factoria**

One to two surveyors will be present to survey vehicles entering the facilities. There will be two surveyors at Renton and Factoria, and one at Enumclaw. The surveyors' names are listed below:

Kaye Pethe
Heather Woodhams

Thank you for your cooperation and help throughout this study. The upcoming dates will be the final customer load survey days for the Enumclaw, Renton, and Factoria facilities. Please call me at 206-343-9759 x111 (or by cell phone on the sampling days at 206-295-6783) if you have any questions. Jim Lindler, your Division's project manager, is also available at 206-296-4348.

cc:
CJ Sprague, Transfer Station Supervisor
Alan Duncan, Transfer Station Supervisor
Stephanie Erickess, Scale Operator Supervisor
Luther Anderson, Scale Operator Lead
Laurie Nakagawa, Scale Operator Lead
Terri Zinter, Scale Operator Alternate Lead
Thea Severn, Assistant Operations Manager
Linda Hyatt, Transfer Station Operator Scheduler
Janis McWilliams, Transfer Station Operator Scheduler
Nigel White, Transportation Supervisor
Bob Jones, Landfill Operations Supervisor
Steve Smith, Shop Supervisor
Mike Parker, Shop Supervisor
Julia Bassett, Program Coordinator
Francisco Gaspay, Engineer
Jim Lindler, Program Manager
Geraldine Cole, Planning and Communications Manager

Figure J-11. Survey Fact Sheet (front)

Customer Surveys at Transfer Stations

The King County Solid Waste Division is surveying customers at transfer stations in King County to update information about the type of waste disposed in the County and where it comes from. The surveys will take place between June 2002 and May 2003.

Why does the County conduct these surveys?
The County wants to obtain information on how people use its transfer stations. This information helps the County anticipate the needs of its customers so it can provide appropriate services.

Why was I selected for the survey?
We are surveying every customer who visits this transfer station today. By doing so, we will be able to make sure we obtain data that will allow us to draw meaningful conclusions about the use of our transfer stations.

-over-

Figure J-12. Survey Fact Sheet (back)

Who is administering the survey?
Staff from Cascadia Consulting Group and Cunningham Environmental Consulting, on behalf of King County.

How do I get more information?
Call Jim Lindler, King County Solid Waste Division, 206-296-4348; 711 (TTY Relay). He is the County's program manager for the customer survey.

Thank you for participating in today's survey.

This material will be provided in alternate formats upon request.

Printed on recycled paper

Figure J-13. Survey Instruction Sheet (front)

KING COUNTY WASTE MONITORING PROGRAM
CUSTOMER SURVEY INSTRUCTIONS

AS THE VEHICLE APPROACHES:

- *At all sites except Skykomish, Third & Lander, and Eastmont:* Select a **numbered card**; record the number.
- Decide whether the vehicle is a commercial hauler or self-hauler (review the attached list of garbage companies) and record the **collection type.**
- Observe and record the **vehicle type** (from the list on the survey form; ask driver if you are uncertain.)
- Observe and record whether they are pulling a **trailer** ("X" if yes).

STOP THE VEHICLE, THEN BEGIN QUESTIONS:

ALL DRIVERS:

- Introduction: "Hello, King County is conducting a customer survey today."
- *At all sites except Skykomish, Third & Lander, and Eastmont:* Hand the driver the numbered card. "This card will be collected when you leave the facility. Please don't leave without returning the card."
- Ask where the load is from. Refer to the sheet entitled "City of Origin." If the load is from somewhere not on the list of cities, verify whether the load is from Unincorporated King County, all over King County, or Outside King County. Record the **city** on the survey form.
- Ask the driver whether the load is yard waste, construction/demolition/landclearing (CDL), mixed garbage, or special waste (refer to attached sheet for definition of special waste). Record the **waste type**.
- If the waste type is yard waste or construction/demolition, ask the driver if he/she is a contractor/builder or a landscaper. Record only if he/she is **contractor/builder or landscaper**.
- Ask the driver where the load was generated: single-family residential, multi-family residential, mixed residential, residential and non-residential, or non-residential (business/institutional). Record the **generator** type.

SELF-HAUL DRIVERS ONLY:

- Ask the driver how often he/she visits any transfer station. Record the **trips/period** in terms of XX times per DAY, WEEK, MONTH or YEAR only. (For example, write down 3/year if he/she says "once every four months.")
- Ask the driver from which **ZIP code** the load originated.
- Ask the driver whether he/she has curbside **garbage service** (circle yes or no). [This question pertains to: a) home if the driver indicated the load is from his/her home, or b) business if the driver indicated the load is from his/her business.]
- Ask the driver **why** he/she is **self-haul**ing today. If the driver previously answered "no" to having curbside garbage service, ask why he/she does not subscribe, instead of asking why he/she is self-hauling. Refer to the list provided to code the answer.

Figure J-14. Survey Instruction Sheet (back)

ALL DRIVERS

Record any additional comments the driver may offer. Thank the driver for his/her responses.

AS THE VEHICLE DEPARTS THE FACILITY:

Not required at Skykomish, Third & Lander, or Eastmont.

- Remove the numbered card and ask for the transaction receipt.
- *If you have a two-person survey team*, the second person will record the **numbered card**'s number and the **ticket number** on the *exit form*.
- *If only one person is conducting the survey*, you will record the **ticket number** on the *survey form*, making sure to write it next to the correct **numbered card** number.

Figure J-15. Survey Interview Form (front)

	As All Vehicles Approach				*Ask All Vehicles*				*Ask Self-Haul Only*				
												Skip if CB/Landscaper	
Ticket Number	Numbered Card	Collection Type	Vehicle Type	Trailer	City	Waste Type	**Contractor or Landscaper**	House/ Business	Trips to Any Station per Time Period		ZIP Code	**Subscribe Garbage Service?**	**Why Self-Haul?**
Obtain from "Exit Form"		C comm'l. S self-haul	1 Rear Packer 2 Front Packer 3 Side Packer 4 Drop Box, Loose 5 Drop Box, Compacted 6 Pick-up, Van, SUV 7 Large Other 8 Car 9 Semi Truck	X if yes	If city is not on the list of King County cities, clarify whether it is a rural area inside King County or a city outside King County	**Y Yard Waste** **C Construction/ Demolition** M Mixed Garbage S Special Waste	If waste type = **Y** yard waste or **C** construction/demo., then ask: CB Contractor/Builder LN Landscaper	1 single-family 2 multi-family 3 both SF & MF 4 res & non-res. 5 non-residential	(Number)	(Circle time period) D day W week M month Y year E ever *(or <1 per 10 yrs)*		Yes No	If "**No**" to Garbage Service, ask "Why don't you subscribe to garbage service?"
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	
		C S				Y C M S	CB LN			D W M Y E	98	Y N	

Figure J-16. Survey Interview Form (back)

Complete this section for every page

Page _____ of _____

Date _____

Surveyor(s) _____

_____

Circle the site:

Public		*Private*
Algona	First NE	Eastmont
Bow Lake	Houghton	Third & Lander
Cedar Falls	Renton	
Enumclaw	Skykomish	
Factoria	Vashon Island	

Complete this section for first page only

Inclement Weather? _____

Start Time _____ Stop Time _____

Start Ticket _____ End Ticket _____

Other Notes about Today's Surveying:

Figure J-17. Coding Forms (front)

CITY OF ORIGIN

Possible King County answers (Bold are incorporated cities)

Algona
Allentown
Auburn
Baring
Beaux Arts
Bellevue
Black Diamond
Bothell
Bryn Mawr
Burien
Carnation
Cedar Falls Drop Box
Clyde Hill
Covington
Cumberland
Des Moines
Duvall
Eastgate
Enumclaw
Factoria
Fairwood
Fall City
Federal Way
Grotto
Haller Lake
Hobart
Hunts Point
Issaquah
Juanita
Kenilworth
Kenmore
Kent
Kingsgate
Kirkland
Lake Forest Park
Lake Hills
Lake Sammamish
Lakewood Park
Maple Heights
Maple Valley
Maury Island
Medina
Mercer Island
Meridian Heights
Milton
Newport Hills
Newport Shores
Newcastle
Normandy Park
North Bend
North City
Pacific
Palmer
Pine Lake
Preston
Ravensdale
Redmond
Redondo
Renton
Richmond Beach
Sahalee
Sammamish
Scenic
Seahurst
SeaTac
Seattle
Shoreline
Skyway
Skykomish
Skykomish Drop Box
Spring Lake
Snoqualmie
Tukwila
Vashon Island
West Seattle
Woodinville
Yarrow Point

Outside King County:

Arlington
Bainbridge Island
Bonney Lake
Brier
Brown's Point
Buckley
Camano Island
Canon Park
Carbonado
Chelan
Cle Elum
Clearview
Clinton
Dash Point
Edmonds
Edgewater
Edgewood
Ellensburg
Everett
Fairview
Fife
Fort Lewis
Gig Harbor
Gold Bar
Graham
Greenwater
Hyak
Index
Lacey
Lake Stevens
Lake Tapps
Lake Wenatchee
Leavenworth
Livingston
Lynnwood
Maltby
Marysville
McMillan
Mill Creek
Monroe
Mountlake Terrace
Mukilteo
Olympia
Orting
Parkland
Peshastin
Plain
Puyallup
Roslyn
Roy
Selah
Silverdale
Silver Lake
Smokey Point
Snohomish
Spanaway
Stanwood
Steilacoom
Stevens Pass
Sultan
Sumner
Tacoma
Wenatchee
Whidbey Island
Wilkinson
Woodway
Yelm

If city is not on either list, determine if it is:

Unincorporated King County
All over King County
Outside King County

Figure J-18. Coding Forms (back)

COMMERCIAL COLLECTION VS. SELF-HAUL

If one of these company names is printed on the vehicle, it is a COMMERCIAL COLLECTION vehicle:

City of Enumclaw
Container Hauling Corp.
Eastside Disposal
Emerald City Disposal
WM–Federal Way Disposal
Island Disposal (American)
Kent Meridian Disposal
Lawson Disposal Inc.
WM–Nick Raffo Garbage
Pacific Resource Management
Rabanco Connections
Rabanco Recycling
Sea-Tac Diposal
Seattle Disposal Co.
WM–Northwest
WM–Rainier Inc.
WM–Recycling Northwest
WM–RST Disposal Co.
WM–Seattle
WM–Sno-King
WM–Tri-Star Disposal

If none of these names appears on the vehicle, it is SELF-HAUL.

Waste Type "Special Wastes"

"Special wastes" are petroleum-contaminated soil, sludge, or asbestos. These wastes are rarely (if ever) hauled to the transfer stations.

REASONS FOR SELF-HAULING

***Ask the drivers for the MAIN (only one) reason why* they are self-hauling today**

1. Large amount of garbage
2. Cheaper / saves money
3. Cleaning home or workplace
4. Garbage service is not available in my area
5. Items too big to fit into garbage can
6. Convenience (often: "driveway is too long")
7. Yard debris
8. Remodeling
9. Moving home or workplace
10. Garbage hauler won't pick up this type of waste
11. Small amount of garbage / recycle almost everything
12. Dissatisfied with regular collection service
13. Forgot or missed the regular collection service
14. Disaster-related (flood, mudslide, earthquake, etc.)
15. Self-sufficiency / don't like government
16. Favor for a friend/neighbor/family member
17. Dogs get into garbage if left on curb
18. Waste is from vacation home
19. Roadside litter removal
20. Other
21. Refused to answer
23. Independent hauler (business is hauling, but not demo.)
24. Habit

For Third & Lander and Eastmont Only

22. Demolition trucking company

King County
Department of
Natural Resources and Parks
Solid Waste Division
King Street Center, Suite 701
201 S. Jackson St.
Seattle, WA 98104-3855