2015 King County Waste Characterization and Customer Survey Report

King County Waste Monitoring Program

King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste **Prevention** | *Resource* **Recovery** | *Waste* **Disposal**

www.kingcounty.gov/solidwaste

September 2016
FINAL

Table of Contents

Tables and Figures

Executive Summary

Project Purpose and Background

In 2015, residents and businesses in King County disposed nearly 843,000 tons of garbage, also known as municipal solid waste (MSW).[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 County's disposed waste. The Waste Monitoring Program includes waste characterization studies, customer surveys, and other studies as needed to help King County provide efficient and effective services, plan for future needs, and track progress towards its recycling goals.

In 2015, King County completed a waste characterization study and customer survey at its ten waste facilities as part of the Waste Monitoring Program. The key objectives of the two different studies are presented below:

- **Waste characterization studies** create a picture of the waste stream through the collection and sorting of materials disposed at King County's ten waste facilities. These studies help the County target recoverable materials, such as food scraps and other organics, for potential future efforts to increase diversion.
- **Customer surveys** provide King County with answers to crucial questions such as where the waste arriving at transfer stations comes from, how to increase recycling, and why and how often people visit a County facility. By answering these questions, these surveys help the County understand its customers and provide effective service.

To manage its current waste effectively and to plan for future needs, King County wants to understand both its existing MSW stream and its waste facility users. To facilitate analyzing waste materials and customers, waste flows and customers were divided into substreams according to where the waste came from and who brought it to the facility. Analysis by substream eases 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 were divided into substreams according to the source, or generator, of the waste: residential or nonresidential. Wastes were then further categorized according to how materials were delivered to waste facilities: commercially collected by waste hauling companies or self-hauled by residents or other businesses that bring loads to waste facilities.[2]

[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 serviced by Pierce County, but includes the waste from Bothell (Snohomish County part) and Auburn and Pacific (Pierce County part)

[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. Loads hauled by the City of Enumclaw and Town of Skykomish are considered commercially hauled. Self-haul loads are categorized as

Between January 2015 and January 2016 at the County's ten waste facilities (eight transfer station and two dropbox facilities), the project team hand-sorted 421 waste samples into 97 material types (described in detail in Appendix B. Material Definitions) and completed more than 5,500 customer surveys. This report presents the results of those waste sorts and surveys.

Summary of Findings

This section summarizes the waste characterization and customer survey key findings. Detailed waste characterization results cans be found in Section 3. Waste Characterization Findings and Appendix D. Detailed Waste Composition Results. Detailed customer survey results can be found in Section 4. Transfer Station Customer Survey and Appendix E. Detailed Customer Survey Results. Throughout the report, all quantity data is presented in annual tons unless noted otherwise.

Table 1 illustrates the annual disposed quantity (in tons) of waste from each of the various substreams—residential and nonresidential, commercially collected and self-haul—in 2015.

Table 1. MSW Tonnage by Substream, 2015[3]

	Commercially Collected	Self-haul	Total
Residential tons	325,459	210,320	**535,779**
Nonresidential tons	292,674	14,500	**307,174**
Total	**618,133**	**224,820**	**842,953**

Key Waste Characterization Findings

To help identify additional diversion opportunities, the 97 material types were classified into three recoverability groups: Readily Recyclable, Limited Recyclability, and Not Recyclable. Material types included in each of these recoverability groups and the factors that affect recoverability are provided in Section 3. Waste Characterization Findings. The waste composition results show approximately 62% (520,684 tons) of the County's overall waste is Readily Recyclable. The Readily Recyclable fraction includes nearly 257,000 tons of materials acceptable in most curbside compost programs.

Table 2 summarizes the materials that comprise more than 5% of each substream. *Unpackaged/scrap vegetative food* is the largest material type in the overall waste stream (7.7%) as well as in the commercially collected residential (10.8%) and commercially collected nonresidential (9.4%) substreams. *Packaged vegetative food* and *unpackaged/scrap non-vegetative food* were also prevalent in both of the commercially collected substreams. In contrast, none of the material types in the **Food**

residential or nonresidential according to the source of the load, not the type of hauler. Some companies collect waste from homes or businesses but they are not the franchised haulers (1-800-Got Junk, for example). These loads are considered self-haul residential if the waste is produced from homes, even though a company, not the residents, delivers the material to a waste facility.

[3] King County disposed 21,861 tons of other and special waste at Cedar Hills (King County's landfill) in 2015. This waste was not sampled and is not included in the composition results or reported tonnages even though the quantities of some specific materials (contaminated soil, for example) are known.

material classes comprise more than 5% of self-haul loads. The largest material type in self-haul loads was *dimensional lumber* in both the self-haul residential and self-haul nonresidential substreams (15.9% and 13.3%, respectively).

Table 2. Materials Comprising More than 5% of Disposed Waste by Substream, 2015

	Overall	Residential		Nonresidential	
		Commercially Collected	Self-haul	Commercially Collected	Self-haul
Unpackaged/Scrap Vegetative Food	7.7%	10.8%		9.4%	
Dimensional Lumber	6.0%		15.9%		13.3%
Disposable Diapers	5.6%	10.6%			
Animal Feces		8.5%			
Other Compostable Paper				6.3%	
Packaged Vegetative Food	5.1%	7.4%		5.7%	
Unpackaged/Scrap Non-vegetative Food		5.5%		6.2%	
Contaminated Wood			8.4%		9.1%
C&D Wastes			6.2%		7.8%
Yard Waste			7.2%		
Furniture			5.5%		
Gypsum Wallboard					5.3%
Treated Wood			5.5%		
Other Ferrous					6.0%
Industrial Packaging Film Plastic					
Other Glass					6.1%
Total	**24.4%**	**42.8%**	**48.7%**	**27.6%**	**47.6%**

Estimates are presented to the nearest 0.1 percent and, when summed, may not equal the total shown due to rounding.

Comparisons Between Study Years (2011 – 2015)

This section presents findings from statistical comparisons between the 2015 waste composition data and the previous study period in 2011. The analysis examines statistical differences, using *t*-tests, between the 2015 and the 2011 studies. These comparisons are meant to determine if changes in the composition of King County's disposed waste stream are statistically significant. The year-to-year comparisons were made by examining the changes in the composition percentages for selected material groupings. Key findings include:

- Since 2011, Other Curbside Paper has shown a strong trend or statistically significant decrease in all commercially collected substreams.
- Organics in the commercially collected single family substream have shown a statistically significant decrease since 2011.
- The proportion of Newspaper has shown a statistically significant increase since 2011 in the commercially collected nonresidential substream.
- Wood Waste materials have increased in self-hauled waste loads since 2011.

The key findings are summarized in Table 3.

Table 3. Waste Composition Changes and Trends, 2011 vs. 2015

	Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Overall								
Overall	Other Curbside Paper	6.4%	4.3%	-2.2% ↓	4.2336	0.0000 *	**Yes**	Statistically Significant
Overall	Curbside Containers	8.5%	6.5%	-1.9% ↓	2.3591	0.0185	No	Strong Trend
Overall	Wood Waste	10.8%	15.3%	4.5% ↑	2.7519	0.0061 *	**Yes**	Statistically Significant
Commercially Collected								
Single Family	Other Curbside Paper	6.8%	4.3%	-2.5% ↓	3.7772	0.0002 *	**Yes**	Statistically Significant
Single Family	Organics	43.8%	36.5%	-7.3% ↓	3.0118	0.0031 *	**Yes**	Statistically Significant
Multifmaily	Other Curbside Paper	8.2%	5.4%	-2.9% ↓	2.3680	0.0205	No	Strong Trend
Nonresidential	Newspaper	1.1%	1.6%	0.6% ↑	2.4792	0.0137	No	Strong Trend
Nonresidential	Other Curbside Paper	9.7%	6.0%	-3.8% ↓	3.9294	0.0001 *	**Yes**	Statistically Significant
Nonresidential	Construction & Demolition	5.5%	3.2%	-2.2% ↓	1.8962	0.0588	No	Strong Trend
Self-haul								
Self-haul	Wood Waste	21.7%	32.7%	11.0% ↑	3.0685	0.0023 *	**Yes**	Statistically Significant

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Key Customer Survey Findings

- Eighty-one percent of facility users surveyed were self-haul customers. These self-haul customers primarily delivered waste from residences (86%).
- Passenger vehicles composed 87% of the self-haul traffic surveyed.[4]
- More than half (52%) of commercially collected loads originated from nonresidential sources.
- Mixed garbage accounted for 78% of all loads surveyed. Construction and demolition materials represented 19%, and yard waste accounted for 3%.
- Most residential self-haul customers subscribed to curbside garbage service (60%); subscribers make, on average, less than half as many trips per year as non-subscribing self-haul customers.
- "Large amount of garbage" was the top reason for customers to self-haul waste for both residential (18%) and nonresidential customers (26%).

Organization of the Report

The remainder of this report provides the project background, describes the study methodology, and presents the findings. Appendices follow the main body of the report detailing the study methodology, material definitions, and composition calculations, etc.

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

1. Project Purpose and Background

In 2015, residents and businesses in King County disposed nearly 843,000 tons of garbage, also known as municipal solid waste (MSW).[5] 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 County's disposed waste.

King County's Waste Monitoring Program

The Waste Monitoring Program assesses how much and what types of materials King County's residents and businesses dispose. This program includes waste characterization studies, customer surveys, and other studies as needed to help King County provide appropriate services to current customers, effectively manage disposed materials, and plan for the future.

In 2015, King County completed a waste characterization study and customer survey at its ten waste facilities as part of the Waste Monitoring Program. The key objectives of the two different studies are presented below:

- **Waste characterization studies** create a picture of the waste stream through the collection and sorting of materials disposed at King County's ten waste facilities. These studies help the County target recoverable materials, such as food scraps and other organics, for potential future efforts to increase diversion.
- **Customer surveys** provide King County with answers to crucial questions such as where the waste arriving at transfer stations comes from, how to increase recycling, and why and how often people visit a transfer station. By answering these questions, these surveys help the County understand its customers and provide effective service.

Waste Characterization Studies

Between January 2015 and January 2016, the project team hand-sorted 421 waste samples into 97 material types. Table 4 summarizes the number of samples sorted as part of King County's Waste Monitoring Program since 1991.

The total waste was divided into various substreams according to where the waste came from and who brought it to the waste facilities. Analysis by substream is useful because the different substreams often have different waste types, user profiles, and public programs for reaching customers.

Table 4. Number of Samples by Study Year

Study Period	# of Samples
2015	421
2011	420
2007	421
2002-2003	369
1999-2000	412
1995-1996	630
1993-1994	568
1991	569
Total	**3,810**

[5] 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 serviced by Pierce County, but includes the waste from Bothell (Snohomish County part) and Auburn and Pacific (Pierce County part).

Substreams were divided by the source, or generator, of the waste (residential or nonresidential) as well as by how materials were delivered to waste facilities (commercially collected or self-haul) using the following definitions:

- **Residential waste** is material disposed from single family or multifamily dwellings.
- **Nonresidential waste** is material disposed from businesses, schools, government offices, and other institutions that are not residences.
- **Commercially collected** material is hauled by a firm under contract with local governments to operate a garbage collection company or operate under a state franchise in a particular geographic area.[6]
- **Self-haul** material is hauled by a resident or a business that is not primarily engaged in hauling waste.[7]

Waste loads were first divided into residential and nonresidential generator substreams. Then, those substreams were further divided between commercially collected and self-haul waste, as shown in Table 5. In some cases, loads contained a mixture of waste from residential and nonresidential sources, but these mixed loads represented only a small portion of the total waste. Commercial waste haulers typically classify these mixed loads as nonresidential. To be consistent with previous studies, tonnage from mixed loads is included in the nonresidential substream tonnage. All regional direct waste is considered commercially collected nonresidential waste.

Table 5. Waste Streams and Substreams

	Commercially Collected	Self-haul
Residential Waste	Commercially collected waste from residential sources	Self-haul waste from residential sources
Nonresidential Waste	Commercially collected waste from nonresidential sources	Self-haul waste from nonresidential sources
Mixed Residential and Nonresidential Waste	Commercially collected waste from residential and nonresidential sources	Self-haul waste from residential and nonresidential sources

Customer Surveys

Between January 2015 and January 2016, the project team completed more than 5,500 customer surveys at the County's ten waste facilities. Table 6 summarizes the number of customer surveys completed as part of King County's Waste Monitoring Program since 1993.

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

[7] Self-haul loads were 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. These loads were considered self-haul residential if the waste was produced from homes, even though a company, not the residents, delivered the material to a waste facility.

Table 6. Number of Surveys by Study Year

Study Period	# of Surveys
2015	5,530
2011	5,556
2008	5,086
2006	5,665
2002-2003	6,381
2001	7,050
1999-2000	7,809
1998	22,645
1997	12,610
1995-1996	11,132
1993-1994	12,523
Total	**101,987**

Customer survey data was segmented by generator type and how materials were brought to the transfer station, as with the waste characterization studies. For customer surveys, results from mixed residential and nonresidential loads are reported as nonresidential waste. Additionally, customer survey data was further divided by the type of material brought to the transfer station for disposal. These materials were classified into one of the following four waste categories:

- **Yard Waste** is organic waste made primarily of plant material. This includes grass, leaves, and prunings.
- **Construction and Demolition Debris** is waste that is created by construction and/or demolition activities such as roofing or remodeling.
- **Special Waste** is petroleum-contaminated soil, sludge, or asbestos.
- **MSW/Mixed Garbage** is waste that does not fit into any of the above three categories or is a mix of several categories.

Before presenting the study's findings, an overview of King County's waste management system is first provided in the following section.

Waste Management in King County

Private waste management companies collect much of the waste from the County's homes and businesses. Some individuals and companies also choose to haul their own waste, either occasionally or on a regular basis. After collection, most of King County's solid waste destined for disposal first arrives at one of ten facilities: eight County-owned transfer stations and two County-owned dropboxes. The County-owned transfer stations include Algona, Bow Lake, Enumclaw, Factoria, Shoreline, Houghton, Renton, and Vashon. The two dropboxes are located at Cedar Falls and Skykomish. From these facilities, trucks haul King County's waste to the Cedar Hills Regional Landfill for disposal. Some MSW is disposed of directly at Cedar Hills and does not pass through the transfer stations; this is referred to as regional

direct waste, special waste and some direct deliveries from collection trucks which operate in the vicinity of the landfill.[8]

Table 7 shows the quantity of MSW delivered to each of King County's ten facilities, and directly to Cedar Hills landfill during the study period. Residents and businesses in King County disposed of nearly 843,000 tons of MSW at these facilities. Of the County facilities, the Bow Lake transfer station received the most waste, nearly 250,000 tons or 30% of the County total. Waste taken to Skykomish represented the smallest share of the total tonnage, with just less than 1,200 tons or less than 1% of the total MSW waste stream.

Table 8 shows the total number of annual transactions by facility. Bow Lake is the busiest, where approximately 21% of the 815,707 transactions occur. Skykomish is the least busy, with less than 1% of transactions occurring at that facility.

Table 7. Annual Tons by Facility, 2015[9]

Site	Annual Tons	Percent of Total
Algona	144,063	17%
Bow Lake	248,957	30%
Cedar Falls Drop Box	3,776	0%
Enumclaw	21,333	3%
Factoria	122,913	15%
Houghton	156,322	19%
Renton	65,595	8%
Shoreline	65,183	8%
Skykomish Drop Box	1,174	0%
Vashon	7,253	1%
Subtotal	***836,569***	***99%***
Regional Direct Waste	6,384	1%
Total	**842,953**	**100%**

Table 8. Annual Transactions by Facility, 2015

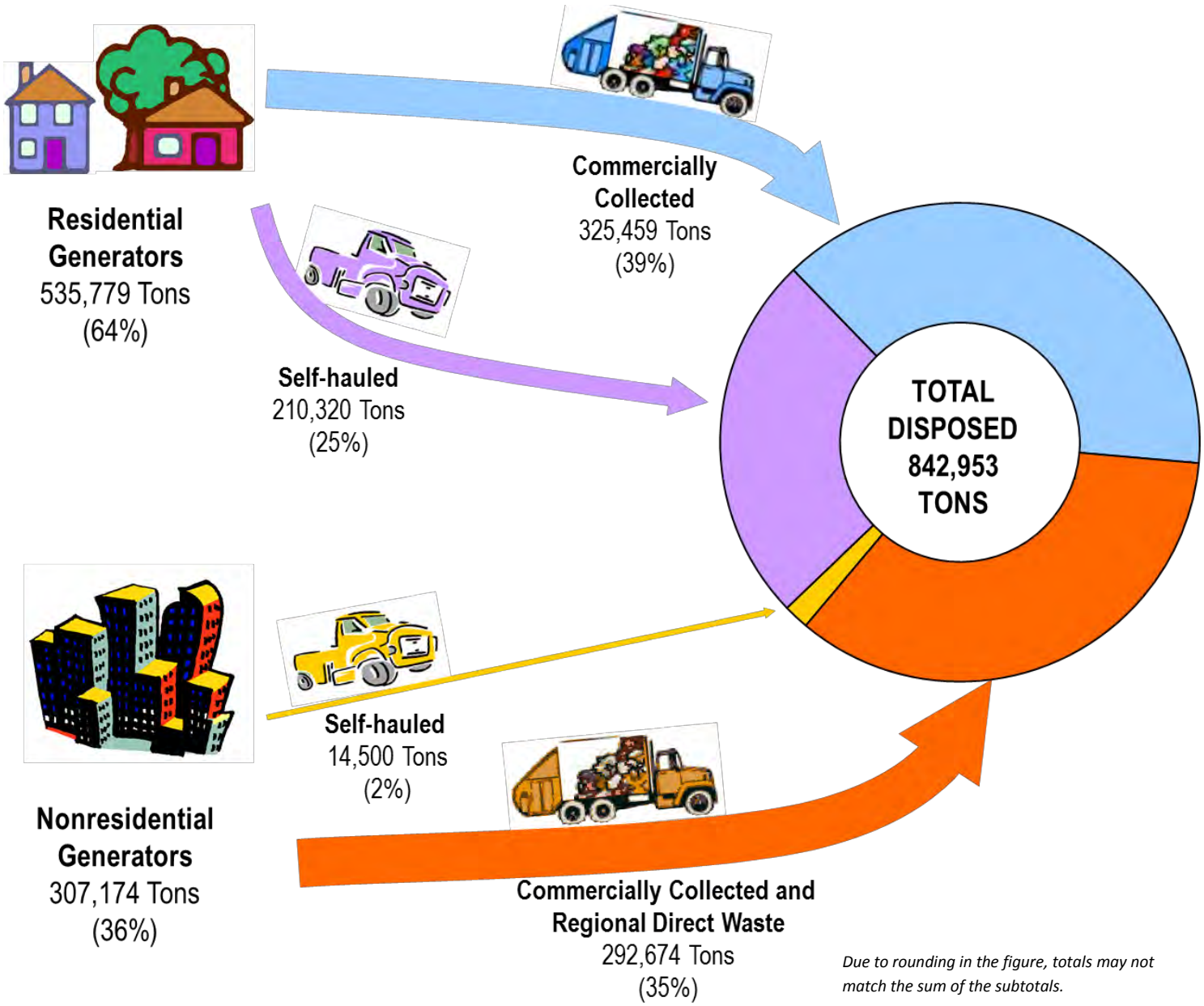
Site	Annual Transactions	Percent of Total
Algona	134,427	16%
Bow Lake	174,711	21%
Cedar Falls Drop Box	19,877	2%
Enumclaw	44,601	5%
Factoria	97,182	12%
Houghton	123,847	15%
Renton	78,393	10%
Shoreline	119,036	15%
Skykomish Drop Box	3,095	0%
Vashon	20,188	2%
Subtotal	***815,357***	***100%***
Regional Direct Waste	350	0%
Total	**815,707**	**100%**

The tonnages associated with the two primary generators of waste, residential and nonresidential, and the two methods of transporting waste to disposal facilities, commercially-collected or self-haul, are graphically presented in Figure 1.

[8] *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.* These are primarily residual tons from regional MRF facilities.

[9] Data in Table 7 were obtained from King County solid waste facility transaction data. King County disposed 21,861 tons of other and special waste at Cedar Hills (King County's landfill) in 2015. This waste was not sampled and is not included in the composition results or reported tonnages even though the quantities of some specific materials (contaminated soil, for example) are known.

Figure 1. Waste Tonnage by Substream, 2015



Due to rounding in the figure, totals may not match the sum of the subtotals.

2. Summary of Methodology

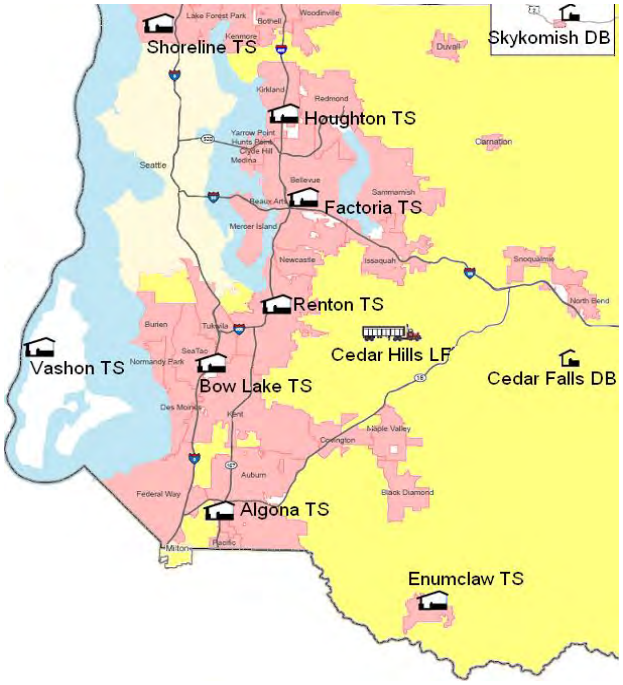
The following section summarizes the four main tasks of the study methodology: develop sampling plan, survey incoming vehicles, collect and sort samples, and analyze data and prepare reports.

Task 1. Develop Sampling Plan

Samples were allocated by source or generator (residential or nonresidential) and then by collection type (commercially collected or self-haul) and vehicle type. The vehicle types for commercially collected loads were packers or dropboxes. For self-haul loads, the vehicle types were passenger vehicles or other large vehicles. Examples of the vehicle types can be found in Appendix I. Example Field Forms.

A sampling schedule was constructed for the study period of January 2015 through December 2015, consisting of four to five 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. After the completion of the December field period, the project team scheduled a make-up day of field work in January 2016 to ensure that sample targets were achieved. Sampling took place at each of the County's eight transfer stations and customer surveying occurred at nine of the ten facilities. The Skykomish and Cedar Falls dropboxes were sampled using a different method described in Appendix A. Sample and Survey Methodology. Customer surveys were not completed at the Skykomish dropbox. The location of the eight transfer stations and two dropboxes are shown in Figure 2.

Figure 2. Map of Transfer Station Locations



Task 2. Survey Incoming Vehicles

The gatekeeper gathered information from the driver of every vehicle about the hauler type (commercially collected or self-haul), vehicle type (packer, passenger vehicle, etc.), waste type (mixed garbage, yard waste, construction and demolition), and generator (residential or nonresidential) of the load. When a surveyed vehicle met the daily sampling criteria, the gatekeeper affixed a *Sample Placard* to the vehicle's windshield and directed the driver to the sample collection area. A vehicle being surveyed is shown in Figure 3. The number of surveys completed each month at each facility is shown in Table 9. The full survey and vehicle selection methods are detailed in Appendix A. Sample and Survey Methodology.

Figure 3. Vehicle Surveyor at Renton Transfer Station

Table 9. Surveys Completed by Facility and Month, 2015

	February	March	April	May	June	July	August	September	October	November	December	Total
Algona	156	0	157	0	194	207	0	0	164	0	0	**878**
Bow Lake	166	0	0	0	282	0	539	0	41	0	128	**1,156**
Cedar Falls Drop Box	0	0	84	0	0	0	61	0	0	0	1	**146**
Enumclaw	72	164	0	0	71	0	0	119	0	0	0	**426**
Factoria	134	0	153	0	212	0	251	0	0	0	110	**860**
Houghton	15	0	0	0	227	0	185	0	182	162	125	**896**
Renton	0	0	117	0	0	0	128	0	189	0	114	**548**
Shoreline	0	0	79	0	120	0	98	0	84	51	0	**432**
Skykomish Drop Box	0	0	0	0	0	0	0	0	0	0	1	**1**
Vashon	0	0	65	0	0	0	0	86	0	0	36	**187**
Total	**543**	**164**	**655**	**0**	**1,106**	**207**	**1,262**	**205**	**660**	**213**	**515**	**5,530**

Task 3. Collect and Sort Samples

When a selected vehicle arrived at the sample collection area, the Sort Crew Manager removed the *Sample Placard,* asked the driver to dump their vehicle's load, and then directed a loader operator to scoop a 225-275 pound portion of the waste dumped from the vehicle. The loader placed the scoop on a tarpaulin for sorting. The average sample weight was 252 pounds. The field crew sorted and weighed each of the 421 samples into 97 material types such as *high-grade paper* or *clear glass containers.* See Appendix B. Material Definitions for the full material definitions and examples. The Sort Crew Manager recorded the weight for each sorted material type on the *Material Weight Tally Sheet* and reviewed the form. The number of samples planned and actually collected for each facility is shown in Table 10. Field work was planned for Houghton in February, but a piece of the transfer station's equipment broke down

shortly before the field crew's arrival at the transfer station, making sampling activities impossible. The field crew relocated to Factoria for the day, and the project team adjusted the field calendar for the remainder of the year to accommodate the schedule change.

Table 10. Planned and Actual Samples by Facility and Month, 2015

	February		April		June		August		October		December		January 2016		Total	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Algona	15	15	15	15	15	15			14	13					**59**	**58**
Bow Lake	15	15			15	15	29	29	14	15	13	16			**86**	**90**
Cedar Falls*									1			1			**1**	**1**
Enumclaw		14			16	16					16				**32**	**30**
Factoria	15	13	16	15	16	16			15			13			**62**	**57**
Houghton	15				15	15	14	15	15	15		14			**59**	**59**
Renton			15	15			15	14			14	13			**44**	**42**
Shoreline			15	11			15	14		14	16			14	**46**	**53**
Skykomish*							1					1			**1**	**1**
Vashon			15	15							15	15			**30**	**30**
Total	**60**	**57**	**76**	**71**	**77**	**77**	**74**	**72**	**59**	**57**	**74**	**73**	**0**	**14**	**420**	**421**

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

Figure 4 (on the next page) illustrates the hand-sort procedure. Examples of all field forms are found in Appendix I. Example Field Forms.

Figure 4. Sample Collection and Sorting Procedures

Step 1. Place a Sample on a Tarp

Step 2. Drag a Sample to the Queue

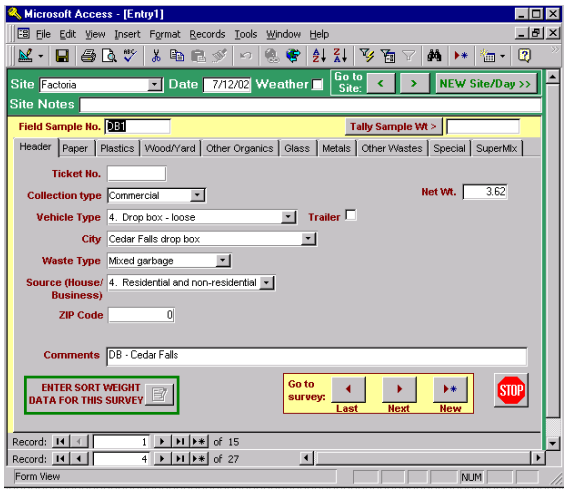
Step 3. Queue Samples for Sorting

Step 4. Sort Materials

Step 5. Weigh Sorted Materials

Task 4. Analyze Data and Prepare Reports

Figure 5. Example Database Screenshot



Each month, the sort and survey data were entered into a customized database and reviewed for data entry errors. A screenshot of the database is shown in Figure 5. 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 were based on the vehicle surveys as well as waste tonnage data provided by the King County Solid Waste Division. The composition calculations and weighting factors are described in detail in Appendix C. Waste Composition Calculation.

The number of samples collected and sorted at each waste facility is shown in Table 11. The number of surveys completed at each waste facility is shown in Table 12.

Table 11. Number of Samples Collected by Facility, 2015

Site	Samples
Algona	58
Bow Lake	90
Cedar Falls Drop Box	1
Enumclaw	30
Factoria	57
Houghton	59
Renton	42
Shoreline	53
Skykomish Drop Box	1
Vashon	30
Total	**421**

Table 12. Number of Surveys Completed by Facility, 2015

Site	Surveys
Algona	878
Bow Lake	1,156
Cedar Falls Drop Box	146
Enumclaw	426
Factoria	861
Houghton	896
Renton	548
Shoreline	432
Skykomish Drop Box	-
Vashon	187
Total	**5,530**

Changes in Methodology from Previous Studies

The 2015 waste characterization study followed the same basic methodology as the 2011 and prior studies. The main methodology change is a change in the number of material types from 98 to 97 to better align the list with materials currently accepted in diversion programs and to gather additional detail on materials of interest for future diversion programs. The new material types are noted in Appendix B. Material Definitions. The 2015 customer survey study followed the same basic methodology as the 2011 and prior studies. The 2015 study did not survey users of the Skykomish dropbox; this is the main methodological difference from 2011 and prior studies.

3. Waste Characterization Findings

Interpreting the Results

How Data Are Presented

For the overall disposed waste stream and for each substream, data are presented in three ways:

- First, an overview of waste composition by recoverability group is presented as a pie chart.
- Next is an overview of waste composition, by **Material Class**, in a pie chart.
- The third presentation is of the ten most prevalent individual *material types*, by weight in tons, shown in a table.

Material Designations

For the sake of clarity, recoverability groups such as Readily Recyclable and Limited Recyclability are capitalized. **Material Classes** such as **Paper**, **Plastic**, and **Glass** are capitalized and bolded. Material types such as *newspaper, PET bottles,* and *used oil* are italicized.

All weight data throughout the report is presented in tons unless otherwise noted. Detailed tables listing the full composition and quantity results for the 97 *material types* are included in Appendix D. Detailed Waste Composition Results.

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 exactly match the subtotals and totals shown. Similarly, the percentages, when added together, may not exactly match the subtotals or totals shown. Percentages less than 0.05% are shown as 0.0%.

It is important to recognize that the tons shown in the report were not calculated using the rounded percentages shown in the tables. Instead tons were calculated using more precise percentages. Using the rounded percentages to calculate tonnages may yield results that are different than the numbers shown in the report.

For example, the rounded percentage for *unpackaged/scrap vegetative food* in Table 14 is shown as 7.7%. If this rounded number had been used in the calculations *unpackaged/scrap vegetative food* would be 64,907 tons. However, using the more precise number (7.71745684406081%), *unpackaged/scrap vegetative food* is calculated as 65,055 tons (as shown), a difference of 148 tons.

Material Recoverability Groups

To identify additional diversion opportunities, material types were classified according to their recoverability, using three recoverability groups:

- **Readily Recyclable –** Materials for which recycling, composting, or digestion technologies are well-developed and for which many materials markets are well-developed. Infrastructure and programs may be readily available and are currently utilized.
- **Limited Recyclability –** Materials for which recycling technologies, programs, and markets exist, but are either not well developed or not currently utilized.
- **Not Recyclable –** Materials that are not readily recyclable or face other market, technology, or programmatic related barriers.

Each material type was assigned to one of the recoverability groups by Solid Waste Division staff based on the definitions listed above. Table 13 shows how material types are categorized into each group.

Table 13. Recoverability Groups and Material Types

Readily Recyclable		Not Recyclable
High Grade Paper	Other Textiles	Other Paper
Low Grade Recyclable Paper	Textiles: Clothes	Expanded Polystyrene Products
Newspaper (ONP)	Tires	Expanded Polystyrene Single-serve Food Packaging
Other Compostable Paper	A/V Equipment	Foam Rubber and Padding
Plain Corrugated Cardboard (OCC)	Cell Phones	Mixed Resin Plastic Products
Single Use Food Service Compostable Paper	Computer Peripherals	Other Plastic Packaging
Waxed Corrugated Cardboard (OCC)	CPU's	Plastic and Other Materials
Compostable Plastics	CRT Computer Monitors & Televisions	Plastic Film Products
HDPE Bottles	Laptops	Plastic Garbage Bags
Industrial Packaging Film Plastic	Other Computer Monitors & Televisions	Other Mixed Metals (items >20% non-metal)
Non-industrial Packaging Film Plastic	Other Electronics	Kitchenware/Ceramics
Other #3-#7 Packaging	Printers/Copiers/Fax Machines	Other Glass
Other Expanded Polystyrene Packaging	Small Household Appliances	Contaminated Wood
Other HDPE Containers	Tablets	Roofing and Siding Wood
Other PET Containers	Mattresses	Treated Wood
PET Bottles	Compact Fluorescent Bulbs	Animal Carcasses
Recyclable Plastic Bags	Household Batteries	Animal Feces
Aluminum Cans	Oil-based Paint	Disposable Diapers
Compressed Gas Cylinders	Other Fluorescent Bulbs/Tubes	Miscellaneous Organics
Mixed Metals (items <20% non-metal)	Solvents and Thinners	Rubber Products
Other Aluminum	Used Oil	Ash
Other Ferrous	Vehicle Batteries	C&D Wastes
Other Non-Ferrous	**Limited Recyclability**	Miscellaneous Inorganics
Tinned Food Cans	Carpet Padding	Nondistinct Fines
Brown Glass Containers	Single Resin Plastic Products	Cleaners and Corrosives
Clear Glass Containers	Other Wood	Medical Waste
Green Glass Containers	Asphalt Shingles	Other Hazardous Waste
Packaged Non-vegetative Food	Carpet	Pesticides and Herbicides
Packaged Vegetative Food	Furniture	
Unpackaged/Scrap Non-vegetative Food	Gypsum Wallboard	
Unpackaged/Scrap Vegetative Food	Adhesives and Glue	
Dimensional Lumber	Antifreeze/Brake Fluid	
Large Prunings	Gasoline and Fuel Oil	
Stumps	Latex Paint	
Yard Waste	Pharmaceuticals and Vitamins	

Composition and Recoverability of Waste

This section describes the composition and recoverability of King County's overall waste stream and of its many substreams. More detailed composition and quantity data for each substream are included in Appendix D. Detailed Waste Composition Results.

Overall Disposed Waste

The overall waste composition is the weighted average of all 421 samples.

Key Findings

As shown in Figure 6, approximately 62% (520,684 tons) of the County's overall waste is Readily Recyclable, shown in blue, and approximately 30% (254,565 tons) of the County's overall waste is Not Recyclable, shown in brown. The Readily Recyclable fraction includes nearly 257,000 tons of materials acceptable in most curbside compost programs.

The waste composition data are presented by material class in Figure 7. **Food** (20.6%) and **Paper** (16.8%) are the two most prevalent material classes.

Figure 6. Waste Recoverability, Overall, 2015

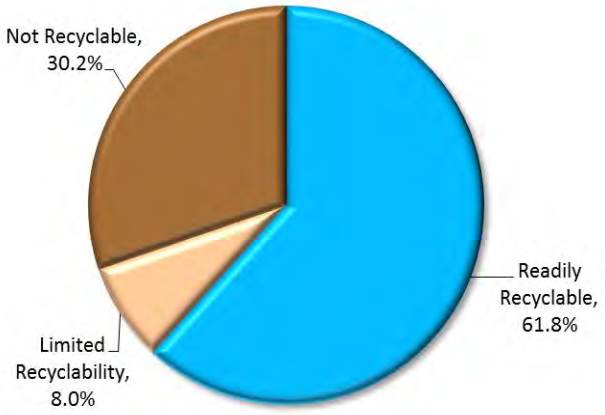
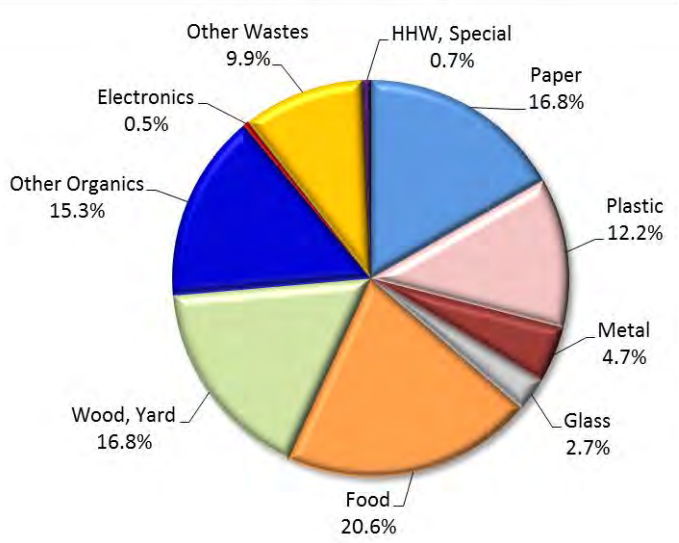


Figure 7. Waste Composition, Overall, 2015



The ten most prevalent disposed materials can be found in Table 14. As shown, *unpackaged/scrap vegetative food*, *dimensional lumber,* and *disposable diapers* are the three most prevalent materials; together they represent more than 19% of MSW disposed in the County.

Table 14. Ten Most Prevalent Disposed Materials, Overall, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	7.7%	7.7%	65,055
Dimensional Lumber	6.0%	13.7%	50,389
Disposable Diapers	5.6%	19.3%	47,083
Packaged Vegetative Food	5.1%	24.4%	42,906
Animal Feces	4.9%	29.3%	41,555
Unpackaged/Scrap Non-vegetative Food	4.4%	33.7%	37,178
Yard Waste	4.1%	37.8%	34,801
Other Compostable Paper	4.0%	41.8%	33,530
Low Grade Recyclable Paper	3.7%	45.5%	31,132
Packaged Non-vegetative Food	3.3%	48.8%	28,098
Subtotal	***48.8%***		***411,726***
All other materials	51.2%		431,227
Total	**100.0%**		**842,953**

Residential Substreams

The residential waste composition is the weighted average of 240 samples from the commercially collected residential and self-haul residential substreams.

Key Findings

Figure 8 summarizes recovery potential for the County's combined residential substreams. Key findings include:

- More than half (304,235 tons) of the County's residential waste is Readily Recyclable, shown in blue, including 75,806 tons of curbside recyclables and 143,452 tons of compostable materials.
- Around 10% (51,548 tons) of the County's residential waste is Limited Recyclability.

The waste composition data are presented by material class in Figure 9. **Wood/Yard** (20.1%) and **Food** (18.2%) are the two most prevalent material classes. The **Wood/Yard** materials are primarily found in self-haul residential loads (87,838 tons in self-haul residential vs 19,592 tons in the commercially collected residential).

Figure 8. **Waste Recoverability, Residential Substreams, 2015**

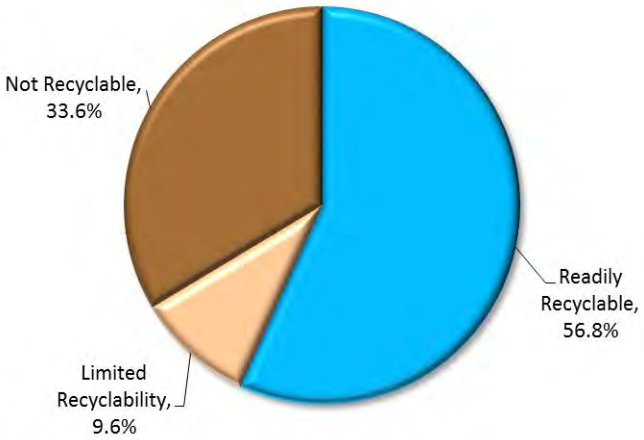
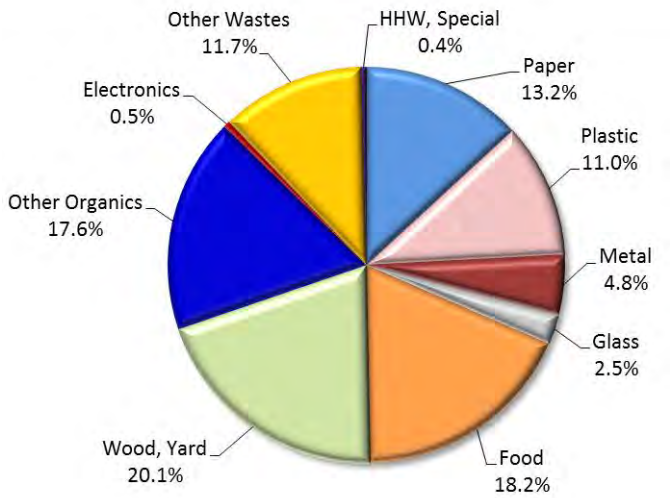


Figure 9. **Waste Composition, Residential Substreams, 2015**



As shown in Table 15, *unpackaged/scrap vegetative food*, *disposable diapers,* and *dimensional lumber* are the three most prevalent material types. The ten most prevalent materials combined account for slightly less than half of the County's total residential waste.

Table 15. Ten Most Prevalent Disposed Materials, Residential Substreams, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	7.0%	7.0%	37,524
Dimensional Lumber	6.9%	13.9%	37,184
Disposable Diapers	6.8%	20.7%	36,200
Animal Feces	6.0%	26.7%	31,883
Packaged Vegetative Food	4.9%	31.5%	26,026
Yard Waste	4.3%	35.8%	23,176
Contaminated Wood	3.7%	39.6%	20,083
Unpackaged/Scrap Non-vegetative Food	3.5%	43.1%	19,016
Low Grade Recyclable Paper	3.3%	46.4%	17,483
C&D Wastes	2.9%	49.3%	15,693
Subtotal	***49.3%***		***264,266***
All other materials	50.7%		271,514
Total	**100.0%**		**535,779**

Nonresidential Substreams

The nonresidential waste composition is the weighted average of 181 samples from the commercially collected nonresidential and self-haul nonresidential substreams.

Key Findings

The key recoverability and material class findings for the County's nonresidential substream are shown in Figure 10 and Figure 11. Over three quarters of the nonresidential waste is Readily Recyclable (70.5%, 216,450 tons) or Limited Recyclability (5.3%, 16,156 tons). **Food** (24.7%) and **Paper** (23.1%) are the two most prevalent material classes in Figure 11.

Figure 10. Waste Recoverability, Nonresidential Substreams, 2015

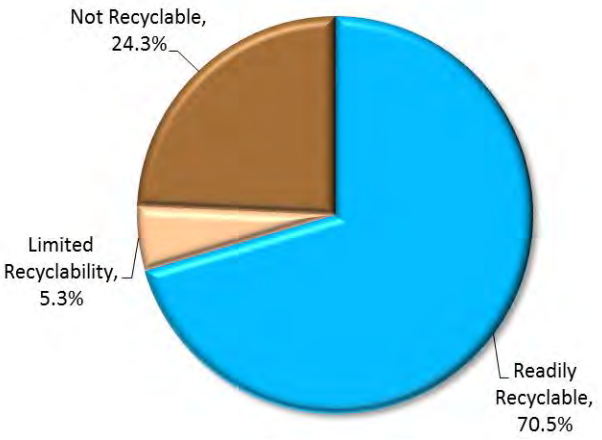
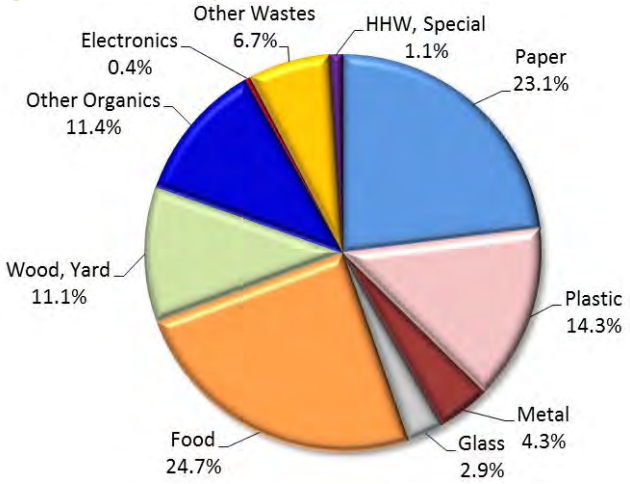


Figure 11. Waste Composition, Nonresidential Substreams, 2015



Unpackaged/scrap vegetative food, *other compostable paper,* and *unpackaged/scrap non-vegetative food* are the three most prevalent materials; together they sum to more than 20% of the County's total nonresidential waste. The ten most prevalent disposed materials can be found in Table 16.

Table 16. Ten Most Prevalent Disposed Materials, Nonresidential Substreams, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	9.0%	9.0%	27,531
Other Compostable Paper	6.1%	15.0%	18,620
Unpackaged/Scrap Non-vegetative Food	5.9%	20.9%	18,162
Packaged Vegetative Food	5.5%	26.4%	16,880
Plain Corrugated Cardboard (OCC)	4.5%	31.0%	13,897
Low Grade Recyclable Paper	4.4%	35.4%	13,649
Packaged Non-vegetative Food	4.3%	39.7%	13,309
Dimensional Lumber	4.3%	44.0%	13,205
Yard Waste	3.8%	47.8%	11,625
Disposable Diapers	3.5%	51.4%	10,883
Subtotal	***51.4%***		***157,761***
All other materials	48.6%		149,413
Total	**100.0%**		**307,174**

Commercially Collected Substreams

The commercial waste composition is the weighted average of 261 samples from the commercially collected residential and the commercially collected nonresidential substreams.

Key Findings

Approximately 67% (414,739 tons) of the County's commercially collected material, shown in blue in Figure 12, is Readily Recyclable. This is primarily materials accepted in a typical curbside compost program (229,827 tons) and 111,966 tons of curbside recyclable materials. **Food** (26.9%) and **Paper** (20.1%) are the two most prevalent material classes (Figure 13).

Figure 12. Waste Recoverability, Commercially Collected Substreams, 2015

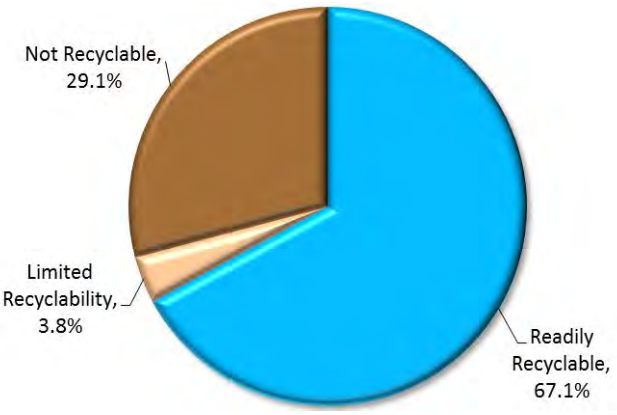
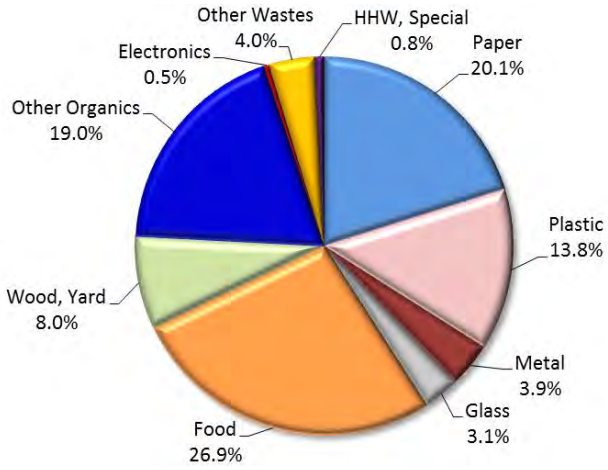


Figure 13. Waste Composition, Commercially Collected Substreams, 2015



The ten most prevalent materials are shown in Table 17; *unpackaged/scrap vegetative food*, *disposable diapers,* and *packaged vegetative food* are the three most prevalent materials. Together they represent approximately 24% of the County's commercially collected waste.

Table 17. Ten Most Prevalent Disposed Materials, Commercially Collected Substreams, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	10.1%	10.1%	62,558
Disposable Diapers	7.3%	17.5%	45,365
Packaged Vegetative Food	6.6%	24.1%	40,787
Animal Feces	6.0%	30.1%	37,255
Unpackaged/Scrap Non-vegetative Food	5.8%	35.9%	36,048
Other Compostable Paper	5.1%	41.0%	31,436
Packaged Non-vegetative Food	4.4%	45.4%	27,092
Low Grade Recyclable Paper	4.2%	49.6%	26,256
Plain Corrugated Cardboard (OCC)	3.5%	53.1%	21,350
Yard Waste	3.2%	56.3%	19,641
Subtotal	***56.3%***		***347,788***
All other materials	43.7%		270,345
Total	**100.0%**		**618,133**

Commercially Collected Residential Substream

The composition data in this section are based on 107 samples from the commercially collected residential substream.

Key Findings

Nearly two-thirds (205,139 tons) of the County's commercially collected residential waste is Readily Recyclable, shown in blue in Figure 14. The Readily Recyclable fraction includes 117,199 tons of compostable materials and 54,563 tons of curbside recyclables. **Food** (27.9% of the disposed waste) and **Other Organics** (25.5%) are the two most prevalent material classes as shown in Figure 15.

Figure 14. Waste Recoverability, Commercially Collected Residential Substream, 2015

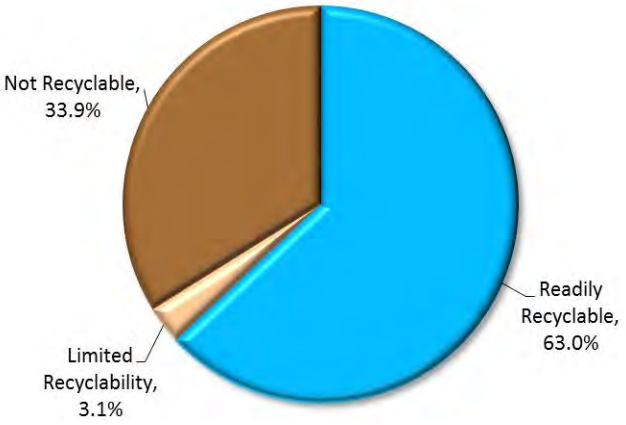
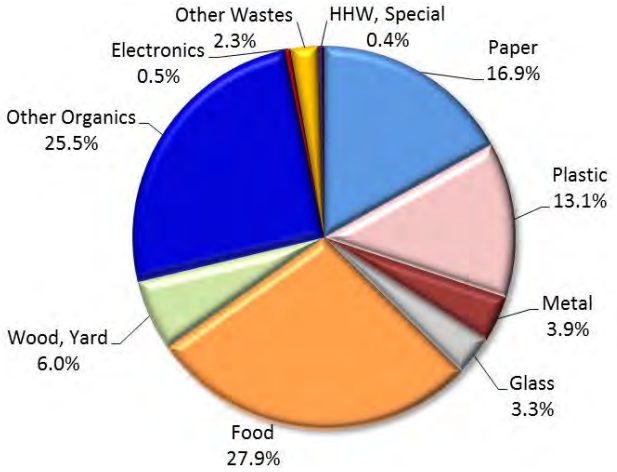


Figure 15. Waste Composition, Commercially Collected Residential Substream, 2015



The three most prevalent materials (*unpackaged/scrap vegetative food*, *disposable diapers,* and *animal feces*) combined account for nearly 30% of the County's commercially collected residential waste. See Table 18 for a summary of the most prevalent materials in this substream.

Table 18. Ten Most Prevalent Disposed Materials, Commercially Collected Residential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	10.8%	10.8%	35,170
Disposable Diapers	10.6%	21.4%	34,494
Animal Feces	8.5%	29.9%	27,582
Packaged Vegetative Food	7.4%	37.2%	23,960
Unpackaged/Scrap Non-vegetative Food	5.5%	42.8%	17,975
Packaged Non-vegetative Food	4.2%	47.0%	13,820
Other Compostable Paper	4.0%	51.0%	12,899
Low Grade Recyclable Paper	3.9%	54.9%	12,691
Textiles: Clothes	2.9%	57.7%	9,296
Non-industrial Packaging Film Plastic	2.6%	60.4%	8,620
Subtotal	***60.4%***		***196,507***
All other materials	39.6%		128,952
Total	**100.0%**		**325,459**

Commercially Collected Nonresidential Substream

The composition data in this section are based on 154 commercially collected nonresidential samples.

Key Findings

Figure 16 shows the following key findings about the recovery potential for the commercially collected nonresidential substream:

- A little more than 70% (209,600 tons) of the County's commercially collected nonresidential waste is Readily Recyclable, shown in blue.
- Approximately 39% (112,628 tons) of the County's commercially collected nonresidential waste is material that can be included a curbside compost collection bin.

The waste composition data are presented by material class in Figure 17. **Food** (25.8%) and **Paper** (23.7%) are the two most prevalent material classes.

Figure 16. Waste Recoverability, Commercially Collected Nonresidential Substream, 2015

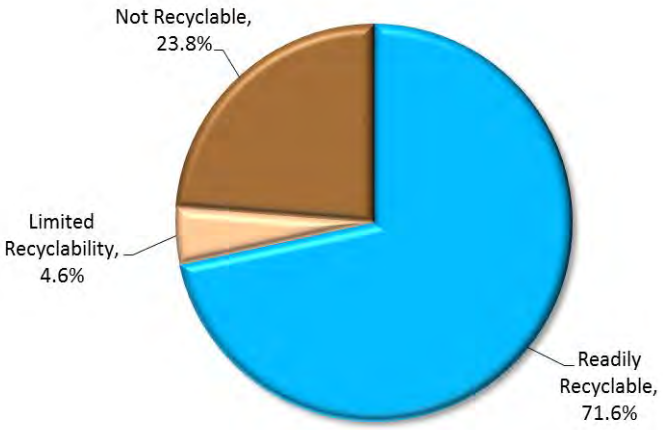
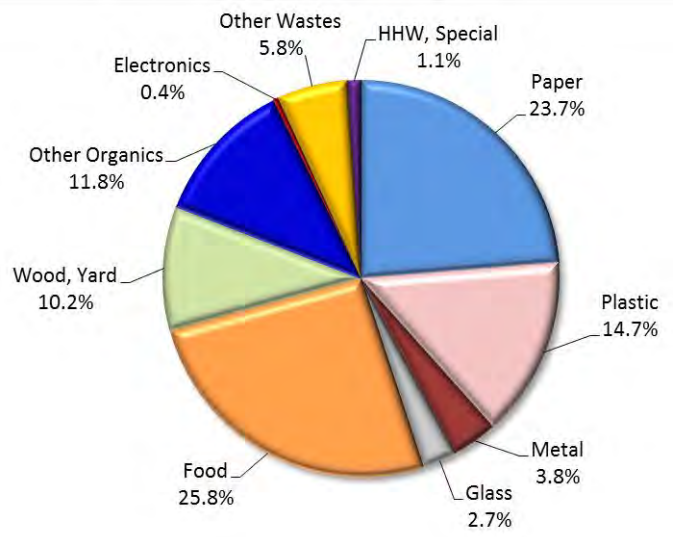


Figure 17. Waste Composition, Commercially Collected Nonresidential Substream, 2015



The ten most prevalent disposed materials can be found in Table 19. *Unpackaged/scrap vegetative food*, *other compostable paper,* and *unpackaged/scrap non-vegetative food* are the three most prevalent materials; together they represent more than 21% of the County's commercially collected nonresidential waste.

Table 19. Ten Most Prevalent Disposed Materials, Commercially Collected Nonresidential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	9.4%	9.4%	27,388
Other Compostable Paper	6.3%	15.7%	18,537
Unpackaged/Scrap Non-vegetative Food	6.2%	21.9%	18,073
Packaged Vegetative Food	5.7%	27.6%	16,828
Low Grade Recyclable Paper	4.6%	32.3%	13,566
Packaged Non-vegetative Food	4.5%	36.8%	13,272
Plain Corrugated Cardboard (OCC)	4.5%	41.3%	13,265
Yard Waste	4.0%	45.3%	11,588
Dimensional Lumber	3.9%	49.1%	11,275
Disposable Diapers	3.7%	52.8%	10,871
Subtotal	***52.8%***		***154,663***
All other materials	47.2%		138,011
Total	**100.0%**		**292,674**

Self-haul Substreams

The overall self-haul waste composition is the weighted average of 160 samples from the self-haul residential and self-haul nonresidential substreams.

Key Findings

Figure 18 summarizes recovery potential for the County's self-haul substreams. Readily Recyclable is the largest recoverability group (47.1%, 105,945 tons). The Limited Recyclability group is relatively large (19.6% here vs. 3.8% of the commercially collected substream). The Limited Recyclability group includes many construction and hazardous materials such as *carpet* and *antifreeze/brake fluid*. As shown in Figure 19, **Wood, Yard** (41.0%) and **Other Wastes** (26.3%) are the two most prevalent material classes.

Figure 18. Waste Recoverability, Self-haul Substreams, 2015

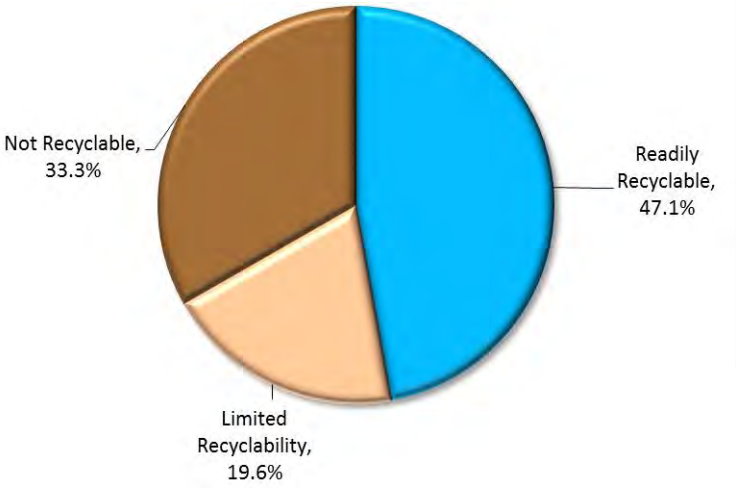
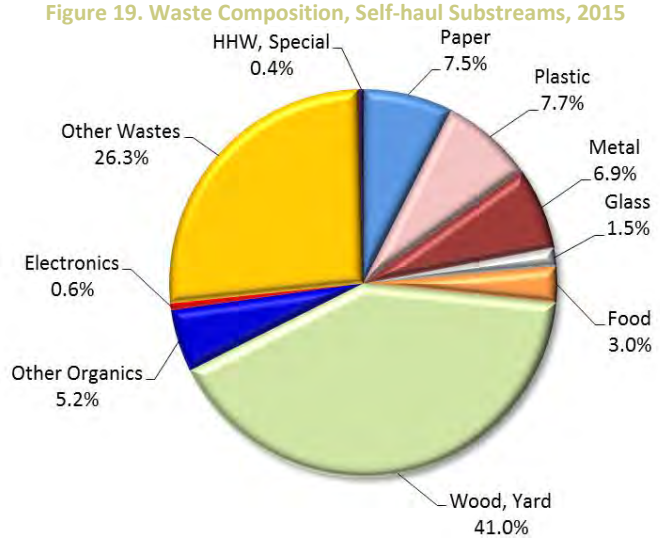


Figure 19. Waste Composition, Self-haul Substreams, 2015



As shown in Table 20, *dimensional lumber, contaminated wood,* and *yard waste* are the three most prevalent materials; together they represent approximately 31% of the County's total self-haul waste.

Table 20. Ten Most Prevalent Disposed Materials, Self-haul Substreams, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Dimensional Lumber	15.8%	15.8%	35,418
Contaminated Wood	8.4%	24.2%	18,965
Yard Waste	6.7%	30.9%	15,160
C&D Wastes	6.3%	37.2%	14,189
Treated Wood	5.4%	42.6%	12,121
Furniture	5.4%	48.0%	12,050
Gypsum Wallboard	4.9%	52.9%	10,970
Carpet	3.3%	56.2%	7,403
Mattresses	2.9%	59.1%	6,606
Other Wood	2.2%	61.3%	4,998
Subtotal	***61.3%***		***137,879***
All other materials	38.7%		86,941
Total	**100.0%**		**224,820**

Self-haul Residential Substream

All 133 self-haul residential samples are aggregated to estimate the composition for the substream.

Key Findings

Readily Recyclable is the most prevalent recoverability group, accounting for more than 47% (99,095 tons) of the County's self-haul residential waste (shown in blue in Figure 20). This substream has a relatively high proportion of Limited Recyclability materials (19.7%, 41,467 tons). The waste composition data are presented by material class in Figure 21. **Wood, Yard** (41.8%) is the most prevalent material class; this is largest portion of any one material class in any substream.

Figure 20. Waste Recoverability, Self-haul Residential Substream, 2015

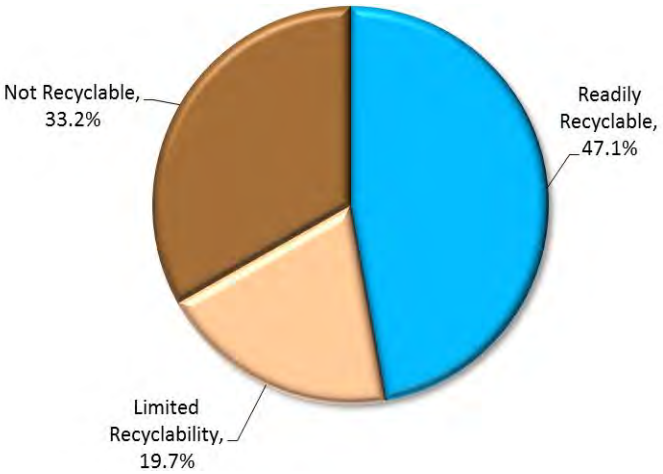
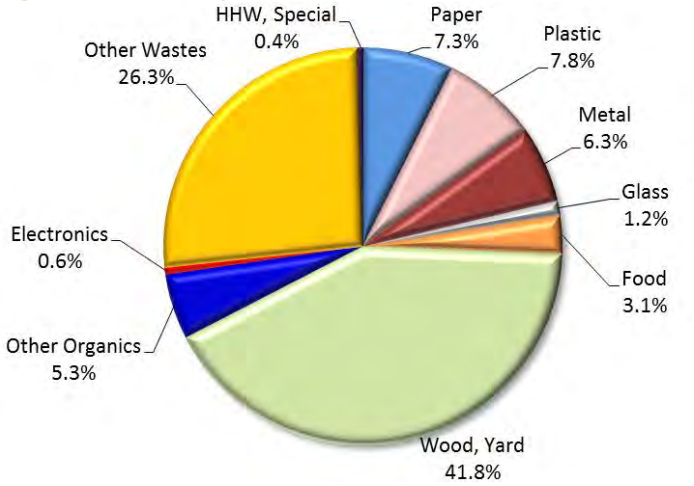


Figure 21. Waste Composition, Self-haul Residential Substream, 2015



The three most prevalent self-haul residential materials (*dimensional lumber, contaminated wood,* and *yard waste*) combined represent about 32% of the substream's disposal. The ten most prevalent materials are summarized in Table 21.

Table 21. Ten Most Prevalent Disposed Materials, Self-haul Residential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Dimensional Lumber	15.9%	15.9%	33,488
Contaminated Wood	8.4%	24.3%	17,645
Yard Waste	7.2%	31.5%	15,123
C&D Wastes	6.2%	37.7%	13,061
Furniture	5.5%	43.2%	11,592
Treated Wood	5.5%	48.7%	11,563
Gypsum Wallboard	4.8%	53.6%	10,198
Carpet	3.3%	56.9%	6,930
Mattresses	3.0%	59.9%	6,338
Other Wood	2.3%	62.2%	4,883
Subtotal	***62.2%***		***130,822***
All other materials	37.8%		79,498
Total	**100.0%**		**210,320**

Self-haul Nonresidential Substream

The self-haul nonresidential composition is based on 27 self-haul nonresidential samples.

Key Findings

Approximately 47% of the self-haul nonresidential substream is Readily Recyclable, shown as blue in Figure 22. Approximately 18% (2,572 tons) of this substream's waste is curbside recyclable material. About 4% of the substream is compostable; this substream has the lowest proportion of compostable materials of the substreams included in this study. The waste composition data are presented by material class in Figure 23. **Wood, Yard** (29.4%) and **Other Wastes** (25.5%) are the two most prevalent material classes.

Figure 22. Waste Recoverability, Self-haul Nonresidential

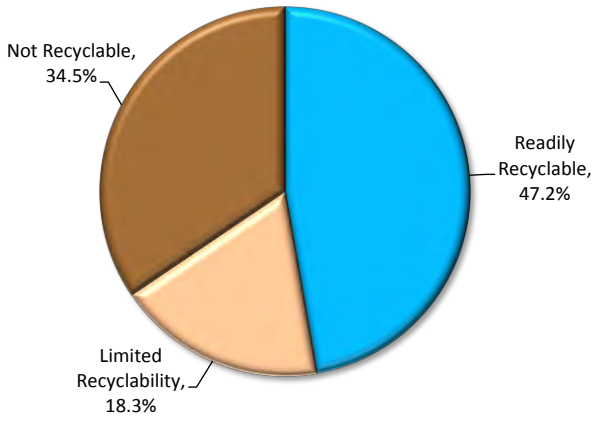
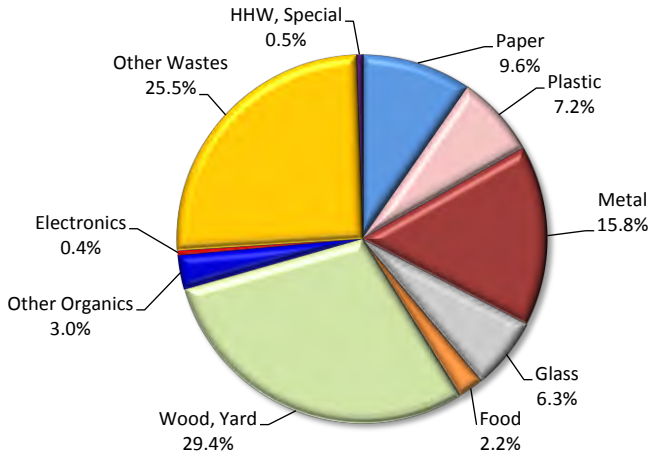


Figure 23. Waste Composition, Self-haul Nonresidential Substream,



As shown in Table 22, *dimensional lumber, contaminated wood, and C&D wastes* are the three most prevalent materials; together they account for more than 30% of this substream's waste.

Table 22. Ten Most Prevalent Disposed Materials, Self-haul Nonresidential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Dimensional Lumber	13.3%	13.3%	1,930
Contaminated Wood	9.1%	22.4%	1,319
C&D Wastes	7.8%	30.2%	1,128
Other Glass	6.1%	36.3%	888
Other Ferrous	6.0%	42.3%	866
Gypsum Wallboard	5.3%	47.6%	772
Other Non-Ferrous	4.8%	52.4%	699
Mixed Metals (items <20% non-metal)	4.5%	56.9%	654
Plain Corrugated Cardboard (OCC)	4.4%	61.3%	631
Asphalt Shingles	3.9%	65.2%	565
Subtotal	***65.2%***		***9,454***
All other materials	34.8%		5,046
Total	**100.0%**		**14,500**

Waste Characterization Changes Over Time

Comparing waste composition data collected during previous studies with the current study allows for a useful examination of trends and changes in the waste stream over time. This section presents both statistical comparisons at the individual material level and comparisons at macro-level.

Statistical Comparisons

This section presents findings from statistical comparisons between the 2015 waste composition data and data from the previous study period in 2011. The analysis examines statistical differences, using *t*-tests, between the 2015 and the 2011 studies. The analysis is used to determine if changes in the composition of King County's disposed waste stream are statistically significant. This report does not attempt an in-depth examination of potential causes of the changes in waste composition over time.

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

- Newspaper
- Cardboard and Kraft paper
- Other curbside paper
- Curbside recyclable containers
- Compostable organics (including food)
- Construction and demolition wastes
- Wood waste
- 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 multifamily residential
- Commercially collected nonresidential
- Self-haul (including both residential and nonresidential)

The differences in material groupings between studies can be divided 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 possibly noteworthy change.

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. For example,

increases over time in materials recycled may alter the percentages for other materials remaining in the waste stream.

The test group Other Curbside Paper, which is made up of the recyclable paper types *low grade paper* and *high grade paper*, showed a statistically significant decrease in the overall disposed waste stream and two of the three commercially collected substreams. Other Curbside Paper also showed a strong downward trend in the commercially collected multifamily substream. This downward trend in all three commercially collected substreams may be due to the long term investments the cities and the County have made in diverting this valuable resource from the waste stream. Organics also showed a statistically significant decrease in the commercially collected single-family waste stream. This may also be due to the long term investments the cities and the County have made in diverting this valuable resource from the waste stream.

The last statistically significant observations were increases in Wood Waste in the self-haul and overall waste streams. The increase in Wood Waste from self-haul customers is the underlying cause for the statistically significant increase in the Wood Waste in the overall waste stream. The source of this change may be impossible to determine, however, possible sources for this would may include:

- Homeowners completing home remodel projects, increases in which have been driven by the strengthening economy.
- Small contractors trying to avoid the County's C&D debris disposal ban.

A strong upward trend in the commercially collected nonresidential Newspaper is unusual given the general decrease in consumption of printed newspapers. The circumstances driving this change are unknown.

Other strong trends are apparent in many of the groups. Comparisons identified as "statistically significant" or "strong trends" in the tested substreams are summarized in Table 23.

Table 23. Waste Composition Changes and Trends, 2011 vs. 2015

	Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Overall								
Overall	Other Curbside Paper	6.4%	4.3%	-2.2% ⬇	4.2336	0.0000 *	**Yes**	Statistically Significant
Overall	Curbside Containers	8.5%	6.5%	-1.9% ⬇	2.3591	0.0185	No	Strong Trend
Overall	Wood Waste	10.8%	15.3%	4.5% ⬆	2.7519	0.0061 *	**Yes**	Statistically Significant
Commercially Collected								
Single Family	Other Curbside Paper	6.8%	4.3%	-2.5% ⬇	3.7772	0.0002 *	**Yes**	Statistically Significant
Single Family	Organics	43.8%	36.5%	-7.3% ⬇	3.0118	0.0031 *	**Yes**	Statistically Significant
Multifmaily	Other Curbside Paper	8.2%	5.4%	-2.9% ⬇	2.3680	0.0205	No	Strong Trend
Nonresidential	Newspaper	1.1%	1.6%	0.6% ⬆	2.4792	0.0137	No	Strong Trend
Nonresidential	Other Curbside Paper	9.7%	6.0%	-3.8% ⬇	3.9294	0.0001 *	**Yes**	Statistically Significant
Nonresidential	Construction & Demolition	5.5%	3.2%	-2.2% ⬇	1.8962	0.0588	No	Strong Trend
Self-haul								
Self-haul	Wood Waste	21.7%	32.7%	11.0% ⬆	3.0685	0.0023 *	**Yes**	Statistically Significant

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

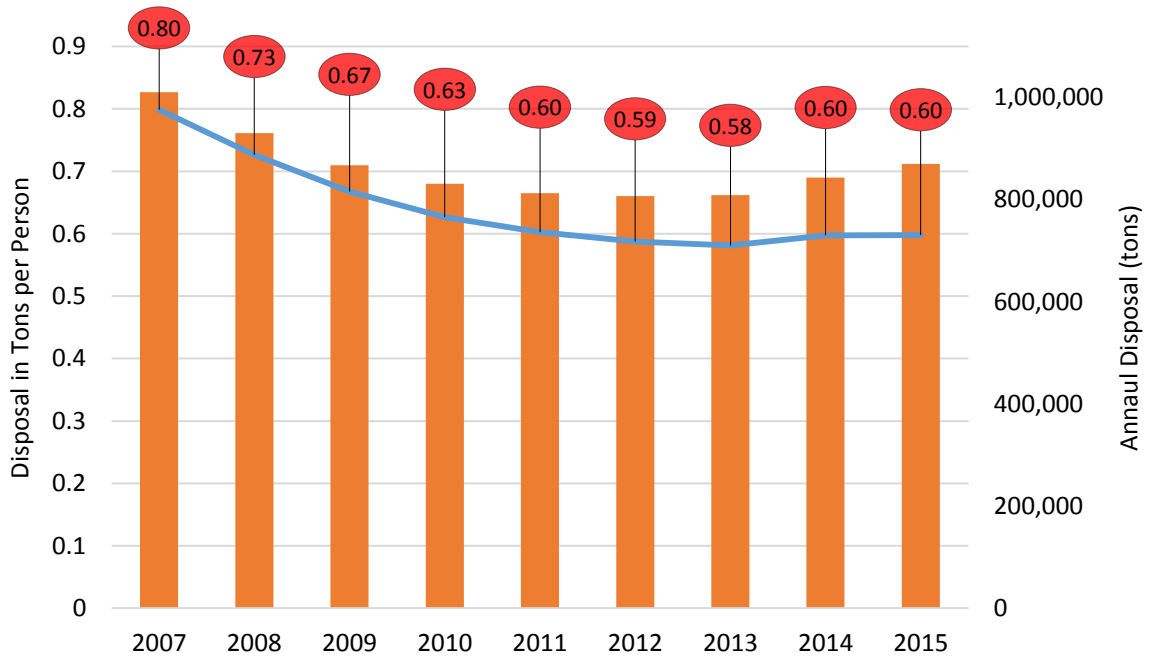
More detail regarding the material groupings and the statistical analyses can be found in Appendix F. Waste Composition Comparisons to Previous Studies. Detailed *t*-test results for each substream can be found in the same appendix beginning with Table 72.

Other Waste Data Comparisons

King County has historical waste characterization data reaching back many years. This section presents some macro-level comparisons of changes in the overall waste stream over time.

Absolute increases or decreases in tonnage over time do not tell the entire story when analyzing waste trends. A decrease in tonnage does not necessarily mean that people are recycling or composting more. As observed during the economic downturn of 2008, waste tons decrease when people spend less money. In the years since 2008 as the economic indicators have pointed upward, so has the disposed tonnage. Despite increasing availability of recycling infrastructure and programs, simple population increases will also drive increased disposed tonnage, making it appear that these programs may not be achieving their goals. Therefore, normalizing the disposal to a tons per capita number can help bring clarity to changes in waste quantities over time. Figure 24 shows that even as total disposed tonnage has increased after its 2012 nadir, the per capita disposal has remained reasonably steady at approximately 0.60 tons per person per year in King County, excluding Seattle. This is down noticeably (25%) from 2007, when the per capita disposal rate was 0.80 tons per person per year. This seems to indicate that even though the County's population and economy may be growing, which is causing an overall increase in tonnage, each individual is disposing less than they have been historically.

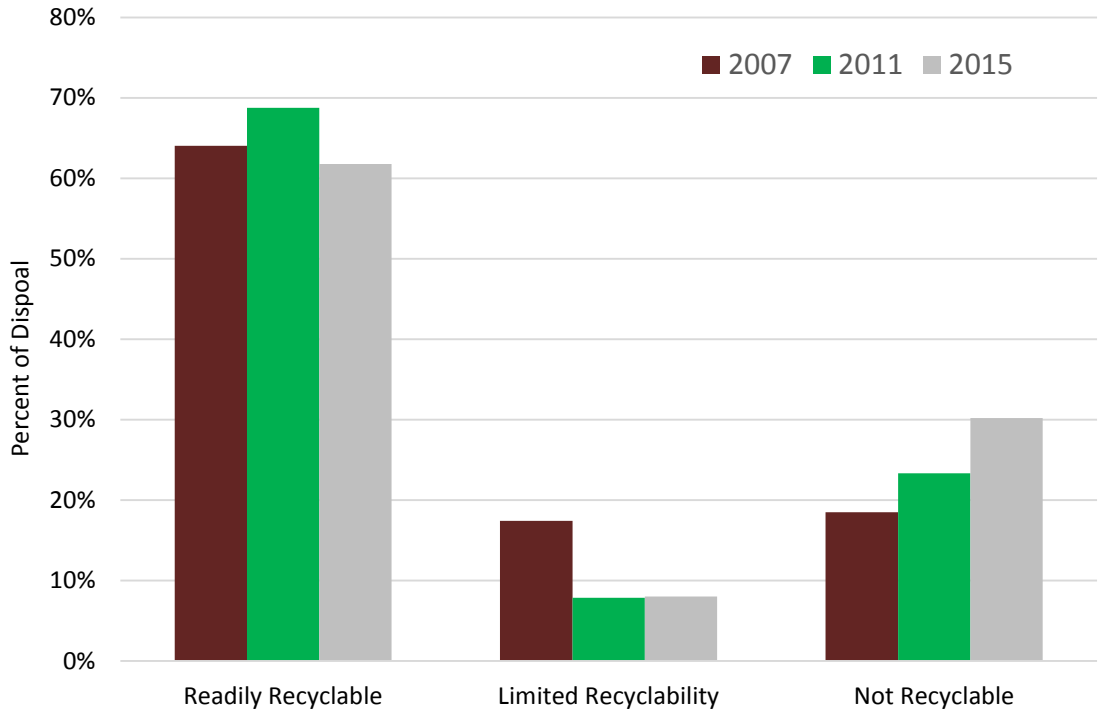
Figure 24. Per Capita Disposal from 2007 through 2015[10]



[10] Tonnage data was provided by the Solid Waste Division, and population data for King County, excluding Seattle, is based on US Census estimates.

As shown in Figure 25, the proportion of Readily Recyclable materials being disposed increased from 2007 to 2011 then decreased from 2011 to 2015. Overall, Readily Recyclable material has decreased from 64% to 62% since 2007. Part of the increase between 2007 and 2011 may be attributable to changes in the material list. For example, in 2007 the material type *plastic film and bags* was considered Limited Recyclability. In 2011, that material type was subdivided into several types of plastic film such as *recyclable plastic bags* and *plastic garbage bags*. The former is considered Readily Recyclable, and the latter is considered Not Recyclable. So, between the two studies, tons that were once considered Limited Recyclability have been split between the Readily Recyclable and the Not Recyclable recoverability groups.

Figure 25. Disposed Waste Recoverability from 2007 through 2015

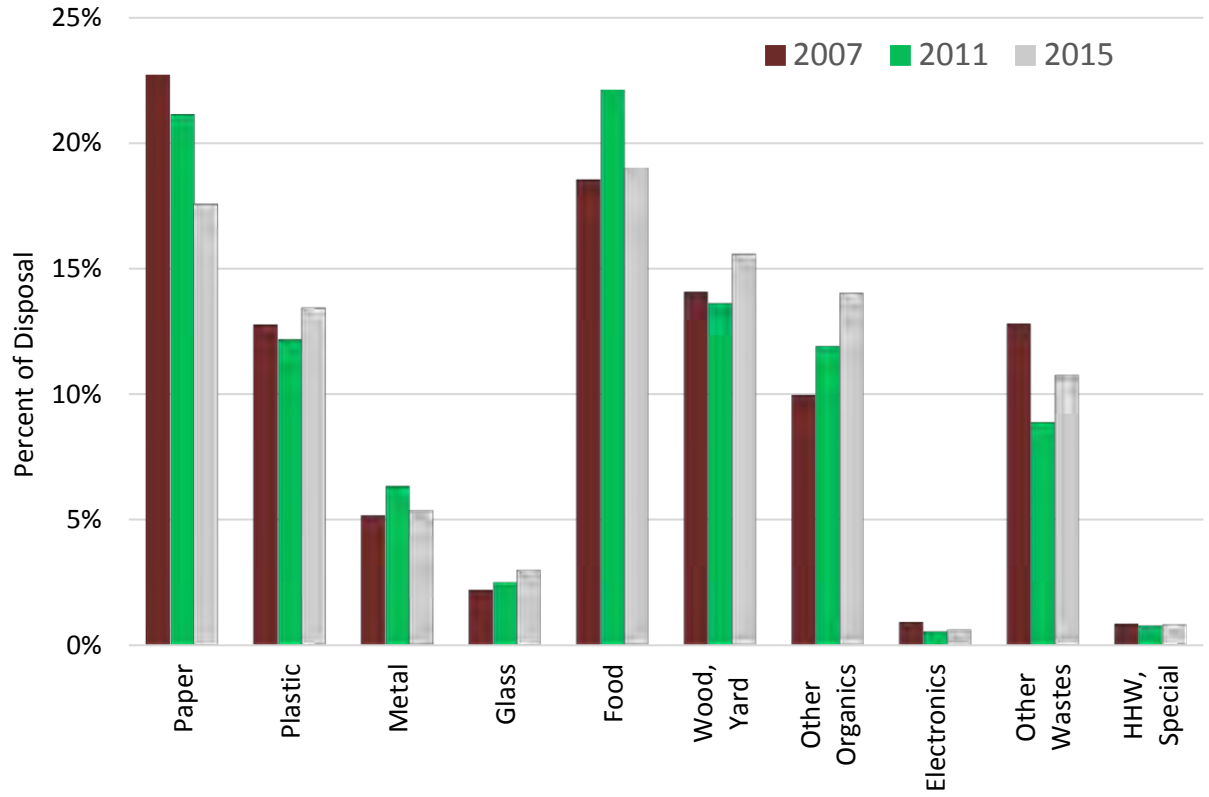


The composition by material class from 2007 through 2015 is summarized in Figure 26. Several trends are apparent when reviewing the figure:

- The **Paper** material class proportion has steadily decreased since 2007.
- The **Other Organics** and **Glass** material classes have steadily increased since 2007.
- The **HHW, Special** material class has remained nearly constant since 2007.

The proportion of the other material classes have been volatile, not showing any clear trends when compared to previous iterations of the study.

Figure 26. Material Classes from 2007 through 2015



4. Transfer Station Customer Survey Findings

In 2015, King County conducted more than 815,700 transactions at the eight County transfer stations and two dropbox facilities. During that time, the project team conducted 5,530 interviews with customers delivering waste for disposal that was generated inside King County, excluding Seattle, to determine who uses each facility and why. Each survey day, a surveyor interviewed the driver of every vehicle entering the facility.[11] This section presents the findings of these customer surveys. Appendix A. Sample and Survey Methodology provides additional details on the study methodology.

The figures presented describe the portion of waste transactions (customers, loads, visits, or users) surveyed at waste facilities – not the weight or tonnages of the waste they delivered.

Hauler Type

Self-haul residential customers represent the majority (69%) of customers surveyed. Commercially collected nonresidential customers (11%) were the next most prevalent customer type. Table 24 summarizes these results. More detailed results by facility can be found in Appendix E. Detailed Customer Survey Results.

Table 24. Reported Generator Type by Hauler Type, 2015

n=5530	Commercially Collected	Self-haul	Total
Residential	8%	69%	**77%**
Nonresidential	11%	11%	**22%**
Mixed	0%	0%	**0%**
Subtotal	***19%***	***80%***	***99%***
No Response	0%	1%	**1%**
Total	**19%**	**81%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

[11] If traffic became too congested, the surveyor skipped a few vehicles to avoid traffic flow problems at the facility.

Vehicle Type

As shown in Table 25, commercially collected loads are approximately evenly split between dropbox vehicles (44%) and packer vehicles (56%). No commercially collected loads are delivered in passenger vehicles or large other vehicles. The majority (87%) of self-haul loads are delivered in passenger vehicles. Examples of the various vehicle types may be found in Appendix I. Example Field Forms. More detailed results by facility can be found in Appendix E. Detailed Customer Survey Results.

Table 25. Observed Vehicle Types by Hauler Type, 2015

n=5530	Commercially Collected	Self-haul	Overall
Dropbox	44%	0%	**9%**
Packer	56%	0%	**11%**
Passenger Vehicle	0%	87%	**70%**
Large Other	0%	12%	**9%**
Subtotal	***99%***	***99%***	***99%***
No Response	1%	1%	**1%**
Total	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Waste Type

Table 26 summarizes the reported waste type disposed by transfer station customers. Nearly all (98%) commercially collected customers report disposing of mixed garbage as did most (73%) self-haul customers. Overall, more than three-quarters of customers (78%) report disposing of mixed garbage. Construction and demolition debris is the next most prevalent waste type overall: 19% of customers report disposing of C&D debris, and the remaining 3% of customers report disposing of yard waste. More detailed results by facility can be found in Appendix E. Detailed Customer Survey Results.

Table 26. Reported Waste Type by Hauler Type, 2015

n=5530	Commercially Collected	Self-haul	Overall
Mixed Garbage	98%	73%	**78%**
Construction & Demolition	1%	23%	**19%**
Yard Waste	0%	3%	**3%**
Special Waste	0%	0%	**0%**
Subtotal	***99%***	***100%***	***100%***
No Response	1%	0%	**0%**
Total	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Generator Type

Table 27 and Table 28 detail the generator types by subtype and by facility for the commercially collected and self-haul substreams. More detailed results can be found in Appendix E. Detailed Customer Survey Results.

Commercially Collected

The Renton transfer station has the highest reported proportion of residential loads; 58% of commercially collected customers report disposing of residential waste. Bow Lake has the lowest proportion of residential loads (32%) and highest proportion of nonresidential loads (61%). The Bow Lake transfer station is the only facility open 24 hours and receives a significant amount of nonresidential traffic between midnight and 8am. Approximately 24% of customers at Bow Lake and Factoria report disposing of single family residential loads, the lowest proportion of single family residential loads among the surveyed facilities. The single family proportion is highest at Enumclaw (46%). At Enumclaw, zero customers report disposing of multifamily loads, the lowest proportion among the surveyed facilities. The multifamily proportion is highest at Renton (18%). Factoria has the highest proportion of mixed residential and nonresidential loads, 12%. Only one commercially collected load was surveyed at Vashon; the results of the Vashon surveys are shown in the table but excluded from discussion since there are so few surveys.

Overall, the commercially collected substream is skewed slightly towards nonresidential loads (52%) and away from residential loads (41%). Single family residential loads are approximately 28% of all commercially collected loads.

The reported generator type by facility data for commercially collected loads is detailed in Table 27. Commercially collected loads are not accepted at the Skykomish and Cedar Falls dropboxes.

Table 27. Reported Generator Type by Facility, Commercially Collected, 2015

Commercially Collected, n=1064	Algona	Bow Lake	Enumclaw	Factoria
Residential	**38%**	**32%**	**54%**	**37%**
Single Family	25%	24%	46%	24%
Multifamily	13%	7%	0%	10%
Mixed Residential	0%	2%	8%	3%
Nonresidential	**56%**	**61%**	**46%**	**51%**
Mixed Residential and Nonresidential	**5%**	**6%**	**0%**	**12%**
Subtotal	***99%***	***99%***	***100%***	***100%***
No Response	1%	1%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Commercial, continued	Houghton	Renton	Shoreline	Vashon	Overall
Residential	**45%**	**58%**	**54%**	**0%**	**41%**
Single Family	30%	36%	44%	0%	28%
Multifamily	12%	18%	7%	0%	10%
Mixed Residential	4%	4%	2%	0%	2%
Nonresidential	**45%**	**35%**	**45%**	**0%**	**52%**
Mixed Residential and Nonresidential	**9%**	**7%**	**1%**	**100%**	**7%**
Subtotal	***100%***	***100%***	***100%***	***100%***	***100%***
No Response	0%	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Self-haul

At each facility, more than 75% of self-haul loads are single family residential; the proportion is highest at the Cedar Falls dropbox (97%) and lowest at the Houghton transfer station (79%). Overall, the self-haul substream is approximately 86% single family residential loads and 12% nonresidential loads. The remaining 1% is comprised of mixed residential and nonresidential loads, and 1% of those surveyed did not respond to the question. The reported generator type by facility data for self-haul loads is detailed in Table 28.

Table 28. Reported Generator Type by Facility, Self-haul, 2015

Self-haul, n=4465	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Residential	**88%**	**81%**	**97%**	**92%**	**86%**
Single Family	88%	81%	97%	92%	86%
Multifamily	0%	0%	0%	0%	0%
Mixed Residential	0%	0%	0%	0%	0%
Nonresidential	**10%**	**17%**	**1%**	**7%**	**11%**
Mixed Residential and Nonresidential	**1%**	**1%**	**1%**	**2%**	**2%**
Subtotal	***99%***	***99%***	***100%***	***100%***	***99%***
No Response	1%	1%	0%	0%	1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Self-haul, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Residential	**79%**	**91%**	**85%**	**-**	**90%**	**86%**
Single Family	79%	91%	85%	-	90%	86%
Multifamily	0%	0%	0%	-	0%	0%
Mixed Residential	0%	0%	0%	-	0%	0%
Nonresidential	**18%**	**8%**	**15%**	**-**	**9%**	**12%**
Mixed Residential and Nonresidential	**2%**	**1%**	**1%**	**-**	**0%**	**1%**
Subtotal	***99%***	***100%***	***100%***	**-**	***99%***	***99%***
No Response	1%	0%	0%	-	1%	1%
Total	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Contractors and Landscapers

The surveyors asked self-haul customers disposing of loads of yard waste or C&D waste if they were a contractor or landscaper. Table 29 presents the proportion of C&D and yard waste loads from each source (residential, nonresidential, and mixed) brought by contractors, landscapers, and other self-haul customer types. Customers bringing yard waste to one of the facilities with a yard waste recycling pile were not surveyed because the survey focused on customers with waste for disposal.

As shown, contractors and landscapers combined brought most (80%) of the surveyed C&D and yard waste loads from nonresidential sources. In contrast, only 40% of residential C&D and yard waste loads surveyed were delivered by contractors or landscapers. Overall, loads of self-haul C&D and yard waste disposed of at transfer stations were evenly split between contractors or landscapers and other users. More detailed results by facility can be found in Appendix E. Detailed Customer Survey Results.

Table 29. Proportion of C&D and Yard Waste by Type of Self-haul Customer and Generator, 2015

Self-haul, n=1199	Residential	Nonresidential	Mixed	No Response	Overall
Contractors	38%	75%	0%	0%	**47%**
Landscapers	2%	5%	0%	0%	**3%**
Other Users	59%	20%	0%	0%	**50%**
Total	**100%**	**100%**	**0%**	**0%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Curbside Garbage Service

Table 30 details the proportion of residential self-haul customers who report subscribing to curbside garbage service and the proportion that do not. Overall, 60% of residential self-haul customers report subscribing to curbside garbage service at home. At the Algona transfer station, 67% of customers report subscribing to curbside garbage service, the highest proportion at any transfer station. At Vashon, 17% of customers report subscribing to curbside garbage service, the lowest proportion at any transfer station.

Table 30. Reported Subscription to Curbside Garbage by Facility, Self-haul, 2015

Self-haul, n=3834	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to Garbage Service	67%	61%	67%	53%	66%
Do Not Subscribe to Garbage Service	17%	23%	30%	43%	9%
Subtotal	***84%***	***84%***	***96%***	***96%***	***75%***
No Response	16%	16%	4%	4%	25%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Self-haul, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Subscribe to Garbage Service	60%	66%	58%	-	17%	**60%**
Do Not Subscribe to Garbage Service	11%	20%	8%	-	66%	**21%**
Subtotal	***71%***	***86%***	***67%***	**-**	***83%***	***81%***
No Response	29%	14%	33%	-	17%	**19%**
Total	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Trip Frequency

Self-haul customers were asked the number of visits they make to the transfer station on a per day, week, or month basis. These responses were then converted to visits per year (i.e., "twice a week" equals 104 visits per year).

Residential Generators

Table 31 and Table 32 show the average number of annual visits residential self-haul customers make to each facility. Residential self-haulers are sorted into two groups: those who subscribe to curbside garbage collection service and those who do not subscribe. Users who did not respond to this question are primarily contractors, landscapers, and other independent hauling companies that do not know if their client subscribes to curbside garbage service.

Table 31 summarizes the data for all residential self-haul customers (including contractors, landscapers, and independent haulers). An employee for an independent hauler (i.e., companies such as "Got Junk") frequently makes several visits per day. To avoid a skew in the results due to this small number of respondents making hundreds of visits per year, Table 32 summarizes the annualized visits for the subset of residential self-haul customers making fewer than two visits per day.

All Residential Users

Overall, residential self-haul customers who do not subscribe to curbside garbage service make, on average, more than twice as many visits per year to waste facilities than residential self-haulers who do subscribe to curbside garbage service (28.5 visits vs. 12.9 visits). This overall average was weighted by the proportion of self-haul customers surveyed at each transfer station. Users who did not respond to

this question are primarily contractors, landscapers, and other independent hauling companies that do not know if their client subscribes to curbside garbage service.

Of the residential self-haul customers that subscribe to curbside garbage service, users of the Shoreline transfer station make the most visits, 18.5 annually. These results are detailed in Table 31.

Table 31. Reported Trips per Year by Subscription and by Facility, Residential Self-haul, 2015

All Residential Self-haul, n=3834	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to Garbage Service	17.4	16.3	11.4	8.6	11.5
Do Not Subscribe to Garbage Service	36.9	34.8	12.7	12.3	27.9
No Response	124.3	85.4	6.2	33.5	117.7
Facility Average	**38.0**	**31.7**	**11.6**	**11.2**	**39.7**

All Residential Self-haul, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Subscribe to Garbage Service	10.7	6.8	18.5	-	9.0	**12.9**
Do Not Subscribe to Garbage Service	60.5	28.0	94.3	-	11.4	**28.5**
No Response	100.2	133.4	55.0	-	68.9	**97.9**
Facility Average	**42.0**	**28.6**	**36.9**	**-**	**20.6**	**32.1**

Residential Users Making Less than Two Visits per Day

Residential self-haul customers making less than two visits per day that do not subscribe to curbside garbage service make, on average, about six more visits per year to waste facilities than residential self-haulers that do subscribe to curbside garbage service. This overall average was weighted by the proportion of self-haul customers surveyed at each transfer station. Users who did not respond to this question are primarily contractors, landscapers, and other independent hauling companies that do not know if their client subscribes to curbside garbage service. Of the residential self-haul customers who subscribe to curbside garbage service, Bow Lake transfer station customers made the most visits to a King County facility (13.9 visits). Table 32 details the results.

Table 32. Reported Trips per Year by Subscription and by Facility, Residential Self-haul Users Making Less Than Two Trips per Day, 2015

Residential Self-haul Making Less Than Two Visits/Day, n=3554	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to Garbage Service	9.6	13.9	11.4	8.6	9.6
Do Not Subscribe to Garbage Service	11.9	23.8	12.7	12.3	18.7
No Response	22.2	58.5	7.8	33.5	58.5
Facility Average	**11.3**	**21.4**	**0.0**	**11.2**	**19.9**

Residential Self-haul Making Less Than Two Visits/Day, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Subscribe to Garbage Service	10.7	6.9	10.6	-	9.0	**10.2**
Do Not Subscribe to Garbage Service	25.8	13.4	20.1	-	11.6	**16.3**
No Response	74.5	58.8	43.0	-	58.2	**54.8**
Facility Average	**29.3**	**14.4**	**19.5**	**-**	**18.1**	**17.8**

Nonresidential Generators

Table 33 and Table 34 show the average number of annual visits nonresidential self-haul customers make to each facility. Nonresidential self-haulers are sorted into two groups: those who subscribe to curbside garbage collection service and those who do not subscribe. Users who did not respond to this question are primarily contractors, landscapers, and other independent hauling companies that do not know if their client subscribes to curbside garbage service.

Table 33 summarizes the data for all nonresidential self-haul customers (including contractors, landscapers, and independent haulers). An employee for an independent hauler (i.e., companies such as "Got Junk") frequently makes several visits per day. To avoid a skew in the results due to this small number of respondents making hundreds of visits per year, Table 34 summarizes the annualize visits for the subset of nonresidential self-haul customers making fewer than two visits per day.

All Nonresidential Users

Nonresidential self-haul customers who do not subscribe to curbside garbage service make, on average, more than two times as many visits per year to waste facilities than nonresidential self-haulers who do subscribe to curbside garbage service. Overall averages for each group of customers are weighted by the proportion of self-haul customers surveyed at each transfer station.

Of the nonresidential self-haul customers who do subscribe to curbside garbage service, users of the Houghton facility make the most annual visits to a King County transfer station (110.5 visits). These results are detailed in Table 33.

Table 33. Reported Trips per Year by Subscription and by Facility, Nonresidential Self-haul, 2015

All Nonresidential Self-haul, n=598	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to Garbage Service	38.8	52.0	24.0	22.4	14.3
Do Not Subscribe to Garbage Service	16.5	130.3	24.0	48.7	17.2
No Response	36.6	66.7	12.0	27.7	55.4
Facility Average	**34.7**	**72.9**	**21.0**	**29.2**	**44.9**

All Nonresidential Self-haul, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Subscribe to Garbage Service	110.5	33.7	43.0	-	52.0	**47.7**
Do Not Subscribe to Garbage Service	179.8	25.8	104.0	-	21.3	**107.8**
No Response	203.7	55.7	81.5	-	81.4	**91.2**
Facility Average	**183.7**	**44.8**	**75.8**	**-**	**65.5**	**84.0**

Nonresidential Users Making Less than Two Visits per Day

Nonresidential self-haul customers making less than two visits per day who do not subscribe to curbside garbage service make, on average, more than twice as many visits per year to transfer stations than nonresidential self-haulers who do subscribe to curbside garbage service. Overall averages for each

group of customers are weighted by the proportion of self-haul customers surveyed at each transfer station.

Of the nonresidential self-haul customers who subscribe to curbside garbage service, users of the Vashon transfer station make the most annual visits to a King County facility (52.0 visits). These results are detailed in Table 34.

Table 34. Reported Trips per Year by Subscription and by Facility, Nonresidential Self-haul Users Making Less Than Two Trips per Day, 2015

Nonresidential Self-haul Making Less Than Two Visits/Day, n=547	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria
Subscribe to Garbage Service	20.3	38.6	24.0	22.4	14.3
Do Not Subscribe to Garbage Service	16.5	56.0	24.0	48.7	17.2
No Response	27.5	61.2	12.0	27.7	53.0
Facility Average	**21.0**	**48.8**	**21.0**	**29.2**	**41.3**

Nonresidential Self-haul Making Less Than Two Visits/Day, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Subscribe to Garbage Service	16.4	33.7	43.0	-	52.0	**27.6**
Do Not Subscribe to Garbage Service	93.9	25.8	104.0	-	21.3	**57.6**
No Response	57.5	38.0	66.1	-	81.4	**54.2**
Facility Average	**52.9**	**32.4**	**61.1**	**-**	**65.5**	**44.2**

Reasons for Self-haul

The surveyors asked self-haul customers their reason for self-hauling waste to the transfer station. Table 35 and Table 36 present the five most common reasons for self-hauling, by facility, for residential and nonresidential customers. The data include subscribers to curbside garbage service as well as non-subscribers.

All responses from residential and nonresidential customers regarding reasons for self-hauling waste can be found in Appendix E. Detailed Customer Survey Results.

Residential

Overall, the most common reason for self-haul reported by residential generators is “Large amount of garbage” (18%). The remaining top four reasons are “Items too big to fit into garbage can” (16%), “Cheaper or saves money” (14%), “Other” (10%), and “Cleaning home or work place” (9%).

Table 35. Most Common Reasons to Self-haul by Facility, Residential Generators, 2015

Residential, n=1721	Algona	Bow Lake	Ils Drop Box	Enumclaw	Factoria
Large amount of garbage	11%	9%	0%	7%	22%
Items too big to fit into garbage can	4%	16%	2%	5%	19%
Cheaper / Saves money	39%	25%	33%	20%	3%
Other	19%	9%	9%	9%	12%
Cleaning home or workplace	1%	10%	0%	3%	16%
Subtotal	***75%***	***69%***	***43%***	***44%***	***72%***
All other responses	25%	31%	57%	56%	28%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Residential, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Large amount of garbage	21%	18%	57%	-	15%	**18%**
Items too big to fit into garbage can	34%	10%	9%	-	6%	**16%**
Cheaper / Saves money	5%	14%	6%	-	19%	**14%**
Other	8%	9%	5%	-	10%	**10%**
Cleaning home or workplace	6%	14%	5%	-	4%	**9%**
Subtotal	***74%***	***64%***	***82%***	***-***	***55%***	***66%***
All other responses	26%	36%	18%	-	45%	**34%**
Total	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Nonresidential

Overall, the most common reason to self-haul reported by nonresidential generators is "Large amount of garbage" (26%). The remaining top four reasons are "Other" (21%), "Items too big to fit into garbage can" (11%), "Cheaper or saves money" (10%), and "Convenience" (8%).

Table 36. Most Common Reasons to Self-haul by Facility, Nonresidential Generators, 2015

Nonresidential, n=98	Algona	Bow Lake	Cedar Falls I	Enumclaw	Factoria
Large amount of garbage	22%	4%	0%	43%	50%
Other	11%	30%	0%	14%	10%
Items too big to fit into garbage can	11%	4%	0%	0%	30%
Cheaper / Saves money	33%	4%	100%	14%	0%
Convenience	11%	17%	0%	0%	0%
Subtotal	***89%***	***61%***	***100%***	***71%***	***90%***
All other responses	11%	39%	0%	29%	10%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Nonresidential, continued	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Large amount of garbage	44%	17%	0%	-	0%	**26%**
Other	19%	42%	25%	-	0%	**21%**
Items too big to fit into garbage can	19%	8%	0%	-	0%	**11%**
Cheaper / Saves money	4%	8%	25%	-	0%	**10%**
Convenience	0%	0%	25%	-	50%	**8%**
Subtotal	***85%***	***75%***	***75%***	***-***	***50%***	***77%***
All other responses	15%	25%	25%	-	50%	**23%**
Total	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Load Origin

The surveyors asked every customer the city of origin for their load. Additionally, self-haul customers were asked the load's zip code of origin. Table 37, Table 38, and Table 39 present the load origin for commercially collected and self-haul customers.

Commercially Collected

Table 37 details the reported city of origin for commercially collected loads to each of the County's facilities. Overall, 96% of the commercially collected loads originate from incorporated areas.[12] Kent (13%) is the most commonly reported origin for commercially collected loads.

[12] Vashon Island is considered unincorporated King County.

Table 37. Reported City of Origin for Loads by Facility, Commercially Collected, 2015

Commercially Collected, n=1071	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Algona	3%					1%					1%
Auburn	43%	3%									9%
Bellevue	1%	1%			55%	14%					12%
Black Diamond	2%										
Bothell						8%		29%			4%
Burien		8%									2%
Carnation											
Covington	6%										1%
Des Moines		5%									1%
Duvall						7%					1%
Enumclaw				100%							1%
Federal Way	35%	1%									7%
Issaquah					17%		1%				3%
Kenmore						2%		2%			1%
Kent	5%	44%									13%
Kirkland						24%	1%				5%
Lake Forest Park								1%			
Maple Valley	2%										
Mercer Island					11%						2%
Newcastle							4%				
Normandy Park		1%									
North Bend					4%		3%				1%
Pacific	5%										1%
Redmond	1%					33%		1%			7%
Renton		9%					74%				8%
Sammamish					8%						1%
Seatac		12%									3%
Shoreline								52%			4%
Skykomish											
Snoqualmie					2%	1%					1%
Tukwila		11%									3%
Woodinville						6%					1%
Subtotal Incorporated King County	***100%***	***95%***	***0%***	***100%***	***98%***	***98%***	***84%***	***86%***	***0%***	***0%***	***96%***
Unincorporated King County		3%			2%	1%	14%			100%	2%
Subtotal All King County	***100%***	***98%***	***0%***	***100%***	***100%***	***99%***	***97%***	***86%***	***0%***	***100%***	***98%***
Seattle		2%					3%	2%			1%
Outside King County											
No Response						1%		12%			1%
Total	**100%**	**100%**	**0%**	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Self-haul

Table 38 details the reported city of origin for self-haul loads to each of the County's facilities. Overall, 80% of the self-haul loads originate from incorporated areas.[13] Seattle (12%) is the most commonly reported origin for self-haul loads, overall. Renton (8%) is the most commonly reported origin for loads

[13] Vashon Island is considered unincorporated King County.

not originating in Seattle. The large number of Seattle loads is likely due to the diversion of users of Seattle's closed North Transfer Station to Shoreline.

Table 38. Reported City of Origin for Loads by Facility, Self-haul, 2015

Self Haul, n=5214	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Algona	3%		1%							1%	1%
Auburn	35%	3%		7%			1%				6%
Beaux Arts											
Bellevue		1%	1%		45%	9%	2%				8%
Black Diamond	1%			11%			1%				1%
Bothell						10%		1%			2%
Burien		10%									2%
Carnation			3%		1%	2%					1%
Clyde Hill											
Covington	5%	2%	2%	4%			1%				1%
Des Moines	2%	12%									3%
Duvall			1%			2%					
Enumclaw				49%							4%
Federal Way	25%	9%									5%
Hunts Point											
Issaquah			5%		15%	1%	6%				3%
Kenmore						3%		2%			1%
Kent	8%	25%		3%			4%				7%
Kirkland					1%	31%					4%
Lake Forest Park								4%			1%
Maple Valley	1%	1%		15%	1%		6%				2%
Medina						1%					
Mercer Island	1%				10%						1%
Milton	2%										
Newcastle					3%		2%				1%
Normandy Park		1%	1%								
North Bend			50%		1%						2%
Pacific	4%										1%
Redmond					2%	16%					3%
Renton	1%	5%			1%		65%				8%
Sammamish			1%		9%	3%					2%
Seatac		10%									2%
Shoreline								34%			5%
Skykomish											
Snoqualmie			24%		3%						1%
Tukwila		4%									1%
Woodinville					1%	12%		1%			2%
Yarrow Point											
Subtotal Incorporated King County	***89%***	***84%***	***88%***	***90%***	***95%***	***94%***	***88%***	***44%***	***0%***	***1%***	***80%***
Unincorporated King County	1%	1%	10%	8%	3%	1%	4%			99%	6%
Subtotal All King County	***90%***	***86%***	***99%***	***98%***	***98%***	***95%***	***91%***	***44%***	***0%***	***100%***	***85%***
Seattle	1%	12%			1%	3%	8%	53%			12%
Outside King County	9%	2%	1%	2%	1%	1%		3%			3%
No Response		1%						1%			
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Table 39 details the reported zip code of origin for self-haul loads to each of the County's facilities. Zip code 98022 is the most frequently reported origin, accounting for 4% of customers surveyed.

Table 39. Reported Zip Code of Origin for Loads by Facility, Self-haul, 2015

Zip Code, n=5222	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
98000											
98001	18%	2%	1%							1%	3%
98002	10%			3%							2%
98003	10%	4%									2%
98004					5%	1%					1%
98005					3%	3%					1%
98006			1%		18%		1%				3%
98007					2%						
98008					3%	1%					1%
98010	1%			10%			1%				1%
98011						7%		1%			1%
98012						1%					
98014			6%		1%	2%					1%
98017											
98019			1%			2%					
98020								1%			
98021						2%					
98022				51%							4%
98023	13%	4%									3%
98024			26%		2%						1%
98025				1%							
98026								1%			
98027			5%		5%		6%				1%
98028						3%		2%			1%
98029			1%		3%						1%
98030	2%	6%						1%			2%
98031	1%	7%					2%				2%
98032	1%	5%									1%
98033		1%			1%	12%					2%
98034						10%		1%			1%
98035											
98036											
98037											
98038	1%	1%		14%	1%		5%				2%
98039						1%					
98040	1%				9%						1%
98041											
98042	9%	4%		7%			2%				3%
98043								1%			
98044											
98045			49%		1%						2%
98047	4%										1%
98048			1%								
98050			1%								
98051				5%							
98052					1%	8%	1%				1%
98053					1%	5%					1%
98054							1%				
98055		1%					4%				1%
98056		1%			2%		15%				2%
98057							2%				

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Zip Code, Continued	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
98058		2%					15%				2%
98059		1%			1%		27%				3%
98061											
98064											
98065			7%		1%						
98066											
98067											
98068											
98070										99%	4%
98071	1%										
98072						5%					1%
98074			1%		1%	2%					1%
98075			1%		5%						1%
98076										1%	
98077						4%					1%
98078											
98083											
98090											
98091											
98092	9%	1%		5%							2%
98100		1%									
98101											
98102								1%			
98103								5%			1%
98104											
98105								3%			
98106											
98107								3%			
98108		1%									
98109								1%			
98112											
98113											
98115								7%			1%
98116											
98117								6%			1%
98118		2%					2%				1%
98119								1%			
98120											
98121											
98122											
98123											
98125								11%			2%
98126											
98128											
98132											
98133								14%			2%
98134											
98136											
98138	1%	2%									
98144											

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Zip Code, Continued	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
98146		2%									
98148		4%									1%
98150											
98153											
98155								16%			2%
98158											
98160											
98165											
98166		4%									1%
98167											
98168		4%									1%
98170											
98172											
98174											
98177								5%			1%
98178		1%					4%				1%
98186											
98188		4%									1%
98196											
98198	1%	10%									2%
98199								1%			
98203											
98204											
98206											
98208											
98223											
98224											
98232											
98233											
98258											
98272											
98275											
98276											
98282											
98290											
98296						1%					
98301											
98312											
98321											
98323											
98324											
98334											
98338											
98354	3%										
98357											
98371	1%										
98372	1%										
98373											
98374	1%										
98377											
98387											
98390	1%										

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Zip Code, Continued	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
98391	2%										
98402											
98404											
98409											
98422											
98424	1%										
98444											
98445											
98466											
98473											
98512											
98572											
98580											
98601											
98603											
98682											
98752											
98818											
98842											
98866											
98902											
98918											
98934											
Subtotal	***96%***	***83%***	***99%***	***98%***	***72%***	***76%***	***92%***	***84%***	***0%***	***100%***	***86%***
No Response	4%	17%	1%	2%	28%	24%	8%	16%	0%	0%	14%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

5. Appendices

Appendix A. Sample and Survey Methodology

Overview

The objective of the 2015 waste composition study is to provide statistically valid composition data, by weight, for King County's disposed waste stream. By sorting approximately 420 randomly selected samples, Cascadia derived representative composition estimates for the residential, commercial, and self-haul substreams. The current project followed the same basic methodology as the previous study conducted between February and December 2011.

This appendix outlines the sampling methodology for the current study. The material definitions, quality control plan, health and safety plan, and example field forms are included in separate appendices.

Define Sampling Populations

To gain a clearer understanding of the disposed solid waste stream, the total waste stream was divided into various substreams. Such division was useful because the various substreams often have different waste types, user profiles, and public programs for reaching customers. Substreams were identified according to the source, or generator, of the waste (residential or nonresidential) as well as how materials are delivered to waste sites (commercially collected or self-haul).[14]

The following terms were used to define the substreams:

- **Residential waste** is generated at single-family or multifamily dwellings.
- **Nonresidential waste** is generated at 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.[15]
- **Self-haulers** are residents or businesses that bring waste themselves to transfer stations or dropboxes.[16]

In this study, waste loads were first divided into residential and nonresidential waste streams. These categories were then further divided into either commercially collected or self-haul substreams, as

[14] This study excluded waste from the construction, demolition and land-clearing (CDL) substream, which is disposed at special facilities designated for the purpose.
[15] The City of Enumclaw and the Town of Skykomish operate their own waste collection systems, rather than contracting with commercial haulers. In the 2015 study, King County considered these the commercially collected loads.
[16] Self-haul loads were 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 were considered self-haul residential if the waste originates from a residence, even though the company, not the resident, delivers the material to a waste facility.

shown in Table 40. In some cases, loads contained a mixture of waste from residential and nonresidential generators, but these "mixed loads" represented only a small portion of the total waste.

Table 40. Waste Substream Definitions

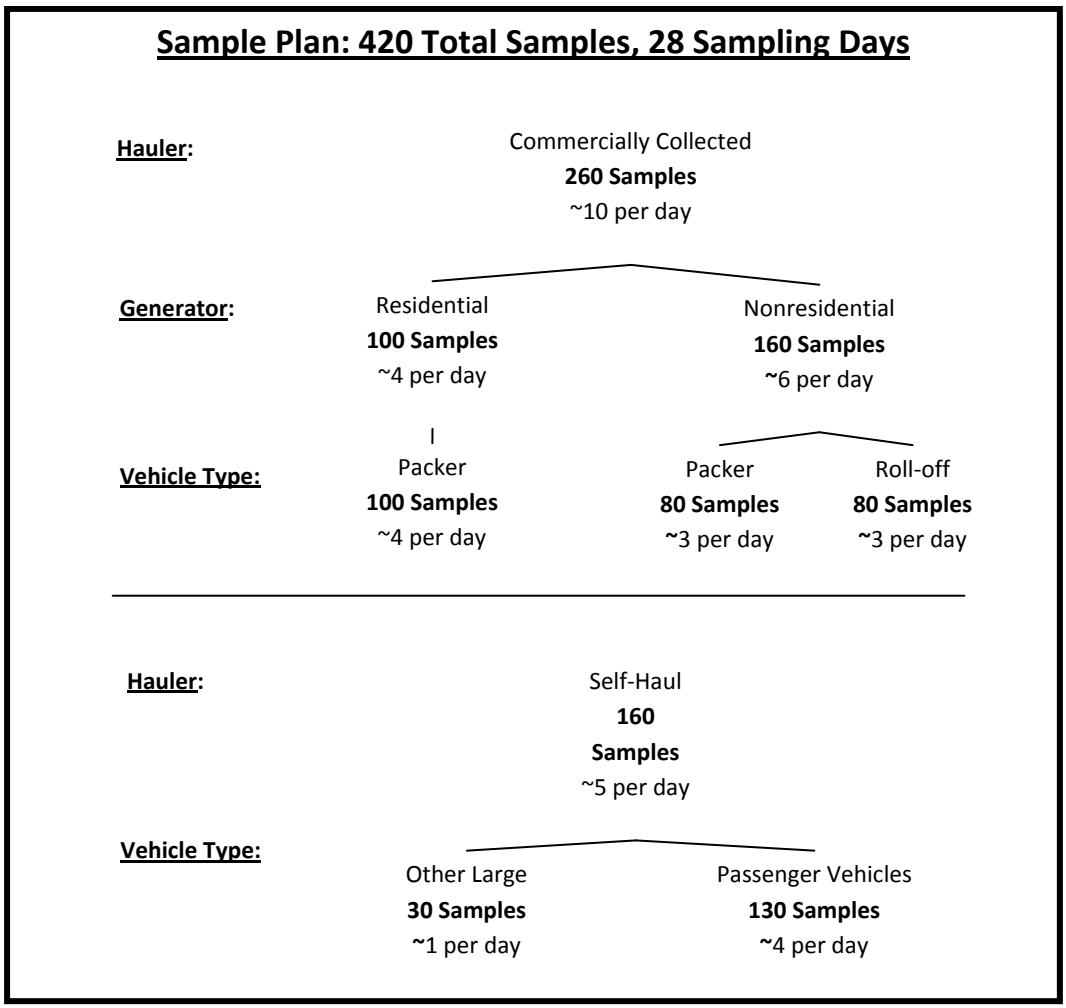
	Commercially Collected	Self-haul
Residential Waste	Commercially collected waste from residential sources	Self-haul waste from residential sources
Nonresidential Waste	Commercially collected waste from nonresidential sources	Self-haul waste from nonresidential sources
Mixed Residential and Nonresidential Waste	Commercially collected waste from residential and nonresidential sources	Self-haul waste from residential and nonresidential sources

Allocate Samples

To provide reliable waste composition estimates, Cascadia hand-sorted 421 randomly selected samples from eight King County transfer stations and two dropboxes. The samples were divided among commercially collected residential, commercially collected nonresidential, self-haul residential, and self-haul nonresidential waste.

Figure 27 shows the distribution of planned samples. Approximately 100 commercially collected residential, 160 commercially collected nonresidential, and 160 self-haul (residential and nonresidential) samples were to be sorted over 28 days. Using predetermined sampling intervals, Cascadia intended to sample an average of 15 loads per day, resulting in 420 total samples.

Figure 27. Sample Allocation



As shown, greater numbers of samples were allocated to the commercially collected nonresidential and self-haul substreams. The waste found in these streams tends to be more variable from load to load. Higher variability means that additional samples are 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 dropboxes (80 samples for each vehicle type). The self-haul substream was divided between passenger vehicles (130 samples) and other large vehicles (30 samples). The planned numbers of samples for each sampling stratum are shown in Table 41.

Table 41. Planned and Actual Samples by Sampling Strata, 2015

Sampling Strata	Number of Samples	
	Plan	Actual
Commercially Collected Residential	100	107
Commercially Collected Packer Trucks	80	71
Commercially Collected Dropboxes	80	83
Self-haul Passenger Vehicles	130	130
Self-haul Large Other	30	30
Total	**420**	**421**

Table 42 shows the planned and actual number of waste samples collected from each facility. Field work was planned for Houghton in February, but a piece of the transfer station's equipment broke down shortly before the field crew's arrival at the transfer station, making sampling activities impossible. The field crew relocated to Factoria for the day, and the project team adjusted the field calendar for the remainder of the year to accommodate the schedule change. After the completion of the December field period, the project team scheduled a make-up day of field work in January 2016 to ensure that sample targets were achieved.

Table 42. Planned and Actual Samples by Facility and Month, 2015

	February		April		June		August		October		December		January 2016		Total	
	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual	Plan	Actual
Algona	15	15	15	15	15	15			14	13					**59**	**58**
Bow Lake	15	15			15	15	29	29	14	15	13	16			**86**	**90**
Cedar Falls*									1			1			**1**	**1**
Enumclaw		14			16	16					16				**32**	**30**
Factoria	15	13	16	15	16	16			15			13			**62**	**57**
Houghton	15				15	15	14	15	15	15		14			**59**	**59**
Renton			15	15			15	14			14	13			**44**	**42**
Shoreline			15	11			15	14		14	16			14	**46**	**53**
Skykomish*							1					1			**1**	**1**
Vashon			15	15							15	15			**30**	**30**
Total	**60**	**57**	**76**	**71**	**77**	**77**	**74**	**72**	**59**	**57**	**74**	**73**	**0**	**14**	**420**	**421**

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

Apportion Sampling and Surveying Days

A total of 28 sampling days were scheduled for the 2015 study, divided into six sampling events lasting four to five days each. Waste was sampled from ten King County facilities, including eight transfer stations and two dropboxes.

Sites with relatively more vehicle traffic were allocated additional sampling days. For example, sampling at Bow Lake occurred six times during the study year while Algona, Factoria, and Houghton were sampled four times. Shoreline and Renton hosted waste sampling three times, and the Enumclaw and Vashon facilities were visited twice. Waste disposed at the Skykomish and Cedar Falls facilities is consolidated into dropboxes. The dropboxes are then hauled to the Houghton and Factoria transfer stations, respectively. Because of this unique arrangement and because only self-haul customers use the

two dropbox sites, self-haul residential samples from Skykomish and Cedar Falls were collected from the dropboxes as they were dumped at Houghton and Factoria.

Surveying was completed over 39 days, including one Saturday at each facility and across all three shifts at Bow Lake. Every sampling day including surveying, but not every survey day included sampling.

Assign Facilities to Dates

To capture any seasonal variation in the composition of waste or the mix of vehicles using the transfer stations, sampling occurred every other month and surveying nearly every month starting in February 2015. Cascadia used the random function in Microsoft Excel to select the first sampling day each month. The random number generated was used to assign a first sampling day in February, April, or June to each facility. Subsequent sampling days at each site were then distributed based on the number of planned sampling days for that facility. The interval between sampling or surveying days at a site varied depending on how often the site was visited by the project team during the study period.

Table 43 shows the planned sampling and surveying dates for each facility.

Table 43. Sampling and Surveying Calendar

		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February	Date(s)		24	25	26	27	
4 Shifts	Site(s)		Houghton*	Factoria	Bow Lake-Day	Algona	
March	Date(s)						28
1 Shift	Site(s)						Enumclaw
April	Date(s)	6	7	8	9	10	11
6 Shifts	Site(s)	Factoria	Algona	Shoreline	Renton	Vashon	Cedar Falls
May	Date(s)						
0 Shifts	Site(s)						
June	Date(s)	15	16	17	18	19	20
7 Shifts	Site(s)	Algona	Enumclaw	Bow Lake - Day, Eve	Factoria	Houghton	Shoreline
July	Date(s)						25
1 Shift	Site(s)						Algona
	Date(s)					7	8
August	Site(s)					Cedar Falls	Bow Lake - Day
8 Shifts	Date(s)	10	11	12	13	14	15
	Site(s)	Bow Lake - Day	Shoreline	Renton	Bow Lake - Eve	Houghton	Factoria
September	Date(s)					18	19
2 Shifts	Site(s)					Enumclaw	Vashon
October	Date(s)	19	20	21	22		24
5 Shifts	Site(s)	Houghton	Factoria	Algona	Bow Lake - Night		Renton
November	Date(s)						7
1 Shifts	Site(s)						Houghton
December	Date(s)	7	8	9	10	11	
5 Shifts	Site(s)	Enumclaw	Bow Lake - Day	Vashon	Shoreline	Renton	
# of Shifts		**5 Shifts**	**6 Shifts**	**7 Shifts**	**6 Shifts**	**7 Shifts**	**9 Shifts**

**Due to an equipment breakdown at Houghton, the survey and sampling crew relocated to Factoria*

Determine Sampling Frequency

Sampling frequency refers to the process by which particular vehicles were selected for sampling. Vehicles were randomly selected for sampling through systematic selection process as they arrived at each facility during a sampling day. A staff member was designated as the "gatekeeper." The gatekeeper surveyed and counted all incoming vehicles and applied the process described below to select loads from which samples were extracted. The survey script is detailed in a following section.

1. For each sampling day and each waste stream, the expected number, *L*, of arriving loads from each stream was estimated using the vehicle survey data obtained in 2011. The number *L* was then reduced by 20% (equal to 0.8 x *L*). This was done in order to ensure that the targeted number of loads for each waste stream could be selected on each sampling day, even if traffic was lighter than expected.
2. Next, the sampling interval *n* was determined to ensure systematic sampling of vehicles. If *r* represents the number of samples needed for the waste stream and 0.8 x *L* represents the number of expected loads from the waste stream, then *n* is calculated by dividing 0.8 x *L* by *r*. To facilitate this process, a *Daily Vehicle Selection Sheet* was constructed for each day, and every n^{th} vehicle was selected for sampling. An example of a sample vehicle selection sheet appears in Appendix I. Example Field Forms.

Field Procedures

Vehicle Surveys

All incoming vehicles were surveyed using the following survey script.

AS THE VEHICLE APPROACHES:

Select a numbered card; record the number.

Decide whether the vehicle is a commercial hauler or self-haul (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."

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 and demolition debris (C&D)), MSW/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 C&D, 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, multifamily residential, mixed residential, mixed residential and nonresidential, or nonresidential (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.

Skip if Contractor of Landscaper:

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-hauling 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.

All Drivers:

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

AS THE VEHICLE DEPARTS THE FACILITY:

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.

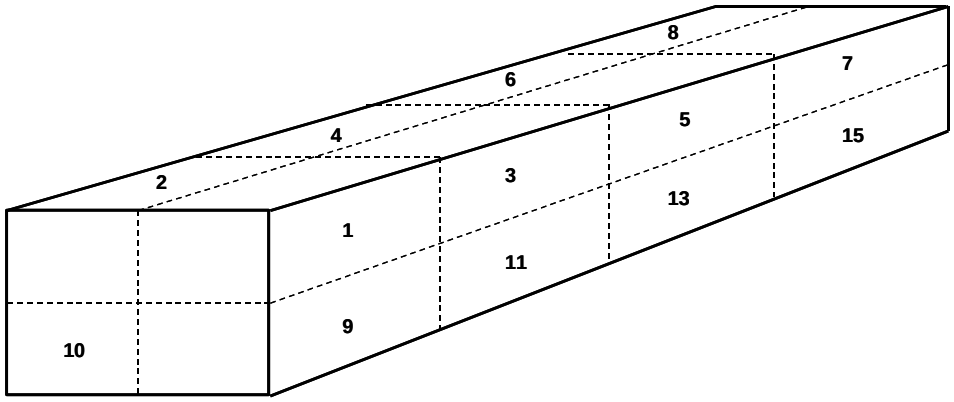
Survey responses were recorded using customized *Customer Survey Forms*.

Obtaining Samples for Sorting

Using the process described in the previous section, the gatekeeper determined which vehicles were to be sampled. For a vehicle to be eligible for sampling, the load had to match one of the targeted waste stream categories. If the vehicle was eligible and was the correct n^{th} vehicle, the gatekeeper placed a *Sample Placard* on the vehicle's windshield or dashboard. At the sorting area, the Sort Crew Manager intercepted the vehicle, took the *Sample Placard*, and recorded the sample ID number from the sample placard onto the *Material Weight Tally Sheet*. Examples of these field forms are included in Appendix I. Example Field Forms.

If selected for sampling, commercially collected loads arriving in compactors, roll-off containers, or packer trucks were instructed to dump their contents in an elongated pile. The sample was selected using an imaginary 16-cell grid (Figure 28) superimposed over the dumped material. The Sort Crew Manager then located the 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 225 to 275 pounds of waste was extracted by machine or hand from the designated cell and placed on a tarp.

Figure 28. The 16 Cell Grid Applied to Selected Loads



Samples from large (greater than 500 pounds) self-haul loads were selected using the same random cell selection method as commercially collected loads,. If the self-haul load weighed less than 250 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.

Sorting Samples

Once a sample was selected, extracted from the load, and placed on a clean tarp, it was sorted by hand into the 97 material types. Sorted materials were placed in plastic laundry baskets for weighing and

recording. The Sort Crew Manager monitored the homogeneity of the baskets as material accumulated, rejecting items that were 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 and recorded on the sampling form.

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

Appendix B. Material Definitions

*Material types added to the material list or changed for the 2015 study are noted with an asterisk.

Paper

1. **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.

2. **Plain Corrugated Cardboard (OCC)—**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.

3. **Waxed Corrugated Cardboard—**Kraft linerboard, containerboard, cartons, and other boxes with a wax coating. Examples include commercial produce boxes.

4. **Low Grade Recyclable Paper—**all recyclable paper other than that listed in another category. This list includes 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 polycoated paperboard, aseptic packaging and other low-grade recyclable papers used in packaging, including polycoated or aseptic milk, ice cream, or juice containers, chipboard and other solid boxboard such as for beer, cereal, and soda cans, clothing forms, egg cartons (molded pulp), and other boxes.

5. **High Grade Paper—**white and lightly colored bond, rag, or stationary grade paper. 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.

6. **Single-use Food Service Compostable Paper—**includes paper soiled with food that was used in a "single-use" capacity. Examples include, paper plates, pizza boxes, french-fry containers. Does not include napkins or paper towels.

7. **Other Compostable Paper—**includes paper soiled with food that was *not* used in a "single-use" capacity. Examples include napkins, and paper towels.

8. **Other Paper—**includes materials that are primarily paper but combined with other materials that are not easily recyclable. Examples include frozen juice cans, oil cans, paper with foil laminates, foil-lined paper, spiral-bound notebooks, carbon paper, photographs, poly-lined chipboard, microwave containers, gift wrapping paper, and hardcover books.

Plastics

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

10. **Other PET Containers—**PET containers other than bottles.

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

12. **Other HDPE Containers—**HDPE containers other than bottles.

13. **Other #3-#7 Packaging—**all other rigid bottles and containers with SPI codes 3 through 7.

14. **Compostable Plastics—**all items made from compostable materials such as corn or potatoes with the words "compostable" on the product.

15. **Expanded Polystyrene Single Serve Food Packaging—**expanded polystyrene packaging used for carrying food. Examples include food trays, cups, plates, clamshells, egg cartons, and other packaging.

16. **Other Expanded Polystyrene Packaging—**any expanded polystyrene packaging not used for food service, such as molded packing blocks and Styrofoam peanuts.

17. **Expanded Polystyrene Products—**expanded polystyrene products such as some ice-chests, floatation devices, and EPS wig forms. This does not include EPS insulation, which is categorized in Construction/Demolition.

18. **Recyclable Plastic Bags—**plastic shopping bags used to contain merchandise to transport from the place of purchase, given out by the store with the purchase. This type includes dry cleaning bags and newspaper bags intended for one-time use. Does not include produce bags.

19. **Non-industrial Packaging Film Plastic—**all film used as food packaging or in another non-industrial capacity. Include produce bags, zip-lock bags, frozen vegetable bags, bread bags, food wrappers such as candy bar wrappers, deli bags, and other film packaging with a label or sticker.

20. **Industrial Packaging Film Plastic—**film plastic used for large-scale packaging or transport packaging. Examples include shrink-wrap, mattress bags, furniture wrap, and film bubble wrap.

21. **Plastic Garbage Bags—**plastic bags sold for use as trash bags, for both residential and commercial use. This type includes garbage, kitchen, compactor, can-liner, yard, lawn, leaf, and recycling bags. This type does not include other plastic bags, like shopping bags, that might have been used to contain trash.

22. **Plastic Film Products—**items made of film plastic not intended for a single use, such as shower curtains, kid's pools, and utility tarps.

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

24. **Single Resin Plastic Products—**primarily rigid or solid consumer items made from a single resin type. Examples include dishware, utensils and other household items, vinyl products, plastic furniture and toys, car parts, and hangers. Also includes thermoset plastics such as Formica, fiberglass, and other related products.

25. **Mixed Resin Plastic Products—**primarily rigid or solid consumer items made from more than one type of plastic resin. Examples include hair brushes, toothbrushes, and pens.

26. **Foam Rubber and Padding—**foam materials, consisting primarily of polyurethane, such as foam mattress pads.

27. **Carpet Padding—**foam material used for carpet padding.

28. **Plastic and Other Materials—**items that are predominantly made of plastic, but are combined with other material, such as three-ring binders, some toys, razors, some kitchenware and car parts with wood or metal components.

Wood and Yard

29. **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.

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

31. **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.

32. **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.

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

34. **Large Prunings—**other natural woods, such as logs and branches in excess of four inches in diameter (Prunings less than four inches in diameter are categorized as yard wastes).

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

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

Food

37. **Packaged Vegetative Food—**any vegetative food item such as pasta, grains, baked goods, beans, fruits, vegetables, sauces, soda, tea, juice and water where the package has remained intact. In the sorter's judgment, packaged vegetative food items *could* have been donated to a food bank or similar organization, rather than disposed. This category may include fresh fruits and vegetables (packaged in waxed boxes, for example) if, in the sorter's judgment, the food was not spoiled at the time of disposal.

38. **Opened, Unpackaged or Scrap Vegetative Food—**any vegetative food item such as pasta, grains, backed goods, beans, fruits, vegetables, sauces, soda, tea, juice, water, and ice where the package has been opened or broken, the item is unpackaged, or where the vegetative food is found in scraps or pieces. In the sorter's judgment, theses food items *would not have been* acceptable for donation.

39. **Packaged Non-vegetative Food—**any non-vegetative food item such as fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has remained intact. In the sorter's judgment, packaged non-vegetative food items *could have been* donated to a food bank or similar organization, rather than disposed.

40. **Opened, Unpackaged, or Scrap Non-vegetative Food—**any non-vegetative food item such fresh or canned meat or fish, cheeses, eggs, dairy items, and chili or soup containing meat, where the package has been opened or broken, the item is unpackaged, or where the food is found in scraps or pieces. In the sorter's judgment, theses food items *would not have been* acceptable for donation.

Other Organics

41. **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.

42. **Other Textiles—**upholstery, shoes, and other non-recyclable products including leather products.

43. **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.

44. **Rubber Products—**items made of natural and synthetic rubber, including door mats, car parts, hoses, rubber toys, and other products. This material type does not include tires or foam rubber.

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

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

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

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

Glass

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

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

51. **Brown Containers—**bottles and jars that are brown in color; used for food, soft drinks, beer, and wine. This category also includes blue glass containers.

52. **Kitchenware/Ceramics—**glass or ceramic cooking ware, dishware, and other products.

53. **Other Glass—**window glass, automotive glass, glass table-tops, mirrors, light bulbs, and any other glass item that does not fit into a category above.

Metals

54. **Aluminum Cans—**beverage cans composed of aluminum only.

55. **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.

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

57. **Other Ferrous—**ferrous and alloyed ferrous scrap materials, without non-metal contaminants, including household, industrial, and commercial products such as other cans and containers. This category includes scrap iron and steel to which a magnet can adhere.

58. **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. Examples include brass door knobs and copper pipes. Metals that are significantly contaminated are not included.

59. **Mixed Metals—**composite, multi-metal products such as engines and electric motors with minor non-metal contaminants. The metal content must be more than 80% by weight of the material.

60. **Other Mixed Metals—**metals combined with significant amounts of other materials, such as umbrellas and coated wire. The non-metal content of the item must be greater than 20% by weight.

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

Other Wastes

62. **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, non-wood roofing materials, and insulation of various types (including foam, fiberglass etc.).

63. **Asphalt Shingles—**roofing material composed of fiberglass or organic felts saturated with asphalt and covered with asphalt and inert aggregates. Commonly known as three-tab roofing shingles.

64. **Ash—**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.

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

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

67. **Furniture—**furniture made of mixed materials and in any condition.

68. **Mattresses—**mattresses made of mixed materials and in any condition.

69. **Carpet—**general category of flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material.

70. **Miscellaneous Inorganics—**other non-combustible, inorganic material not classified elsewhere. Also includes non-C&D plaster and concrete statuary, or other products.

Electronics

71. **Small Household Appliances—**small household appliances such as toasters, broilers, can openers, microwaves, coffee machines, and blenders.

72. **Audio/Visual Equipment—**stereos, VCRs, DVD players, large radios, gaming systems, cable or satellite television control boxes, and audio/visual equipment. This category does not include televisions or monitors.

73. **Printers/Copiers/Fax Machines—**computer printers (both inkjet and laser), facsimile machines, and photocopying machines.

74. **Central Processing Units (CPUs)—**such as computer hard drives when the CPU is a separate component in the system.

75. **Computer Peripherals—**computer peripherals including keyboards, gaming controllers, and mice.

76. **CRT Computer Monitors and Televisions*—**computer monitors and televisions containing a cathode ray tube (CRT). Includes items with built in optical drives or other processors.

77. **Other Computer Monitors and Televisions*—**all non-CRT monitors and televisions (LCD, plasma, OLED, etc.). Includes items with built-in optical drives or other processors such as an iMac or personal DVD player. Control of the content viewed on the item must be performed by an external control device such as a keyboard, mouse, or remote. Does not include "tablets" or other small touch screen personal computing devices.

78. **Laptops—**all laptop and notebook computers. Must have a permanently attached, physical keyboard.

79. **Cell Phones—**personal electronic devices primarily intended for mobile voice communication over a cellular network. This includes both smartphones and traditional cell phones.

80. **Tablets*—**personal computing and entertainment devices with a screen greater than 4". Examples include video display devices, e-readers, and touch screen portable computers. This type includes products like the iPad, Kindle Fire, Nook, Surface, and Galaxy tab.

81. **Other Electronics—**includes scanners, personal digital assistants (PDAs), portable music players, answering machines, electronic toys, and any other electronic item with some circuitry not categorized elsewhere and with displays less than 4" when the item includes a display.

Household Hazardous/Special Waste

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

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

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

85. **Latex Paint—**water-based paints and similar products.

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

87. **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.

88. **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.

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

90. **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.

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

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

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

94. **Pharmaceuticals and Vitamins—**means both prescription and over-the-counter medications and supplements in all forms, including pills, liquid medications, creams, and ointments. Does not include containers for these items, except for tubes for creams and ointments and other containers that cannot be easily separated from the product they contain.

95. **Compact Fluorescent Bulbs—**all compact fluorescent bulbs.

96. **Other Fluorescent Bulbs and Tubes—**includes other fluorescent lighting and fluorescent tube lighting.

97. **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, 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 Calculation

Estimating Waste Composition

Waste composition estimates were calculated using a method that gave equal weighting or "importance" to each sample within a given stratum. Confidence intervals (error ranges) were calculated based on assumptions of normality in the composition estimates.

In the descriptions of calculation methods, the following variables are used frequently:

- *i* denotes an individual sample;
- *j* denotes the material type;
- c_j is the weight of the material type *j* in a sample;
- *w* is the weight of an entire sample;
- r_j is the composition estimate for material *j* (*r* stands for *ratio*);
- *s* denotes a particular stream or substream of the waste stream; and
- *n* denotes the number of samples in the particular group that is being analyzed at that step.

Estimating the Composition

For a given stratum (that is, for the samples belonging to the same generator type collected by the same hauler type), the composition estimate denoted by r_j represents the ratio of the component's weight to the total weight of all the samples in the stratum. This estimate was derived by summing each component's weight across all of the selected samples belonging to a given stratum and dividing by the sum of the total weight of waste for all of the samples in that stratum, as shown in the following equation:

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

where:

- *c* = weight of particular component;
- *w* = sum of all component weights;
- for *i* = 1 to *n*, where *n* = number of selected samples; and
- for *j* = 1 to *m*, where *m* = number of components.

For example, the following simplified scenario involves three samples. For the purposes of this example, only the weights of the component *carpet* are shown.

	Sample 1	Sample 2	Sample 3
Weight (*c*) of *carpet* (in lbs)	5	3	4
Total Sample Weight (*w*) (in lbs)	80	70	90

$$r_{Carpet} = \sum \frac{5+3+4}{80+70+90} = 0.05$$

To find the composition estimate for the component *carpet*, the weights for that material are added for all selected samples and divided by the total sample weights of those samples. The resulting composition is 0.05, or 5%. In other words, 5% of the sampled material, by weight, is *carpet*. This finding is then projected onto the stratum being examined in this step of the analysis.

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

$$\mathrm{Var}(r_j) \approx \left(\frac{1}{n}\right)\left(\frac{1}{\overline{w}^2}\right)\left(\frac{\sum_i \left(c_{ij} - r_j w_i\right)^2}{n-1}\right)$$

where:

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

(For more information regarding Equation 2, refer to *Sampling Techniques, 3rd Edition* by William G. Cochran [John Wiley & Sons, Inc., 1977].)

Second, precision levels at the 90% confidence level were calculated for a component's mean as follows:

$$r_j \pm \left(z\sqrt{\mathrm{Var}(r_j)}\right)$$

where *z* = the value of the *z*-statistic (1.645) corresponding to a 90% confidence level.

Composition results for strata were then combined, using a weighted averaging method, to estimate the composition of larger portions of the waste stream. For example, the commercially collected residential substream was combined with the commercially collected nonresidential substream to estimate the composition for the County's overall commercially collected waste stream. The relative tonnages associated with each stratum served as the weighting factors. The calculation was performed as follows:

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

where:

- p = the proportion of tonnage contributed by the noted waste stratum (the weighting factor);
- r = ratio of component weight to total waste weight in the noted waste stratum (the composition percent for the given material component); and
- for j = 1 to m, where m = number of material components.

For example, the above equation is illustrated here using three waste strata.

	Stratum 1	**Stratum 2**	**Stratum 3**
Ratio (r) of *carpet*	5%	10%	10%
Tonnage	25,000	100,000	50,000
Proportion of tonnage (*p*)	14.3%	57.1%	28.6%

To estimate the larger portions of the waste stream, the composition results for the three strata are combined as follows.

$$O_{Carpet} = (0.143 * 0.05) + (0.571 * 0.10) + (0.286 * 0.10) = 0.093 = 9.3\%$$

Therefore, 9.3% of this examined portion of the waste stream is *carpet*.

The variance of the weighted average was calculated as follows:

$$\mathrm{Var}(O_j) = \left(p_1^2\ \mathrm{Var}(r_{j1})\right) + \left(p_2^2\ \mathrm{Var}(r_{j2})\right) + \left(p_3^2\ \mathrm{Var}(r_{j3})\right) + \ldots$$

Estimating the Composition of King County's Overall Disposed Waste Stream

Composition results for all substreams were combined, using a weighted averaging method, to estimate the composition of the County's entire waste stream. The relative tonnages associated with each substream served as the weighting factors. The calculation was performed as follows:

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

where:

- p = the proportion of tonnage contributed by the noted waste sector (the weighting factor);
- r = ratio of component weight to total waste weight in the noted waste sector (the composition percent for the given material component); and
- for j = 1 to m, where m = number of material components.

The following scenario illustrates the above equation. This example involves the component *carpet* in three waste sectors.

	Substream 1	**Substream 2**	**Substream 3**
Ratio of *carpet* (*r*)	0.05	0.10	0.15
Proportion of Tonnage (*p*)	50%	25%	25%

$$O_{Carpet} = (0.50 * 0.05) + (0.25 * 0.10) + (0.25 * 0.15) = 0.0875$$

So, it is estimated that 0.0875 or 8.75% of the entire waste stream is composed of *carpet*.

The variance of the weighted average was calculated as follows:

$$\mathrm{Var}(O_j) = \left(p_1^2\ \mathrm{Var}(r_{j1})\right) + \left(p_2^2\ \mathrm{Var}(r_{j2})\right) + \left(p_3^2\ \mathrm{Var}(r_{j3})\right) + \ldots$$

Appendix D. Detailed Waste Composition Results

This appendix contains the detailed composition tables for all substreams. The detailed composition tables show the mean, error range, and tons for each material type as well as the total substream tonnage and number of samples. In addition, this appendix contains the pie charts and top ten tables for the commercially collected single family and multifamily residential substreams. All quantity data is presented in annual tons unless noted otherwise.

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 types*:

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

All estimates of precision were calculated at the 90% confidence level. The equations used in these calculations appear in Appendix C. Waste Composition Calculation. The example below illustrates how the results can be interpreted. In this example, the best estimate of the amount of *unpackaged/scrap vegetative food* present in the universe of waste sampled is 7.3%. The figure 0.7% reflects the precision of the estimate. When calculations are performed at the 90% confidence level, we are 90% certain that the true amount of *unpackaged/scrap vegetative food* is between 7.3% plus 0.7% and 7.3% minus 0.7%. In other words, we are 90% certain that the mean lies between 6.6% and 8.0%.

Error Range (+/-)

The error range is a measure of the spread of values in a collection of data. For instance, if the quantities of *newspaper* were found to be nearly the same in each of the 421 samples collected for this study, the result would be a very narrow error range. By contrast, if some samples were comprised of 75% *newspaper* and others were 0% *newspaper,* the results would show a much broader error

Another way to interpret the 90% confidence interval is this: If the County completed this study 100 times the *unpackaged/scrap vegetative food* mean composition would fall between 6.6% and 8.0% 90 times.

Material Type	Estimated Percent	+ / -
Unpackaged/Scrap Vegetative Food	7.3%	0.7%

Table 44. Detailed Composition, Overall Disposed Waste, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**16.8%**		**141,366**	**Metal**	**4.7%**		**39,280**
Newspaper (ONP)	1.5%	0.2%	12,962	Aluminum Cans	0.3%	0.0%	2,582
Plain Corrugated Cardboard (OCC)	3.1%	0.3%	26,112	Other Aluminum	0.2%	0.0%	1,647
Waxed Corrugated Cardboard (OCC)	0.2%	0.1%	1,797	Tinned Food Cans	0.5%	0.1%	4,002
Low Grade Recyclable Paper	3.7%	0.4%	31,132	Other Ferrous	1.2%	0.3%	9,745
High Grade Paper	0.8%	0.1%	6,726	Other Non-Ferrous	0.8%	0.3%	7,134
Single Use Food Service Compostable Paper	1.3%	0.1%	10,670	Mixed Metals (items <20% non-metal)	0.7%	0.2%	5,744
Other Compostable Paper	4.0%	0.4%	33,530	Other Mixed Metals (items >20% non-metal)	1.0%	0.5%	8,248
Other Paper	2.2%	0.4%	18,437	Compressed Gas Cylinders	0.0%	0.0%	178
Plastic	**12.2%**		**102,943**	**Glass**	**2.7%**		**22,379**
PET Bottles	0.5%	0.0%	4,045	Clear Glass Containers	0.8%	0.1%	6,820
Other PET Containers	0.4%	0.1%	3,043	Green Glass Containers	0.4%	0.1%	3,523
HDPE Bottles	0.3%	0.0%	2,449	Brown Glass Containers	0.6%	0.1%	5,108
Other HDPE Containers	0.2%	0.1%	1,930	Kitchenware/Ceramics	0.2%	0.1%	1,786
Other #3-#7 Packaging	0.3%	0.0%	2,655	Other Glass	0.6%	0.2%	5,143
Compostable Plastics	0.0%	0.0%	151				
Expanded Polystyrene Single-serve Food Packaging	0.3%	0.1%	2,832	**Electronics**	**0.5%**		**4,096**
Other Expanded Polystyrene Packaging	0.2%	0.1%	1,771	Small Household Appliances	0.2%	0.2%	2,008
Expanded Polystyrene Products	0.1%	0.1%	724	A/V Equipment	0.0%	0.0%	194
Recyclable Plastic Bags	0.5%	0.1%	4,169	Printers/Copiers/Fax Machines	0.1%	0.1%	530
Non-industrial Packaging Film Plastic	2.1%	0.2%	18,082	CPU's	0.0%	0.0%	123
Industrial Packaging Film Plastic	1.5%	0.6%	12,602	Computer Peripherals	0.0%	0.0%	66
Plastic Garbage Bags	2.2%	0.2%	18,413	CRT Computer Monitors & Televisions	0.0%	0.1%	407
Plastic Film Products	0.1%	0.1%	1,221	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.3%	0.1%	2,143	Laptops	0.0%	0.0%	169
Single Resin Plastic Products	1.1%	0.2%	8,887	Cell Phones	0.0%	0.0%	10
Mixed Resin Plastic Products	0.3%	0.2%	2,726	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.1%	0.1%	1,182	Other Electronics	0.1%	0.0%	590
Carpet Padding	0.5%	0.3%	3,948				
Plastic and Other Materials	1.2%	0.2%	9,971	**Other Wastes**	**9.9%**		**83,485**
				C&D Wastes	2.6%	0.7%	22,185
Food	**20.6%**		**173,236**	Asphalt Shingles	0.4%	0.3%	3,002
Packaged Vegetative Food	5.1%	0.4%	42,906	Ash	0.0%	0.0%	49
Unpackaged/Scrap Vegetative Food	7.7%	0.6%	65,055	Nondistinct Fines	0.6%	0.4%	5,005
Packaged Non-vegetative Food	3.3%	0.4%	28,098	Gypsum Wallboard	1.8%	0.6%	14,797
Unpackaged/Scrap Non-vegetative Food	4.4%	0.5%	37,178	Furniture	1.5%	0.7%	12,788
				Mattresses	1.0%	0.5%	8,251
Wood/Yard	**16.8%**		**141,429**	Carpet	1.6%	0.7%	13,830
Dimensional Lumber	6.0%	1.0%	50,389	Miscellaneous Inorganics	0.4%	0.3%	3,577
Treated Wood	2.0%	0.8%	16,440				
Contaminated Wood	3.0%	0.8%	24,900	**HHW/Special**	**0.7%**		**5,557**
Roofing and Siding Wood	0.4%	0.4%	3,290	Used Oil	0.0%	0.0%	23
Stumps	0.0%	0.0%	374	Vehicle Batteries	0.0%	0.0%	1
Large Prunings	0.3%	0.3%	2,408	Household Batteries	0.0%	0.0%	138
Yard Waste	4.1%	0.9%	34,801	Latex Paint	0.1%	0.1%	965
Other Wood	1.0%	0.5%	8,827	Oil-based Paint	0.0%	0.0%	56
				Solvents and Thinners	0.0%	0.0%	20
Other Organics	**15.3%**		**129,183**	Adhesives and Glue	0.1%	0.1%	541
Textiles: Clothes	2.2%	0.3%	18,376	Cleaners and Corrosives	0.0%	0.0%	103
Other Textiles	0.9%	0.2%	7,490	Pesticides and Herbicides	0.0%	0.0%	224
Disposable Diapers	5.6%	0.6%	47,083	Gasoline and Fuel Oil	0.0%	0.0%	2
Rubber Products	0.5%	0.2%	4,543	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.1%	667	Medical Waste	0.4%	0.2%	2,974
Animal Carcasses	0.5%	0.3%	4,280	Pharmaceuticals and Vitamins	0.0%	0.0%	117
Animal Feces	4.9%	0.6%	41,555	Compact Fluorescent Bulbs	0.0%	0.0%	40
Miscellaneous Organics	0.6%	0.1%	5,188	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	14
				Other Hazardous Waste	0.0%	0.0%	340
Sample Count	**421**			**Totals**	**100.0%**		**842,953**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 45. Detailed Composition, Residential Substreams, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**13.2%**		**70,550**	**Metal**	**4.8%**		**25,933**
Newspaper (ONP)	1.5%	0.2%	7,865	Aluminum Cans	0.3%	0.0%	1,385
Plain Corrugated Cardboard (OCC)	2.3%	0.4%	12,215	Other Aluminum	0.2%	0.1%	1,169
Waxed Corrugated Cardboard (OCC)	0.1%	0.1%	498	Tinned Food Cans	0.4%	0.1%	2,335
Low Grade Recyclable Paper	3.3%	0.5%	17,483	Other Ferrous	0.9%	0.3%	4,936
High Grade Paper	0.6%	0.2%	3,239	Other Non-Ferrous	1.0%	0.4%	5,194
Single Use Food Service Compostable Paper	1.0%	0.1%	5,131	Mixed Metals (items <20% non-metal)	0.7%	0.3%	3,702
Other Compostable Paper	2.8%	0.4%	14,910	Other Mixed Metals (items >20% non-metal)	1.3%	0.8%	7,070
Other Paper	1.7%	0.6%	9,209	Compressed Gas Cylinders	0.0%	0.0%	142
Plastic	**11.0%**		**58,962**	**Glass**	**2.5%**		**13,433**
PET Bottles	0.4%	0.1%	2,235	Clear Glass Containers	0.8%	0.2%	4,064
Other PET Containers	0.3%	0.1%	1,667	Green Glass Containers	0.4%	0.1%	2,176
HDPE Bottles	0.3%	0.0%	1,368	Brown Glass Containers	0.6%	0.1%	3,074
Other HDPE Containers	0.2%	0.1%	1,303	Kitchenware/Ceramics	0.3%	0.1%	1,566
Other #3-#7 Packaging	0.3%	0.0%	1,417	Other Glass	0.5%	0.2%	2,552
Compostable Plastics	0.0%	0.0%	99				
Expanded Polystyrene Single-serve Food Packaging	0.3%	0.1%	1,521	**Electronics**	**0.5%**		**2,811**
Other Expanded Polystyrene Packaging	0.1%	0.0%	714	Small Household Appliances	0.2%	0.2%	950
Expanded Polystyrene Products	0.1%	0.1%	506	A/V Equipment	0.0%	0.1%	194
Recyclable Plastic Bags	0.5%	0.1%	2,681	Printers/Copiers/Fax Machines	0.1%	0.1%	530
Non-industrial Packaging Film Plastic	1.8%	0.2%	9,703	CPU's	0.0%	0.0%	123
Industrial Packaging Film Plastic	1.1%	0.9%	6,091	Computer Peripherals	0.0%	0.0%	66
Plastic Garbage Bags	1.6%	0.1%	8,755	CRT Computer Monitors & Televisions	0.1%	0.1%	330
Plastic Film Products	0.1%	0.1%	637	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.2%	0.1%	1,194	Laptops	0.0%	0.0%	73
Single Resin Plastic Products	1.1%	0.3%	6,069	Cell Phones	0.0%	0.0%	10
Mixed Resin Plastic Products	0.4%	0.2%	1,946	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.2%	0.2%	996	Other Electronics	0.1%	0.1%	536
Carpet Padding	0.6%	0.4%	3,271				
Plastic and Other Materials	1.3%	0.3%	6,787	**Other Wastes**	**11.7%**		**62,949**
				C&D Wastes	2.9%	1.0%	15,693
Food	**18.2%**		**97,355**	Asphalt Shingles	0.4%	0.4%	2,198
Packaged Vegetative Food	4.9%	0.5%	26,026	Ash	0.0%	0.0%	49
Unpackaged/Scrap Vegetative Food	7.0%	0.7%	37,524	Nondistinct Fines	0.6%	0.6%	3,184
Packaged Non-vegetative Food	2.8%	0.3%	14,789	Gypsum Wallboard	2.1%	0.9%	11,499
Unpackaged/Scrap Non-vegetative Food	3.5%	0.5%	19,016	Furniture	2.2%	1.1%	11,963
				Mattresses	1.2%	0.7%	6,532
Wood/Yard	**20.1%**		**107,430**	Carpet	1.6%	0.8%	8,493
Dimensional Lumber	6.9%	1.4%	37,184	Miscellaneous Inorganics	0.6%	0.4%	3,338
Treated Wood	2.8%	1.2%	14,848				
Contaminated Wood	3.7%	1.1%	20,083	**HHW/Special**	**0.4%**		**2,259**
Roofing and Siding Wood	0.5%	0.5%	2,647	Used Oil	0.0%	0.0%	19
Stumps	0.1%	0.1%	303	Vehicle Batteries	0.0%	0.0%	1
Large Prunings	0.4%	0.4%	2,284	Household Batteries	0.0%	0.0%	110
Yard Waste	4.3%	1.2%	23,176	Latex Paint	0.1%	0.1%	595
Other Wood	1.3%	0.7%	6,907	Oil-based Paint	0.0%	0.0%	47
				Solvents and Thinners	0.0%	0.0%	20
Other Organics	**17.6%**		**94,098**	Adhesives and Glue	0.1%	0.1%	469
Textiles: Clothes	2.2%	0.3%	11,880	Cleaners and Corrosives	0.0%	0.0%	94
Other Textiles	1.0%	0.3%	5,338	Pesticides and Herbicides	0.0%	0.0%	14
Disposable Diapers	6.8%	0.8%	36,200	Gasoline and Fuel Oil	0.0%	0.0%	2
Rubber Products	0.5%	0.2%	2,460	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.1%	335	Medical Waste	0.1%	0.1%	423
Animal Carcasses	0.5%	0.4%	2,565	Pharmaceuticals and Vitamins	0.0%	0.0%	79
Animal Feces	6.0%	0.8%	31,883	Compact Fluorescent Bulbs	0.0%	0.0%	32
Miscellaneous Organics	0.6%	0.2%	3,438	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	13
				Other Hazardous Waste	0.1%	0.0%	339
Sample Count	**240**			**Totals**	**100.0%**		**535,779**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 46. Detailed Composition, Nonresidential Substreams, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**23.1%**		**70,815**	**Metal**	**4.3%**		**13,347**
Newspaper (ONP)	1.7%	0.3%	5,098	Aluminum Cans	0.4%	0.1%	1,197
Plain Corrugated Cardboard (OCC)	4.5%	0.6%	13,897	Other Aluminum	0.2%	0.1%	479
Waxed Corrugated Cardboard (OCC)	0.4%	0.3%	1,299	Tinned Food Cans	0.5%	0.1%	1,667
Low Grade Recyclable Paper	4.4%	0.6%	13,649	Other Ferrous	1.6%	0.7%	4,809
High Grade Paper	1.1%	0.2%	3,487	Other Non-Ferrous	0.6%	0.4%	1,940
Single Use Food Service Compostable Paper	1.8%	0.3%	5,538	Mixed Metals (items <20% non-metal)	0.7%	0.3%	2,041
Other Compostable Paper	6.1%	0.8%	18,620	Other Mixed Metals (items >20% non-metal)	0.4%	0.2%	1,178
Other Paper	3.0%	0.6%	9,228	Compressed Gas Cylinders	0.0%	0.0%	36
Plastic	**14.3%**		**43,981**	**Glass**	**2.9%**		**8,947**
PET Bottles	0.6%	0.1%	1,810	Clear Glass Containers	0.9%	0.2%	2,756
Other PET Containers	0.4%	0.1%	1,375	Green Glass Containers	0.4%	0.1%	1,347
HDPE Bottles	0.4%	0.1%	1,080	Brown Glass Containers	0.7%	0.1%	2,033
Other HDPE Containers	0.2%	0.1%	627	Kitchenware/Ceramics	0.1%	0.1%	221
Other #3-#7 Packaging	0.4%	0.1%	1,238	Other Glass	0.8%	0.4%	2,590
Compostable Plastics	0.0%	0.0%	52				
Expanded Polystyrene Single-serve Food Packaging	0.4%	0.2%	1,311	**Electronics**	**0.4%**		**1,286**
Other Expanded Polystyrene Packaging	0.3%	0.2%	1,057	Small Household Appliances	0.3%	0.4%	1,058
Expanded Polystyrene Products	0.1%	0.0%	218	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.5%	0.1%	1,488	Printers/Copiers/Fax Machines	0.0%	0.0%	0
Non-industrial Packaging Film Plastic	2.7%	0.5%	8,378	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	2.1%	0.7%	6,511	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	3.1%	0.5%	9,657	CRT Computer Monitors & Televisions	0.0%	0.0%	77
Plastic Film Products	0.2%	0.1%	584	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.3%	0.1%	950	Laptops	0.0%	0.1%	97
Single Resin Plastic Products	0.9%	0.3%	2,818	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.3%	0.1%	780	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.1%	0.1%	186	Other Electronics	0.0%	0.0%	53
Carpet Padding	0.2%	0.2%	676				
Plastic and Other Materials	1.0%	0.2%	3,184	**Other Wastes**	**6.7%**		**20,536**
				C&D Wastes	2.1%	0.8%	6,492
Food	**24.7%**		**75,881**	Asphalt Shingles	0.3%	0.3%	805
Packaged Vegetative Food	5.5%	0.8%	16,880	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	9.0%	1.2%	27,531	Nondistinct Fines	0.6%	0.4%	1,821
Packaged Non-vegetative Food	4.3%	0.9%	13,309	Gypsum Wallboard	1.1%	0.6%	3,298
Unpackaged/Scrap Non-vegetative Food	5.9%	1.0%	18,162	Furniture	0.3%	0.3%	824
				Mattresses	0.6%	0.6%	1,719
Wood/Yard	**11.1%**		**33,998**	Carpet	1.7%	1.2%	5,337
Dimensional Lumber	4.3%	1.4%	13,205	Miscellaneous Inorganics	0.1%	0.1%	239
Treated Wood	0.5%	0.2%	1,592				
Contaminated Wood	1.6%	0.6%	4,817	**HHW/Special**	**1.1%**		**3,298**
Roofing and Siding Wood	0.2%	0.2%	644	Used Oil	0.0%	0.0%	4
Stumps	0.0%	0.0%	72	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	0.0%	0.0%	124	Household Batteries	0.0%	0.0%	28
Yard Waste	3.8%	1.3%	11,625	Latex Paint	0.1%	0.1%	369
Other Wood	0.6%	0.6%	1,919	Oil-based Paint	0.0%	0.0%	8
				Solvents and Thinners	0.0%	0.0%	0
Other Organics	**11.4%**		**35,085**	Adhesives and Glue	0.0%	0.0%	72
Textiles: Clothes	2.1%	0.4%	6,496	Cleaners and Corrosives	0.0%	0.0%	9
Other Textiles	0.7%	0.2%	2,152	Pesticides and Herbicides	0.1%	0.1%	210
Disposable Diapers	3.5%	0.9%	10,883	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.7%	0.3%	2,084	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.1%	332	Medical Waste	0.8%	0.6%	2,551
Animal Carcasses	0.6%	0.6%	1,715	Pharmaceuticals and Vitamins	0.0%	0.0%	37
Animal Feces	3.1%	0.8%	9,673	Compact Fluorescent Bulbs	0.0%	0.0%	8
Miscellaneous Organics	0.6%	0.2%	1,750	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	0
				Other Hazardous Waste	0.0%	0.0%	1
Sample Count	**181**			**Totals**	**100.0%**		**307,174**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 47. Detailed Composition, Commercially Collected Substreams, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**20.1%**		**124,534**	**Metal**	**3.9%**		**23,822**
Newspaper (ONP)	1.9%	0.2%	11,698	Aluminum Cans	0.4%	0.1%	2,402
Plain Corrugated Cardboard (OCC)	3.5%	0.4%	21,350	Other Aluminum	0.2%	0.0%	1,336
Waxed Corrugated Cardboard (OCC)	0.3%	0.1%	1,689	Tinned Food Cans	0.6%	0.1%	3,696
Low Grade Recyclable Paper	4.2%	0.4%	26,256	Other Ferrous	0.9%	0.3%	5,564
High Grade Paper	1.0%	0.2%	6,235	Other Non-Ferrous	0.5%	0.2%	2,907
Single Use Food Service Compostable Paper	1.7%	0.2%	10,214	Mixed Metals (items <20% non-metal)	0.4%	0.2%	2,666
Other Compostable Paper	5.1%	0.5%	31,436	Other Mixed Metals (items >20% non-metal)	0.8%	0.7%	5,104
Other Paper	2.5%	0.5%	15,655	Compressed Gas Cylinders	0.0%	0.0%	147
Plastic	**13.8%**		**85,600**	**Glass**	**3.1%**		**18,910**
PET Bottles	0.6%	0.1%	3,823	Clear Glass Containers	1.0%	0.2%	6,341
Other PET Containers	0.4%	0.1%	2,766	Green Glass Containers	0.5%	0.1%	3,376
HDPE Bottles	0.4%	0.1%	2,229	Brown Glass Containers	0.8%	0.1%	4,659
Other HDPE Containers	0.2%	0.0%	1,064	Kitchenware/Ceramics	0.2%	0.1%	1,455
Other #3-#7 Packaging	0.4%	0.1%	2,469	Other Glass	0.5%	0.2%	3,078
Compostable Plastics	0.0%	0.0%	140				
Expanded Polystyrene Single-serve Food Packaging	0.4%	0.1%	2,755	**Electronics**	**0.5%**		**2,803**
Other Expanded Polystyrene Packaging	0.3%	0.1%	1,623	Small Household Appliances	0.3%	0.2%	1,679
Expanded Polystyrene Products	0.1%	0.1%	656	A/V Equipment	0.0%	0.1%	194
Recyclable Plastic Bags	0.6%	0.1%	3,793	Printers/Copiers/Fax Machines	0.1%	0.1%	480
Non-industrial Packaging Film Plastic	2.7%	0.3%	16,900	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	1.6%	0.7%	10,194	Computer Peripherals	0.0%	0.0%	66
Plastic Garbage Bags	2.8%	0.3%	17,436	CRT Computer Monitors & Televisions	0.0%	0.0%	77
Plastic Film Products	0.2%	0.1%	1,131	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.3%	0.1%	1,873	Laptops	0.0%	0.0%	128
Single Resin Plastic Products	0.9%	0.2%	5,292	Cell Phones	0.0%	0.0%	10
Mixed Resin Plastic Products	0.3%	0.1%	1,553	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.2%	0.1%	1,015	Other Electronics	0.0%	0.0%	170
Carpet Padding	0.3%	0.3%	2,155				
Plastic and Other Materials	1.1%	0.2%	6,732	**Other Wastes**	**4.0%**		**24,446**
				C&D Wastes	1.3%	0.5%	7,996
Food	**26.9%**		**166,486**	Asphalt Shingles	0.1%	0.1%	346
Packaged Vegetative Food	6.6%	0.6%	40,787	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	10.1%	0.8%	62,558	Nondistinct Fines	0.4%	0.2%	2,219
Packaged Non-vegetative Food	4.4%	0.5%	27,092	Gypsum Wallboard	0.6%	0.4%	3,828
Unpackaged/Scrap Non-vegetative Food	5.8%	0.6%	36,048	Furniture	0.1%	0.1%	738
				Mattresses	0.3%	0.3%	1,645
Wood/Yard	**8.0%**		**49,325**	Carpet	1.0%	0.7%	6,428
Dimensional Lumber	2.4%	0.8%	14,971	Miscellaneous Inorganics	0.2%	0.1%	1,247
Treated Wood	0.7%	0.7%	4,319				
Contaminated Wood	1.0%	0.6%	5,935	**HHW/Special**	**0.8%**		**4,673**
Roofing and Siding Wood	0.1%	0.1%	409	Used Oil	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Vehicle Batteries	0.0%	0.0%	1
Large Prunings	0.0%	0.0%	221	Household Batteries	0.0%	0.0%	109
Yard Waste	3.2%	0.8%	19,641	Latex Paint	0.1%	0.1%	831
Other Wood	0.6%	0.4%	3,829	Oil-based Paint	0.0%	0.0%	8
				Solvents and Thinners	0.0%	0.0%	20
Other Organics	**19.0%**		**117,535**	Adhesives and Glue	0.0%	0.0%	30
Textiles: Clothes	2.5%	0.3%	15,561	Cleaners and Corrosives	0.0%	0.0%	56
Other Textiles	1.0%	0.2%	5,918	Pesticides and Herbicides	0.0%	0.1%	224
Disposable Diapers	7.3%	0.9%	45,365	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.7%	0.3%	4,116	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.1%	354	Medical Waste	0.5%	0.3%	2,974
Animal Carcasses	0.7%	0.4%	4,235	Pharmaceuticals and Vitamins	0.0%	0.0%	110
Animal Feces	6.0%	0.7%	37,255	Compact Fluorescent Bulbs	0.0%	0.0%	22
Miscellaneous Organics	0.8%	0.2%	4,733	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	6
				Other Hazardous Waste	0.0%	0.0%	281
Sample Count	**261**			**Totals**	**100.0%**		**618,133**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 48. Detailed Composition, Commercially Collected Residential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**16.9%**		**55,117**	**Metal**	**3.9%**		**12,773**
Newspaper (ONP)	2.1%	0.3%	6,691	Aluminum Cans	0.4%	0.1%	1,213
Plain Corrugated Cardboard (OCC)	2.5%	0.5%	8,085	Other Aluminum	0.3%	0.1%	885
Waxed Corrugated Cardboard (OCC)	0.1%	0.1%	441	Tinned Food Cans	0.6%	0.1%	2,057
Low Grade Recyclable Paper	3.9%	0.5%	12,691	Other Ferrous	0.5%	0.2%	1,622
High Grade Paper	0.8%	0.2%	2,748	Other Non-Ferrous	0.5%	0.3%	1,667
Single Use Food Service Compostable Paper	1.4%	0.2%	4,695	Mixed Metals (items <20% non-metal)	0.4%	0.2%	1,279
Other Compostable Paper	4.0%	0.5%	12,899	Other Mixed Metals (items >20% non-metal)	1.2%	1.3%	3,940
Other Paper	2.1%	0.7%	6,868	Compressed Gas Cylinders	0.0%	0.0%	111
Plastic	**13.1%**		**42,657**	**Glass**	**3.3%**		**10,879**
PET Bottles	0.6%	0.1%	2,022	Clear Glass Containers	1.1%	0.3%	3,604
Other PET Containers	0.4%	0.1%	1,398	Green Glass Containers	0.6%	0.2%	2,034
HDPE Bottles	0.4%	0.1%	1,190	Brown Glass Containers	0.8%	0.2%	2,630
Other HDPE Containers	0.1%	0.0%	446	Kitchenware/Ceramics	0.4%	0.2%	1,235
Other #3-#7 Packaging	0.4%	0.1%	1,242	Other Glass	0.4%	0.2%	1,377
Compostable Plastics	0.0%	0.0%	89				
Expanded Polystyrene Single-serve Food Packaging	0.4%	0.1%	1,446	**Electronics**	**0.5%**		**1,575**
Other Expanded Polystyrene Packaging	0.2%	0.1%	581	Small Household Appliances	0.2%	0.2%	678
Expanded Polystyrene Products	0.1%	0.2%	438	A/V Equipment	0.1%	0.1%	194
Recyclable Plastic Bags	0.7%	0.1%	2,342	Printers/Copiers/Fax Machines	0.1%	0.1%	480
Non-industrial Packaging Film Plastic	2.6%	0.3%	8,620	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	1.2%	1.3%	4,004	Computer Peripherals	0.0%	0.0%	66
Plastic Garbage Bags	2.4%	0.2%	7,853	CRT Computer Monitors & Televisions	0.0%	0.0%	0
Plastic Film Products	0.2%	0.1%	547	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.3%	0.1%	951	Laptops	0.0%	0.0%	32
Single Resin Plastic Products	0.8%	0.2%	2,671	Cell Phones	0.0%	0.0%	10
Mixed Resin Plastic Products	0.2%	0.2%	806	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.3%	0.3%	829	Other Electronics	0.0%	0.0%	116
Carpet Padding	0.5%	0.6%	1,478				
Plastic and Other Materials	1.1%	0.2%	3,704	**Other Wastes**	**2.3%**		**7,603**
				C&D Wastes	0.8%	0.8%	2,631
Food	**27.9%**		**90,925**	Asphalt Shingles	0.0%	0.1%	107
Packaged Vegetative Food	7.4%	0.7%	23,960	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	10.8%	1.0%	35,170	Nondistinct Fines	0.1%	0.1%	428
Packaged Non-vegetative Food	4.2%	0.6%	13,820	Gypsum Wallboard	0.4%	0.4%	1,301
Unpackaged/Scrap Non-vegetative Food	5.5%	0.8%	17,975	Furniture	0.1%	0.2%	371
				Mattresses	0.1%	0.1%	194
Wood/Yard	**6.0%**		**19,592**	Carpet	0.5%	0.6%	1,563
Dimensional Lumber	1.1%	0.9%	3,695	Miscellaneous Inorganics	0.3%	0.2%	1,007
Treated Wood	1.0%	1.3%	3,284				
Contaminated Wood	0.7%	1.0%	2,438	**HHW/Special**	**0.4%**		**1,450**
Roofing and Siding Wood	0.0%	0.0%	0	Used Oil	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Vehicle Batteries	0.0%	0.0%	1
Large Prunings	0.0%	0.0%	97	Household Batteries	0.0%	0.0%	82
Yard Waste	2.5%	0.8%	8,053	Latex Paint	0.1%	0.1%	462
Other Wood	0.6%	0.6%	2,025	Oil-based Paint	0.0%	0.0%	0
				Solvents and Thinners	0.0%	0.0%	20
Other Organics	**25.5%**		**82,889**	Adhesives and Glue	0.0%	0.0%	30
Textiles: Clothes	2.9%	0.4%	9,296	Cleaners and Corrosives	0.0%	0.0%	48
Other Textiles	1.2%	0.4%	3,880	Pesticides and Herbicides	0.0%	0.0%	14
Disposable Diapers	10.6%	1.4%	34,494	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.6%	0.4%	2,084	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.0%	0.0%	22	Medical Waste	0.1%	0.1%	423
Animal Carcasses	0.8%	0.6%	2,520	Pharmaceuticals and Vitamins	0.0%	0.0%	73
Animal Feces	8.5%	1.1%	27,582	Compact Fluorescent Bulbs	0.0%	0.0%	13
Miscellaneous Organics	0.9%	0.3%	3,011	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	5
				Other Hazardous Waste	0.1%	0.1%	280
Sample Count	**107**			**Totals**	**100.0%**		**325,459**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Figure 29. Waste Recoverability, Commercially Collected Single Family Residential Substream, 2015

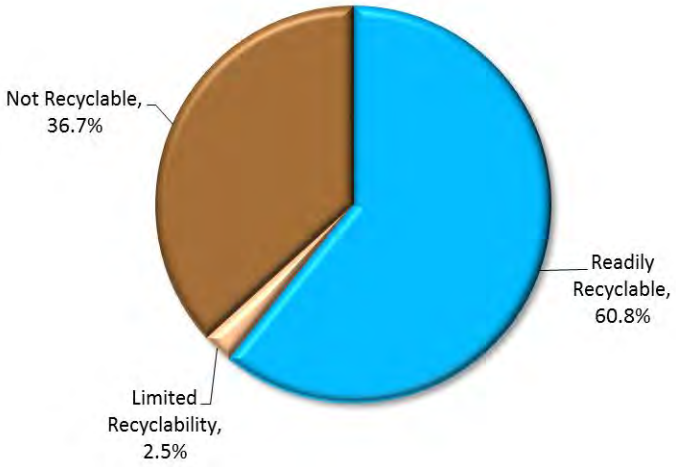


Figure 30. Waste Composition, Commercially Collected Single Family Residential Substream, 2015

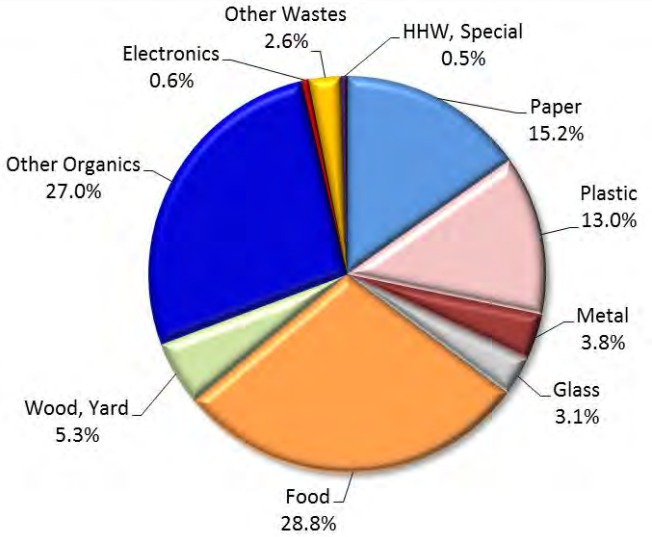


Table 49. Ten Most Prevalent Disposed Materials, Commercially Collected Single Family Residential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Disposable Diapers	11.3%	11.3%	22,114
Unpackaged/Scrap Vegetative Food	10.8%	22.1%	21,103
Animal Feces	9.4%	31.5%	18,395
Packaged Vegetative Food	7.5%	39.0%	14,608
Unpackaged/Scrap Non-vegetative Food	5.9%	44.9%	11,631
Packaged Non-vegetative Food	4.6%	49.6%	9,031
Other Compostable Paper	3.5%	53.1%	6,922
Low Grade Recyclable Paper	3.5%	56.6%	6,842
Non-industrial Packaging Film Plastic	2.8%	59.4%	5,568
Yard Waste	2.7%	62.1%	5,230
Subtotal	***62.1%***		***121,444***
All other materials	37.9%		74,047
Total	**100.0%**		**195,491**

Table 50. Detailed Composition, Commercially Collected Single Family Residential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**15.2%**		**29,809**	**Metal**	**3.8%**		**7,348**
Newspaper (ONP)	2.1%	0.4%	4,060	Aluminum Cans	0.3%	0.1%	634
Plain Corrugated Cardboard (OCC)	1.7%	0.3%	3,304	Other Aluminum	0.3%	0.1%	541
Waxed Corrugated Cardboard (OCC)	0.1%	0.1%	264	Tinned Food Cans	0.6%	0.1%	1,189
Low Grade Recyclable Paper	3.5%	0.6%	6,842	Other Ferrous	0.4%	0.1%	808
High Grade Paper	0.8%	0.2%	1,632	Other Non-Ferrous	0.2%	0.1%	340
Single Use Food Service Compostable Paper	1.3%	0.2%	2,540	Mixed Metals (items <20% non-metal)	0.3%	0.1%	662
Other Compostable Paper	3.5%	0.5%	6,922	Other Mixed Metals (items >20% non-metal)	1.6%	2.1%	3,062
Other Paper	2.2%	1.0%	4,246	Compressed Gas Cylinders	0.1%	0.1%	111
Plastic	**13.0%**		**25,428**	**Glass**	**3.1%**		**6,148**
PET Bottles	0.5%	0.1%	993	Clear Glass Containers	1.0%	0.4%	2,019
Other PET Containers	0.4%	0.1%	771	Green Glass Containers	0.6%	0.2%	1,231
HDPE Bottles	0.3%	0.1%	519	Brown Glass Containers	0.7%	0.2%	1,290
Other HDPE Containers	0.1%	0.0%	247	Kitchenware/Ceramics	0.4%	0.3%	739
Other #3-#7 Packaging	0.3%	0.1%	666	Other Glass	0.4%	0.2%	868
Compostable Plastics	0.0%	0.0%	51				
Expanded Polystyrene Single-serve Food Packaging	0.5%	0.2%	882	**Electronics**	**0.6%**		**1,184**
Other Expanded Polystyrene Packaging	0.2%	0.0%	294	Small Household Appliances	0.2%	0.2%	319
Expanded Polystyrene Products	0.0%	0.0%	26	A/V Equipment	0.1%	0.2%	194
Recyclable Plastic Bags	0.6%	0.1%	1,227	Printers/Copiers/Fax Machines	0.2%	0.2%	480
Non-industrial Packaging Film Plastic	2.8%	0.4%	5,568	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	1.7%	2.1%	3,327	Computer Peripherals	0.0%	0.0%	66
Plastic Garbage Bags	2.4%	0.3%	4,624	CRT Computer Monitors & Televisions	0.0%	0.0%	0
Plastic Film Products	0.2%	0.1%	334	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.4%	0.2%	723	Laptops	0.0%	0.0%	0
Single Resin Plastic Products	0.8%	0.3%	1,547	Cell Phones	0.0%	0.0%	10
Mixed Resin Plastic Products	0.3%	0.3%	527	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.3%	0.4%	626	Other Electronics	0.1%	0.1%	116
Carpet Padding	0.1%	0.1%	182				
Plastic and Other Materials	1.2%	0.3%	2,296	**Other Wastes**	**2.6%**		**5,142**
				C&D Wastes	1.0%	1.2%	2,048
Food	**28.8%**		**56,372**	Asphalt Shingles	0.1%	0.1%	107
Packaged Vegetative Food	7.5%	0.7%	14,608	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	10.8%	1.1%	21,103	Nondistinct Fines	0.2%	0.2%	428
Packaged Non-vegetative Food	4.6%	0.7%	9,031	Gypsum Wallboard	0.6%	0.6%	1,151
Unpackaged/Scrap Non-vegetative Food	5.9%	1.0%	11,631	Furniture	0.2%	0.3%	371
				Mattresses	0.0%	0.0%	0
Wood/Yard	**5.3%**		**10,337**	Carpet	0.2%	0.1%	374
Dimensional Lumber	0.6%	0.3%	1,140	Miscellaneous Inorganics	0.3%	0.3%	664
Treated Wood	1.5%	2.1%	2,884				
Contaminated Wood	0.2%	0.1%	402	**HHW/Special**	**0.5%**		**896**
Roofing and Siding Wood	0.0%	0.0%	0	Used Oil	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Vehicle Batteries	0.0%	0.0%	1
Large Prunings	0.0%	0.1%	97	Household Batteries	0.0%	0.0%	68
Yard Waste	2.7%	1.0%	5,230	Latex Paint	0.2%	0.2%	462
Other Wood	0.3%	0.2%	584	Oil-based Paint	0.0%	0.0%	0
				Solvents and Thinners	0.0%	0.0%	3
Other Organics	**27.0%**		**52,827**	Adhesives and Glue	0.0%	0.0%	29
Textiles: Clothes	2.5%	0.4%	4,967	Cleaners and Corrosives	0.0%	0.0%	21
Other Textiles	0.9%	0.3%	1,763	Pesticides and Herbicides	0.0%	0.0%	14
Disposable Diapers	11.3%	1.8%	22,114	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.7%	0.6%	1,384	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.0%	0.0%	22	Medical Waste	0.0%	0.0%	26
Animal Carcasses	1.0%	0.9%	1,923	Pharmaceuticals and Vitamins	0.0%	0.0%	65
Animal Feces	9.4%	1.3%	18,395	Compact Fluorescent Bulbs	0.0%	0.0%	13
Miscellaneous Organics	1.2%	0.4%	2,258	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	4
				Other Hazardous Waste	0.1%	0.1%	191
Sample Count	**78**			**Totals**	**100.0%**		**195,491**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Figure 31. Waste Recoverability, Commercially Collected Multifamily Residential Substream, 2015

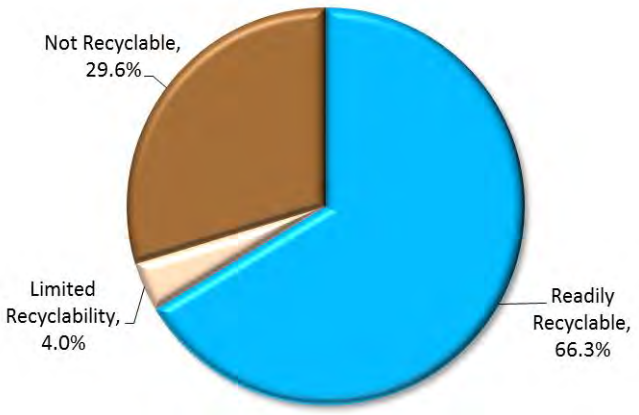


Figure 32. Waste Composition, Commercially Collected Multifamily Residential Substream, 2015

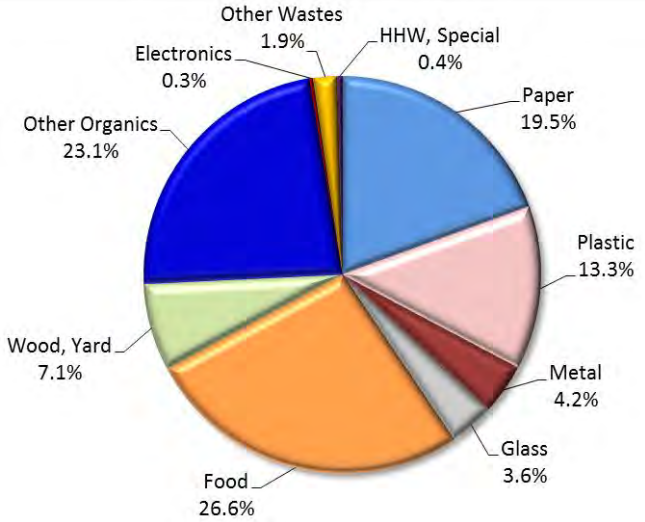


Table 51. Ten Most Prevalent Disposed Materials, Commercially Collected Multifamily Residential Substream, 2015

Material	Estimated Percent	Cumulative Percent	Estimated Tons
Unpackaged/Scrap Vegetative Food	10.8%	10.8%	14,068
Disposable Diapers	9.5%	20.3%	12,380
Packaged Vegetative Food	7.2%	27.5%	9,352
Animal Feces	7.1%	34.6%	9,187
Unpackaged/Scrap Non-vegetative Food	4.9%	39.5%	6,344
Other Compostable Paper	4.6%	44.1%	5,977
Low Grade Recyclable Paper	4.5%	48.6%	5,849
Packaged Non-vegetative Food	3.7%	52.3%	4,789
Plain Corrugated Cardboard (OCC)	3.7%	56.0%	4,781
Textiles: Clothes	3.3%	59.3%	4,329
Subtotal	***59.3%***		***77,055***
All other materials	40.7%		52,913
Total	**100.0%**		**129,968**

Table 52. Detailed Composition, Commercially Collected Multifamily Residential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**19.5%**		**25,308**	**Metal**	**4.2%**		**5,425**
Newspaper (ONP)	2.0%	0.5%	2,631	Aluminum Cans	0.4%	0.1%	579
Plain Corrugated Cardboard (OCC)	3.7%	1.1%	4,781	Other Aluminum	0.3%	0.1%	344
Waxed Corrugated Cardboard (OCC)	0.1%	0.1%	177	Tinned Food Cans	0.7%	0.3%	867
Low Grade Recyclable Paper	4.5%	0.7%	5,849	Other Ferrous	0.6%	0.4%	814
High Grade Paper	0.9%	0.4%	1,116	Other Non-Ferrous	1.0%	0.6%	1,326
Single Use Food Service Compostable Paper	1.7%	0.4%	2,155	Mixed Metals (items <20% non-metal)	0.5%	0.4%	617
Other Compostable Paper	4.6%	1.1%	5,977	Other Mixed Metals (items >20% non-metal)	0.7%	0.7%	877
Other Paper	2.0%	1.0%	2,622	Compressed Gas Cylinders	0.0%	0.0%	0
Plastic	**13.3%**		**17,229**	**Glass**	**3.6%**		**4,731**
PET Bottles	0.8%	0.2%	1,029	Clear Glass Containers	1.2%	0.4%	1,585
Other PET Containers	0.5%	0.1%	627	Green Glass Containers	0.6%	0.3%	802
HDPE Bottles	0.5%	0.1%	671	Brown Glass Containers	1.0%	0.4%	1,340
Other HDPE Containers	0.2%	0.1%	199	Kitchenware/Ceramics	0.4%	0.3%	495
Other #3-#7 Packaging	0.4%	0.1%	576	Other Glass	0.4%	0.3%	509
Compostable Plastics	0.0%	0.0%	38				
Expanded Polystyrene Single-serve Food Packaging	0.4%	0.1%	564	**Electronics**	**0.3%**		**390**
Other Expanded Polystyrene Packaging	0.2%	0.1%	287	Small Household Appliances	0.3%	0.5%	359
Expanded Polystyrene Products	0.3%	0.4%	412	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.9%	0.2%	1,114	Printers/Copiers/Fax Machines	0.0%	0.0%	0
Non-industrial Packaging Film Plastic	2.3%	0.4%	3,053	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	0.5%	0.3%	677	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	2.5%	0.4%	3,230	CRT Computer Monitors & Televisions	0.0%	0.0%	0
Plastic Film Products	0.2%	0.2%	214	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.2%	0.1%	229	Laptops	0.0%	0.0%	32
Single Resin Plastic Products	0.9%	0.4%	1,124	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.2%	0.2%	279	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.2%	0.2%	204	Other Electronics	0.0%	0.0%	0
Carpet Padding	1.0%	1.4%	1,296				
Plastic and Other Materials	1.1%	0.4%	1,408	**Other Wastes**	**1.9%**		**2,461**
				C&D Wastes	0.4%	0.5%	584
Food	**26.6%**		**34,553**	Asphalt Shingles	0.0%	0.0%	0
Packaged Vegetative Food	7.2%	1.4%	9,352	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	10.8%	2.0%	14,068	Nondistinct Fines	0.0%	0.0%	0
Packaged Non-vegetative Food	3.7%	0.9%	4,789	Gypsum Wallboard	0.1%	0.1%	150
Unpackaged/Scrap Non-vegetative Food	4.9%	1.2%	6,344	Furniture	0.0%	0.0%	0
				Mattresses	0.1%	0.2%	194
Wood/Yard	**7.1%**		**9,255**	Carpet	0.9%	1.4%	1,189
Dimensional Lumber	2.0%	2.2%	2,556	Miscellaneous Inorganics	0.3%	0.4%	344
Treated Wood	0.3%	0.3%	400				
Contaminated Wood	1.6%	2.4%	2,035	**HHW/Special**	**0.4%**		**554**
Roofing and Siding Wood	0.0%	0.0%	0	Used Oil	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	0.0%	0.0%	0	Household Batteries	0.0%	0.0%	14
Yard Waste	2.2%	1.3%	2,823	Latex Paint	0.0%	0.0%	0
Other Wood	1.1%	1.4%	1,441	Oil-based Paint	0.0%	0.0%	0
				Solvents and Thinners	0.0%	0.0%	17
Other Organics	**23.1%**		**30,062**	Adhesives and Glue	0.0%	0.0%	2
Textiles: Clothes	3.3%	0.9%	4,329	Cleaners and Corrosives	0.0%	0.0%	27
Other Textiles	1.6%	0.7%	2,117	Pesticides and Herbicides	0.0%	0.0%	0
Disposable Diapers	9.5%	2.2%	12,380	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.5%	0.4%	701	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.0%	0.0%	0	Medical Waste	0.3%	0.3%	397
Animal Carcasses	0.5%	0.6%	597	Pharmaceuticals and Vitamins	0.0%	0.0%	7
Animal Feces	7.1%	2.1%	9,187	Compact Fluorescent Bulbs	0.0%	0.0%	0
Miscellaneous Organics	0.6%	0.3%	752	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	2
				Other Hazardous Waste	0.1%	0.1%	89
Sample Count	**29**			**Totals**	**100.0%**		**129,968**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 53. Detailed Composition, Commercially Collected Nonresidential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**23.7%**		**69,417**	**Metal**	**3.8%**		**11,049**
Newspaper (ONP)	1.7%	0.3%	5,007	Aluminum Cans	0.4%	0.1%	1,189
Plain Corrugated Cardboard (OCC)	4.5%	0.7%	13,265	Other Aluminum	0.2%	0.1%	451
Waxed Corrugated Cardboard (OCC)	0.4%	0.3%	1,248	Tinned Food Cans	0.6%	0.1%	1,639
Low Grade Recyclable Paper	4.6%	0.6%	13,566	Other Ferrous	1.3%	0.6%	3,943
High Grade Paper	1.2%	0.3%	3,487	Other Non-Ferrous	0.4%	0.2%	1,241
Single Use Food Service Compostable Paper	1.9%	0.3%	5,519	Mixed Metals (items <20% non-metal)	0.5%	0.3%	1,387
Other Compostable Paper	6.3%	0.9%	18,537	Other Mixed Metals (items >20% non-metal)	0.4%	0.2%	1,164
Other Paper	3.0%	0.6%	8,787	Compressed Gas Cylinders	0.0%	0.0%	36
Plastic	**14.7%**		**42,944**	**Glass**	**2.7%**		**8,031**
PET Bottles	0.6%	0.1%	1,801	Clear Glass Containers	0.9%	0.2%	2,737
Other PET Containers	0.5%	0.1%	1,368	Green Glass Containers	0.5%	0.1%	1,343
HDPE Bottles	0.4%	0.1%	1,039	Brown Glass Containers	0.7%	0.2%	2,029
Other HDPE Containers	0.2%	0.1%	619	Kitchenware/Ceramics	0.1%	0.1%	221
Other #3-#7 Packaging	0.4%	0.1%	1,228	Other Glass	0.6%	0.3%	1,702
Compostable Plastics	0.0%	0.0%	51				
Expanded Polystyrene Single-serve Food Packaging	0.4%	0.2%	1,309	**Electronics**	**0.4%**		**1,228**
Other Expanded Polystyrene Packaging	0.4%	0.2%	1,043	Small Household Appliances	0.3%	0.4%	1,000
Expanded Polystyrene Products	0.1%	0.0%	218	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.5%	0.1%	1,451	Printers/Copiers/Fax Machines	0.0%	0.0%	0
Non-industrial Packaging Film Plastic	2.8%	0.5%	8,279	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	2.1%	0.7%	6,190	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	3.3%	0.5%	9,583	CRT Computer Monitors & Televisions	0.0%	0.0%	77
Plastic Film Products	0.2%	0.1%	584	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.3%	0.1%	922	Laptops	0.0%	0.1%	97
Single Resin Plastic Products	0.9%	0.3%	2,620	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.3%	0.2%	747	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.1%	0.1%	186	Other Electronics	0.0%	0.0%	53
Carpet Padding	0.2%	0.2%	676				
Plastic and Other Materials	1.0%	0.2%	3,029	**Other Wastes**	**5.8%**		**16,843**
				C&D Wastes	1.8%	0.8%	5,364
Food	**25.8%**		**75,561**	Asphalt Shingles	0.1%	0.1%	240
Packaged Vegetative Food	5.7%	0.9%	16,828	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	9.4%	1.3%	27,388	Nondistinct Fines	0.6%	0.5%	1,790
Packaged Non-vegetative Food	4.5%	1.0%	13,272	Gypsum Wallboard	0.9%	0.6%	2,526
Unpackaged/Scrap Non-vegetative Food	6.2%	1.0%	18,073	Furniture	0.1%	0.1%	367
				Mattresses	0.5%	0.6%	1,451
Wood/Yard	**10.2%**		**29,733**	Carpet	1.7%	1.2%	4,865
Dimensional Lumber	3.9%	1.4%	11,275	Miscellaneous Inorganics	0.1%	0.1%	239
Treated Wood	0.4%	0.2%	1,035				
Contaminated Wood	1.2%	0.5%	3,497	**HHW/Special**	**1.1%**		**3,223**
Roofing and Siding Wood	0.1%	0.2%	409	Used Oil	0.0%	0.0%	0
Stumps	0.0%	0.0%	0	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	0.0%	0.0%	124	Household Batteries	0.0%	0.0%	28
Yard Waste	4.0%	1.4%	11,588	Latex Paint	0.1%	0.1%	369
Other Wood	0.6%	0.6%	1,804	Oil-based Paint	0.0%	0.0%	8
				Solvents and Thinners	0.0%	0.0%	0
Other Organics	**11.8%**		**34,646**	Adhesives and Glue	0.0%	0.0%	0
Textiles: Clothes	2.1%	0.4%	6,265	Cleaners and Corrosives	0.0%	0.0%	9
Other Textiles	0.7%	0.2%	2,037	Pesticides and Herbicides	0.1%	0.1%	210
Disposable Diapers	3.7%	0.9%	10,871	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.7%	0.4%	2,031	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.1%	332	Medical Waste	0.9%	0.7%	2,551
Animal Carcasses	0.6%	0.6%	1,715	Pharmaceuticals and Vitamins	0.0%	0.0%	37
Animal Feces	3.3%	0.8%	9,673	Compact Fluorescent Bulbs	0.0%	0.0%	8
Miscellaneous Organics	0.6%	0.2%	1,722	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	0
				Other Hazardous Waste	0.0%	0.0%	1
Sample Count	**154**			**Totals**	**100.0%**		**292,674**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 54. Detailed Composition, Self-haul Substreams, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**7.5%**		**16,832**	**Metal**	**6.9%**		**15,458**
Newspaper (ONP)	0.6%	0.2%	1,264	Aluminum Cans	0.1%	0.0%	180
Plain Corrugated Cardboard (OCC)	2.1%	0.7%	4,762	Other Aluminum	0.1%	0.1%	312
Waxed Corrugated Cardboard (OCC)	0.0%	0.0%	107	Tinned Food Cans	0.1%	0.0%	306
Low Grade Recyclable Paper	2.2%	0.9%	4,876	Other Ferrous	1.9%	0.9%	4,180
High Grade Paper	0.2%	0.2%	491	Other Non-Ferrous	1.9%	1.0%	4,227
Single Use Food Service Compostable Paper	0.2%	0.1%	456	Mixed Metals (items <20% non-metal)	1.4%	0.8%	3,078
Other Compostable Paper	0.9%	0.3%	2,094	Other Mixed Metals (items >20% non-metal)	1.4%	0.6%	3,145
Other Paper	1.2%	0.8%	2,781	Compressed Gas Cylinders	0.0%	0.0%	31
Plastic	**7.7%**		**17,342**	**Glass**	**1.5%**		**3,470**
PET Bottles	0.1%	0.0%	222	Clear Glass Containers	0.2%	0.1%	479
Other PET Containers	0.1%	0.1%	277	Green Glass Containers	0.1%	0.0%	147
HDPE Bottles	0.1%	0.0%	219	Brown Glass Containers	0.2%	0.2%	449
Other HDPE Containers	0.4%	0.3%	865	Kitchenware/Ceramics	0.1%	0.1%	331
Other #3-#7 Packaging	0.1%	0.0%	186	Other Glass	0.9%	0.5%	2,064
Compostable Plastics	0.0%	0.0%	12				
Expanded Polystyrene Single-serve Food Packaging	0.0%	0.0%	77	**Electronics**	**0.6%**		**1,294**
Other Expanded Polystyrene Packaging	0.1%	0.0%	148	Small Household Appliances	0.1%	0.2%	330
Expanded Polystyrene Products	0.0%	0.0%	68	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.2%	0.1%	376	Printers/Copiers/Fax Machines	0.0%	0.0%	50
Non-industrial Packaging Film Plastic	0.5%	0.2%	1,182	CPU's	0.1%	0.1%	123
Industrial Packaging Film Plastic	1.1%	1.1%	2,408	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	0.4%	0.1%	976	CRT Computer Monitors & Televisions	0.1%	0.2%	330
Plastic Film Products	0.0%	0.0%	90	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.1%	0.1%	270	Laptops	0.0%	0.0%	41
Single Resin Plastic Products	1.6%	0.5%	3,595	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.5%	0.5%	1,172	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.1%	0.1%	167	Other Electronics	0.2%	0.2%	420
Carpet Padding	0.8%	0.7%	1,793				
Plastic and Other Materials	1.4%	0.7%	3,239	**Other Wastes**	**26.3%**		**59,039**
				C&D Wastes	6.3%	2.1%	14,189
Food	**3.0%**		**6,750**	Asphalt Shingles	1.2%	1.0%	2,656
Packaged Vegetative Food	0.9%	0.4%	2,118	Ash	0.0%	0.0%	49
Unpackaged/Scrap Vegetative Food	1.1%	0.5%	2,496	Nondistinct Fines	1.2%	1.4%	2,787
Packaged Non-vegetative Food	0.4%	0.2%	1,005	Gypsum Wallboard	4.9%	2.0%	10,970
Unpackaged/Scrap Non-vegetative Food	0.5%	0.2%	1,129	Furniture	5.4%	2.6%	12,050
				Mattresses	2.9%	1.6%	6,606
Wood/Yard	**41.0%**		**92,104**	Carpet	3.3%	1.9%	7,403
Dimensional Lumber	15.8%	3.1%	35,418	Miscellaneous Inorganics	1.0%	1.0%	2,330
Treated Wood	5.4%	2.1%	12,121				
Contaminated Wood	8.4%	2.4%	18,965	**HHW/Special**	**0.4%**		**884**
Roofing and Siding Wood	1.3%	1.3%	2,881	Used Oil	0.0%	0.0%	23
Stumps	0.2%	0.1%	374	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	1.0%	1.1%	2,186	Household Batteries	0.0%	0.0%	29
Yard Waste	6.7%	2.7%	15,160	Latex Paint	0.1%	0.1%	134
Other Wood	2.2%	1.4%	4,998	Oil-based Paint	0.0%	0.0%	47
				Solvents and Thinners	0.0%	0.0%	0
Other Organics	**5.2%**		**11,648**	Adhesives and Glue	0.2%	0.3%	511
Textiles: Clothes	1.3%	0.4%	2,816	Cleaners and Corrosives	0.0%	0.0%	47
Other Textiles	0.7%	0.3%	1,573	Pesticides and Herbicides	0.0%	0.0%	0
Disposable Diapers	0.8%	0.3%	1,718	Gasoline and Fuel Oil	0.0%	0.0%	2
Rubber Products	0.2%	0.1%	427	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.2%	313	Medical Waste	0.0%	0.0%	0
Animal Carcasses	0.0%	0.0%	45	Pharmaceuticals and Vitamins	0.0%	0.0%	7
Animal Feces	1.9%	0.8%	4,301	Compact Fluorescent Bulbs	0.0%	0.0%	18
Miscellaneous Organics	0.2%	0.1%	455	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	8
				Other Hazardous Waste	0.0%	0.0%	60
Sample Count	**160**			**Totals**	**100.0%**		**224,820**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 55. Detailed Composition, Self-haul Residential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**7.3%**		**15,433**	**Metal**	**6.3%**		**13,160**
Newspaper (ONP)	0.6%	0.2%	1,174	Aluminum Cans	0.1%	0.0%	172
Plain Corrugated Cardboard (OCC)	2.0%	0.6%	4,130	Other Aluminum	0.1%	0.1%	284
Waxed Corrugated Cardboard (OCC)	0.0%	0.0%	57	Tinned Food Cans	0.1%	0.0%	278
Low Grade Recyclable Paper	2.3%	1.0%	4,792	Other Ferrous	1.6%	0.8%	3,314
High Grade Paper	0.2%	0.2%	491	Other Non-Ferrous	1.7%	1.0%	3,528
Single Use Food Service Compostable Paper	0.2%	0.1%	437	Mixed Metals (items <20% non-metal)	1.2%	0.7%	2,423
Other Compostable Paper	1.0%	0.3%	2,011	Other Mixed Metals (items >20% non-metal)	1.5%	0.6%	3,130
Other Paper	1.1%	0.9%	2,341	Compressed Gas Cylinders	0.0%	0.0%	31
Plastic	**7.8%**		**16,305**	**Glass**	**1.2%**		**2,554**
PET Bottles	0.1%	0.0%	213	Clear Glass Containers	0.2%	0.1%	460
Other PET Containers	0.1%	0.1%	270	Green Glass Containers	0.1%	0.1%	143
HDPE Bottles	0.1%	0.0%	178	Brown Glass Containers	0.2%	0.2%	444
Other HDPE Containers	0.4%	0.3%	857	Kitchenware/Ceramics	0.2%	0.1%	331
Other #3-#7 Packaging	0.1%	0.0%	175	Other Glass	0.6%	0.4%	1,176
Compostable Plastics	0.0%	0.0%	10				
Expanded Polystyrene Single-serve Food Packaging	0.0%	0.0%	75	**Electronics**	**0.6%**		**1,236**
Other Expanded Polystyrene Packaging	0.1%	0.0%	133	Small Household Appliances	0.1%	0.2%	272
Expanded Polystyrene Products	0.0%	0.0%	68	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.2%	0.1%	339	Printers/Copiers/Fax Machines	0.0%	0.0%	50
Non-industrial Packaging Film Plastic	0.5%	0.2%	1,083	CPU's	0.1%	0.1%	123
Industrial Packaging Film Plastic	1.0%	1.2%	2,087	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	0.4%	0.1%	902	CRT Computer Monitors & Televisions	0.2%	0.3%	330
Plastic Film Products	0.0%	0.0%	90	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.1%	0.1%	242	Laptops	0.0%	0.0%	41
Single Resin Plastic Products	1.6%	0.6%	3,398	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.5%	0.5%	1,140	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.1%	0.1%	167	Other Electronics	0.2%	0.2%	420
Carpet Padding	0.9%	0.7%	1,793				
Plastic and Other Materials	1.5%	0.8%	3,083	**Other Wastes**	**26.3%**		**55,346**
				C&D Wastes	6.2%	2.2%	13,061
Food	**3.1%**		**6,429**	Asphalt Shingles	1.0%	1.0%	2,091
Packaged Vegetative Food	1.0%	0.4%	2,066	Ash	0.0%	0.0%	49
Unpackaged/Scrap Vegetative Food	1.1%	0.5%	2,353	Nondistinct Fines	1.3%	1.5%	2,756
Packaged Non-vegetative Food	0.5%	0.2%	969	Gypsum Wallboard	4.8%	2.1%	10,198
Unpackaged/Scrap Non-vegetative Food	0.5%	0.2%	1,040	Furniture	5.5%	2.8%	11,592
				Mattresses	3.0%	1.7%	6,338
Wood/Yard	**41.8%**		**87,838**	Carpet	3.3%	2.0%	6,930
Dimensional Lumber	15.9%	3.3%	33,488	Miscellaneous Inorganics	1.1%	1.0%	2,330
Treated Wood	5.5%	2.3%	11,563				
Contaminated Wood	8.4%	2.5%	17,645	**HHW/Special**	**0.4%**		**809**
Roofing and Siding Wood	1.3%	1.4%	2,647	Used Oil	0.0%	0.0%	19
Stumps	0.1%	0.1%	303	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	1.0%	1.1%	2,186	Household Batteries	0.0%	0.0%	29
Yard Waste	7.2%	2.9%	15,123	Latex Paint	0.1%	0.1%	134
Other Wood	2.3%	1.5%	4,883	Oil-based Paint	0.0%	0.0%	47
				Solvents and Thinners	0.0%	0.0%	0
Other Organics	**5.3%**		**11,209**	Adhesives and Glue	0.2%	0.3%	439
Textiles: Clothes	1.2%	0.4%	2,584	Cleaners and Corrosives	0.0%	0.0%	47
Other Textiles	0.7%	0.3%	1,458	Pesticides and Herbicides	0.0%	0.0%	0
Disposable Diapers	0.8%	0.4%	1,706	Gasoline and Fuel Oil	0.0%	0.0%	2
Rubber Products	0.2%	0.1%	375	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.1%	0.2%	313	Medical Waste	0.0%	0.0%	0
Animal Carcasses	0.0%	0.0%	45	Pharmaceuticals and Vitamins	0.0%	0.0%	7
Animal Feces	2.0%	0.9%	4,301	Compact Fluorescent Bulbs	0.0%	0.0%	18
Miscellaneous Organics	0.2%	0.1%	427	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	8
				Other Hazardous Waste	0.0%	0.0%	60
Sample Count	**133**			**Totals**	**100.0%**		**210,320**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Table 56. Detailed Composition, Self-haul Nonresidential Substream, 2015 Annual Tons

Material	Estimated Percent	+ / -	Estimated Tons	Material	Estimated Percent	+ / -	Estimated Tons
Paper	**9.6%**		**1,399**	**Metal**	**15.8%**		**2,298**
Newspaper (ONP)	0.6%	0.6%	90	Aluminum Cans	0.1%	0.1%	8
Plain Corrugated Cardboard (OCC)	4.4%	3.9%	631	Other Aluminum	0.2%	0.3%	28
Waxed Corrugated Cardboard (OCC)	0.3%	0.6%	50	Tinned Food Cans	0.2%	0.2%	27
Low Grade Recyclable Paper	0.6%	0.6%	83	Other Ferrous	6.0%	8.1%	866
High Grade Paper	0.0%	0.0%	0	Other Non-Ferrous	4.8%	7.4%	699
Single Use Food Service Compostable Paper	0.1%	0.2%	20	Mixed Metals (items <20% non-metal)	4.5%	4.6%	654
Other Compostable Paper	0.6%	0.8%	83	Other Mixed Metals (items >20% non-metal)	0.1%	0.1%	14
Other Paper	3.0%	4.1%	441	Compressed Gas Cylinders	0.0%	0.0%	0
Plastic	**7.2%**		**1,037**	**Glass**	**6.3%**		**916**
PET Bottles	0.1%	0.1%	8	Clear Glass Containers	0.1%	0.1%	18
Other PET Containers	0.0%	0.1%	7	Green Glass Containers	0.0%	0.1%	4
HDPE Bottles	0.3%	0.4%	41	Brown Glass Containers	0.0%	0.0%	4
Other HDPE Containers	0.1%	0.1%	8	Kitchenware/Ceramics	0.0%	0.0%	0
Other #3-#7 Packaging	0.1%	0.1%	11	Other Glass	6.1%	6.0%	888
Compostable Plastics	0.0%	0.0%	1				
Expanded Polystyrene Single-serve Food Packaging	0.0%	0.0%	2	**Electronics**	**0.4%**		**58**
Other Expanded Polystyrene Packaging	0.1%	0.1%	14	Small Household Appliances	0.4%	0.7%	58
Expanded Polystyrene Products	0.0%	0.0%	0	A/V Equipment	0.0%	0.0%	0
Recyclable Plastic Bags	0.3%	0.3%	37	Printers/Copiers/Fax Machines	0.0%	0.0%	0
Non-industrial Packaging Film Plastic	0.7%	0.6%	99	CPU's	0.0%	0.0%	0
Industrial Packaging Film Plastic	2.2%	3.2%	320	Computer Peripherals	0.0%	0.0%	0
Plastic Garbage Bags	0.5%	0.3%	74	CRT Computer Monitors & Televisions	0.0%	0.0%	0
Plastic Film Products	0.0%	0.0%	0	Other Computer Monitors & Televisions	0.0%	0.0%	0
Other Plastic Packaging	0.2%	0.3%	28	Laptops	0.0%	0.0%	0
Single Resin Plastic Products	1.4%	0.9%	197	Cell Phones	0.0%	0.0%	0
Mixed Resin Plastic Products	0.2%	0.4%	32	Tablets	0.0%	0.0%	0
Foam Rubber and Padding	0.0%	0.0%	0	Other Electronics	0.0%	0.0%	0
Carpet Padding	0.0%	0.0%	0				
Plastic and Other Materials	1.1%	1.0%	156	**Other Wastes**	**25.5%**		**3,693**
				C&D Wastes	7.8%	6.7%	1,128
Food	**2.2%**		**320**	Asphalt Shingles	3.9%	5.5%	565
Packaged Vegetative Food	0.4%	0.5%	52	Ash	0.0%	0.0%	0
Unpackaged/Scrap Vegetative Food	1.0%	1.5%	143	Nondistinct Fines	0.2%	0.4%	31
Packaged Non-vegetative Food	0.3%	0.4%	36	Gypsum Wallboard	5.3%	5.3%	772
Unpackaged/Scrap Non-vegetative Food	0.6%	1.0%	89	Furniture	3.2%	5.2%	457
				Mattresses	1.8%	2.1%	268
Wood/Yard	**29.4%**		**4,266**	Carpet	3.3%	4.5%	472
Dimensional Lumber	13.3%	8.1%	1,930	Miscellaneous Inorganics	0.0%	0.0%	0
Treated Wood	3.8%	3.2%	557				
Contaminated Wood	9.1%	6.7%	1,319	**HHW/Special**	**0.5%**		**75**
Roofing and Siding Wood	1.6%	2.0%	235	Used Oil	0.0%	0.0%	4
Stumps	0.5%	0.8%	72	Vehicle Batteries	0.0%	0.0%	0
Large Prunings	0.0%	0.0%	0	Household Batteries	0.0%	0.0%	0
Yard Waste	0.3%	0.3%	37	Latex Paint	0.0%	0.0%	0
Other Wood	0.8%	1.0%	115	Oil-based Paint	0.0%	0.0%	0
				Solvents and Thinners	0.0%	0.0%	0
Other Organics	**3.0%**		**439**	Adhesives and Glue	0.5%	0.8%	72
Textiles: Clothes	1.6%	1.8%	232	Cleaners and Corrosives	0.0%	0.0%	0
Other Textiles	0.8%	1.1%	115	Pesticides and Herbicides	0.0%	0.0%	0
Disposable Diapers	0.1%	0.1%	13	Gasoline and Fuel Oil	0.0%	0.0%	0
Rubber Products	0.4%	0.4%	52	Antifreeze/Brake Fluid	0.0%	0.0%	0
Tires	0.0%	0.0%	0	Medical Waste	0.0%	0.0%	0
Animal Carcasses	0.0%	0.0%	0	Pharmaceuticals and Vitamins	0.0%	0.0%	0
Animal Feces	0.0%	0.0%	0	Compact Fluorescent Bulbs	0.0%	0.0%	0
Miscellaneous Organics	0.2%	0.3%	27	Other Fluorescent Bulbs/Tubes	0.0%	0.0%	0
				Other Hazardous Waste	0.0%	0.0%	0
Sample Count	**27**			**Totals**	**100.0%**		**14,500**

Confidence intervals calculated at the 90% confidence level. Percentages for material types may not total 100% due to rounding.

Appendix E. Detailed Customer Survey Results

This appendix includes data tables intended to provide additional detail on the customer survey results presented in the main body of the report. In most cases, the tables in this appendix provide data for each facility individually instead of for all facilities combined as shown in the main body of the report.

Table 57. Detailed Reported Generator Type by Hauler Type and by Facility, 2015

Commercial haul, n=1064	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Residential	**9%**	**8%**	**0%**	**2%**	**7%**	**11%**	**8%**	**10%**	-	**0%**	**8%**
Single Family	6%	6%	0%	1%	5%	7%	5%	8%	-	0%	5%
Multifamily	3%	2%	0%	0%	2%	3%	2%	1%	-	0%	2%
Mixed Single Family & Multifamily Residential	0%	0%	0%	0%	1%	1%	1%	0%	-	0%	0%
Nonresidential	**13%**	**16%**	**0%**	**1%**	**10%**	**11%**	**5%**	**9%**	-	**0%**	**10%**
Mixed Residential and Nonresidential	**1%**	**2%**	**0%**	**0%**	**2%**	**2%**	**1%**	**0%**	-	**1%**	**1%**
Commercial Haul Subtotal	***22%***	***26%***	***0%***	***3%***	***20%***	***25%***	***13%***	***19%***	***0%***	***1%***	***19%***
No Response	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Self-haul, n=4466											
Residential	**68%**	**60%**	**97%**	**89%**	**69%**	**59%**	**79%**	**69%**	-	**89%**	**69%**
Single Family	68%	60%	97%	89%	69%	59%	79%	69%	-	89%	69%
Multifamily	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Mixed Single Family & Multifamily Residential	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Nonresidential	**8%**	**12%**	**1%**	**6%**	**9%**	**13%**	**7%**	**12%**	-	**9%**	**10%**
Mixed Residential and Nonresidential	**1%**	**1%**	**1%**	**2%**	**1%**	**2%**	**1%**	**0%**	-	**0%**	**1%**
Self-haul Subtotal	***76%***	***73%***	***100%***	***97%***	***79%***	***74%***	***87%***	***81%***	***0%***	***98%***	***80%***
No Response	1%	1%	0%	0%	1%	1%	0%	0%	-	1%	1%
Total, n=5530	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**0%**	**100%**	**100%**

Table 58. Observed Vehicle Types by Hauler Type and by Facility, 2015

Commercial haul, n=1064	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Dropbox	10%	13%	0%	0%	9%	9%	6%	8%	-	0%	8%
Packer	12%	13%	0%	3%	11%	16%	7%	11%	-	1%	11%
Large Other	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Passenger Vehicles	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Commercial Haul Subtotal	***23%***	***26%***	***0%***	***3%***	***20%***	***25%***	***13%***	***19%***	***-***	***1%***	***19%***
No Response	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Self-haul, n=4466									-		
Dropbox	0%	0%	1%	0%	0%	0%	0%	0%	-	0%	0%
Packer	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Large Other	11%	10%	1%	7%	8%	14%	6%	7%	-	10%	9%
Passenger Vehicles	66%	63%	99%	90%	71%	61%	80%	72%	-	82%	70%
Self-haul Subtotal	***77%***	***74%***	***100%***	***97%***	***79%***	***75%***	***87%***	***80%***	***-***	***91%***	***80%***
No Response	1%	0%	0%	0%	1%	0%	0%	1%	-	8%	1%
Total, n=5530	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 59. Reported Waste Type by Hauler Type and by Facility, 2015

Commercial haul, n=1064	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Mixed Garbage	22%	26%	0%	3%	20%	25%	13%	18%	-	1%	19%
Construction&Demolition	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Yard Waste	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Special Waste	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Commercial Haul Subtotal	***23%***	***26%***	***0%***	***3%***	***20%***	***25%***	***13%***	***18%***	***-***	***1%***	***19%***
No Response	0%	0%	0%	0%	0%	0%	0%	1%	-	0%	0%
Self-haul, n=4466									-		
Mixed Garbage	61%	56%	86%	86%	50%	47%	66%	56%	-	70%	59%
Construction&Demolition	12%	17%	14%	11%	23%	25%	18%	23%	-	18%	19%
Yard Waste	4%	0%	0%	0%	6%	3%	4%	0%	-	11%	3%
Special Waste	0%	0%	0%	0%	0%	0%	0%	0%	-	0%	0%
Self-haul Subtotal	***77%***	***74%***	***100%***	***97%***	***80%***	***75%***	***87%***	***79%***	***-***	***99%***	***81%***
No Response	0%	0%	0%	0%	0%	0%	0%	2%	-	0%	0%
Total, n=5530	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 60. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Algona, 2015

	Algona, n=878				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	6%	12%	0%	30%	**8%**
Landscapers	1%	1%	0%	0%	**1%**
Other Users	93%	87%	0%	70%	**91%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 61. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Bow Lake, 2015

	Bow Lake, n=1156				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	11%	17%	0%	22%	**13%**
Landscapers	0%	0%	0%	0%	**0%**
Other Users	89%	82%	0%	78%	**87%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 62. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Cedar Falls, 2015

	Cedar Falls Drop Box, n=146				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	3%	25%	0%	0%	**3%**
Landscapers	0%	0%	0%	0%	**0%**
Other Users	97%	75%	0%	0%	**97%**
Total	**100%**	**100%**	**0%**	**0%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 63. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Enumclaw, 2015

	Enumclaw, n=426				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	4%	25%	0%	100%	**6%**
Landscapers	0%	0%	0%	0%	**0%**
Other Users	96%	75%	0%	0%	**94%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 64. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Factoria, 2015

	Factoria, n=860				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	15%	25%	0%	56%	**18%**
Landscapers	1%	3%	0%	0%	**2%**
Other Users	83%	72%	0%	44%	**80%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 65. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Houghton, 2015

	Houghton, n=896				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	19%	29%	0%	43%	**22%**
Landscapers	2%	1%	0%	0%	**1%**
Other Users	79%	71%	0%	57%	**76%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 66. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Renton, 2015

	Renton, n=548				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	9%	22%	0%	0%	**11%**
Landscapers	0%	3%	0%	0%	**0%**
Other Users	91%	75%	0%	0%	**89%**
Total	**100%**	**100%**	**0%**	**0%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 67. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Shoreline, 2015

	Shoreline, n=432				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	15%	36%	0%	0%	**19%**
Landscapers	1%	0%	0%	0%	**1%**
Other Users	84%	64%	0%	100%	**80%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 68. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; Vashon, 2015

	Vashon, n=187				
	Residential	Nonresidential	Mixed	No Response	Site Overall
Contractors	10%	44%	0%	0%	**13%**
Landscapers	4%	11%	0%	0%	**5%**
Other Users	86%	44%	0%	100%	**82%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 69. Reported Generator for Self-haul Contractors, Landscapers, and Other Users; All Facilities, 2015

	All Facilities, n=5530				
	Residential	Nonresidential	Mixed	No Response	Overall
Contractors	11%	22%	0%	36%	**14%**
Landscapers	1%	1%	0%	0%	**1%**
Other Users	88%	76%	0%	64%	**85%**
Total	**100%**	**100%**	**0%**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding.

Table 70. Reported Reasons to Self-haul by Facility, Residential Generators, 2015

Residential, n=1458	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Large amount of garbage	13%	11%		10%	20%	19%	17%	57%	-	13%	19%
Cheaper / Saves money	38%	18%	29%	20%	2%	5%	16%	5%	-	20%	13%
Cleaning home or workplace	1%	9%		4%	17%	5%	13%	4%	-	4%	8%
Do not have garbage service	3%	3%	6%	9%	2%	1%	3%	1%	-	4%	3%
Items too big to fit into garbage can	7%	19%		7%	18%	33%	9%	10%	-	5%	16%
Convenience	7%	6%	26%	12%	1%	2%	8%	1%	-	19%	7%
Yard debris		2%		2%	3%	2%	3%	3%	-		2%
Remodeling	6%	8%	3%	4%	9%	11%	5%	5%	-	1%	7%
Moving home or workplace	2%	4%	12%	2%	11%	5%	5%	2%	-	2%	5%
Garbage hauler will not pick up this type of waste	1%			1%			1%	1%	-	2%	1%
Small amount of garbage / recycle almost everything	2%	1%	3%	3%			1%	1%	-	4%	1%
Dissatisfied with regular collection service	2%	2%	3%	2%			2%	2%	-	1%	1%
Forgot or missed the regular collection service				1%	1%				-		
Disaster-related (flood, mud slide, etc)		2%					1%		-		
Self-sufficiency / do not like government	3%	1%		4%			1%		-	3%	1%
Favor for friend/neighbor/family member	1%	2%		2%		3%	2%	6%	-	6%	2%
Dogs get into garbage if left on curb	1%		3%	1%			1%		-	1%	
Waste is from vacation home		1%		1%					-	2%	
Roadside litter removal									-	1%	
Demolition trucking company								1%	-		
Independent hauler	1%	1%	3%	1%		1%			-	1%	
Habit		1%		2%			1%		-	4%	1%
Subtotal	***89%***	***90%***	***88%***	***84%***	***86%***	***89%***	***89%***	***98%***	***-***	***91%***	***89%***
Other	11%	10%	12%	10%	14%	11%	10%	2%	-	9%	10%
Refused to answer				6%			1%		-		1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Table 71. Reported Reasons to Self-haul by Facility, Nonresidential Generators, 2015

Nonresidential, n=203	Algona	Bow Lake	Cedar Falls	Enumclaw	Factoria	Houghton	Renton	Shoreline	Skykomish	Vashon	Overall
Large amount of garbage		9%		8%	17%	27%	23%	78%	-	25%	28%
Cheaper / Saves money	86%	26%	50%	13%	10%	3%	3%	3%	-	13%	14%
Cleaning home or workplace		4%			24%	17%	13%		-		8%
Do not have garbage service				17%		3%	3%		-	13%	3%
Items too big to fit into garbage can		9%	8%		10%	27%	17%	3%	-	13%	10%
Convenience		9%	42%	25%		3%	7%		-		8%
Yard debris					3%			3%	-		1%
Remodeling		13%		8%	3%	10%	7%		-		5%
Moving home or workplace		9%		4%	14%	7%	3%	3%	-		5%
Garbage hauler will not pick up this type of waste								3%	-		
Small amount of garbage / recycle almost everything				4%			3%		-		1%
Dissatisfied with regular collection service				4%					-		
Forgot or missed the regular collection service									-		
Disaster-related (flood, mud slide, etc)					3%				-		
Self-sufficiency / do not like government									-		
Favor for friend/neighbor/family member								3%	-		
Dogs get into garbage if left on curb									-		
Waste is from vacation home									-		
Roadside litter removal									-	13%	
Demolition trucking company					3%				-		
Independent hauler		4%					3%		-		1%
Habit				4%			3%		-		1%
Subtotal	***86%***	***83%***	***100%***	***88%***	***90%***	***97%***	***87%***	***93%***	0%	***75%***	***90%***
Other	14%	17%		13%	10%	3%	13%	8%	-	25%	10%
Refused to answer									-		
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**-**	**100%**	**100%**

Estimates are rounded to the nearest percent and, when added together, may not equal 100%, due to rounding. Values less than .5% are left blank

Appendix F. Waste Composition Comparisons to Previous Studies

Background

King County has completed periodic waste characterization studies since 1991 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 2015 study are compared to findings from the 2011 study. 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, if 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 has been no change. For example, “There is no statistically significant difference, between the 2011 and 2015 study periods in the proportion of newspaper disposed by the commercially collected single-family substream.” Statistics are then employed to look for evidence disproving the no-change hypothesis. A “significant” result means that there is enough evidence to disprove the hypothesis and that 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 appear to 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 the analysis.

Table 72 lists the eight waste categories chosen for analysis. Composition variations were measured for the following substreams or combinations of substreams:

- Overall disposed waste
- 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 72. T-test Material Groupings

Material Type	T-test Material Category
Plain Corrugated Cardboard (OCC)	Cardboard and Kraft
Newspaper (ONP)	Newspaper
Low Grade Recyclable Paper	Other Curbside Paper
High Grade Paper	Other Curbside Paper
PET Bottles	Curbside Containers
Other PET Containers	Curbside Containers
HDPE Bottles	Curbside Containers
Other HDPE Containers	Curbside Containers
Other #3-#7 Packaging	Curbside Containers
Aluminum Cans	Curbside Containers
Other Aluminum	Curbside Containers
Tinned Food Cans	Curbside Containers
Other Ferrous	Curbside Containers
Other Non-Ferrous	Curbside Containers
Clear Glass Containers	Curbside Containers
Green Glass Containers	Curbside Containers
Brown Glass Containers	Curbside Containers
Waxed Corrugated Cardboard (OCC)	Organics
Single Use Food Service Compostable Paper	Organics
Other Compostable Paper	Organics
Packaged Vegetative Food	Organics
Unpackaged/Scrap Vegetative Food	Organics
Packaged Non-vegetative Food	Organics
Unpackaged/Scrap Non-vegetative Food	Organics
Large Prunings	Organics
Yard Waste	Organics
Dimensional Lumber	Wood Waste
Treated Wood	Wood Waste
Contaminated Wood	Wood Waste
Roofing and Siding Wood	Wood Waste
Other Wood	Wood Waste
C&D Wastes	Construction & Demolition
Asphalt Shingles	Construction & Demolition
Ash	Construction & Demolition
Nondistinct Fines	Construction & Demolition
Gypsum Wallboard	Construction & Demolition
Carpet	Construction & Demolition
Miscellaneous Inorganics	Construction & Demolition
Used Oil	Hazardous
Vehicle Batteries	Hazardous
Household Batteries	Hazardous
Latex Paint	Hazardous
Oil-based Paint	Hazardous
Solvents and Thinners	Hazardous
Adhesives and Glue	Hazardous
Cleaners and Corrosives	Hazardous
Pesticides and Herbicides	Hazardous
Gasoline and Fuel Oil	Hazardous
Antifreeze/Brake Fluid	Hazardous
Medical Waste	Hazardous
Pharmaceuticals and Vitamins	Hazardous
Compact Flourescent Bulbs	Hazardous
Other Flourescent Bulbs/Tubes	Hazardous
Other Hazardous Waste	Hazardous

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. (For example, 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 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 $\frac{0.10}{w}$ (where *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 be used to determine how many samples would be required to detect a particular minimum difference of interest.

Interpreting the Calculation Results

The following tables summarize the t-test findings. The findings can be grouped into two 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). An asterisk notes the statistically significant differences.
- **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.

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 73, the proportion of Other Curbside Paper in the overall disposed waste stream decreased from 6.4% to 4.3% across the study periods. The t-statistic is relatively large (4.2336) and the probability (p-value) of observing that t-statistic if there had been no true difference between years is less than 0.01%. This value is less than the study's pre-determined threshold for statistically significant results (alpha-level of 1.25%); thus the decrease in Other Curbside Paper is considered to be a true difference. On the other hand, the p-value corresponding to the decrease in Cardboard and Kraft is much smaller (p=0.8196). The chance of observing the 3.6% to 3.3% decrease when the actual proportion had not changed is 41.27%—much too high to be considered a true difference.

Key Comparison Study Findings

- Since 2011, Other Curbside Paper has shown a strong trend or statistically significant decrease in all commercially collected substreams.
- Organics in the commercially collected single family substream have shown a statistically significant decrease since 2011.
- The proportion of Newspaper has shown a statistically significant increase since 2011 in the commercially collected nonresidential substream.
- Wood Waste materials have increased in self-hauled waste loads since 2011.

The statistically significant differences between the 2011 and 2015 study periods, along with the trend indicators, for each tested substream are summarized in the following tables. The statistically significant differences between the 2011 and 2015 study periods are also included below as reference.

Table 73. Overall Disposed Waste T-test Results, 2011 vs. 2015

Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	3.6%	3.3%	-0.3% ⬇	0.8196	0.4127	No	
Newspaper	1.1%	1.4%	0.3% ⬆	1.6293	0.1036	No	
Other Curbside Paper	6.4%	4.3%	-2.2% ⬇	4.2336	0.0000 *	**Yes**	Statistically Significant
Curbside Containers	8.5%	6.5%	-1.9% ⬇	2.3591	0.0185	No	Strong Trend
Organics	31.2%	27.3%	-3.9% ⬇	2.2200	0.0267	No	
Wood Waste	10.8%	15.3%	4.5% ⬆	2.7519	0.0061 *	**Yes**	Statistically Significant
Construction & Demolition	8.7%	9.3%	0.6% ⬆	0.4431	0.6578	No	
Hazardous	1.0%	0.8%	-0.2% ⬇	0.6892	0.4909	No	
Number of Samples	420	421					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 74. Overall Disposed Waste T-test Results, 2007 vs. 2015

Material Grouping	Composition+ 2007	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	5.8%	3.3%	-2.5% ⬇	3.9629	0.0001 *	**Yes**	Statistically Significant
Newspaper	1.5%	1.4%	-0.2% ⬇	0.8889	0.3743	No	
Other Curbside Paper	6.5%	4.3%	-2.3% ⬇	4.3761	0.0000 *	**Yes**	Statistically Significant
Curbside Containers	7.4%	6.5%	-0.8% ⬇	1.1989	0.2309	No	
Organics	25.8%	27.3%	1.5% ⬆	0.8788	0.3798	No	
Wood Waste	12.1%	15.3%	3.2% ⬆	1.8703	0.0618	No	
Construction & Demolition	8.8%	9.3%	0.4% ⬆	0.3370	0.7362	No	
Hazardous	0.9%	0.8%	-0.1% ⬇	0.2763	0.7824	No	
Number of Samples	421	421					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 75. Commercially Collected Single Family Residential T-test Results, 2011 vs. 2015

Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	1.6%	1.7%	0.1% ⬆	0.3408	0.7338	No	
Newspaper	1.5%	2.1%	0.5% ⬆	1.3035	0.1947	No	
Other Curbside Paper	6.8%	4.3%	-2.5% ⬇	3.7772	0.0002 *	**Yes**	Statistically Significant
Curbside Containers	6.3%	5.8%	-0.6% ⬇	0.9763	0.3308	No	
Organics	43.8%	36.5%	-7.3% ⬇	3.0118	0.0031 *	**Yes**	Statistically Significant
Wood Waste	2.5%	2.6%	0.1% ⬆	0.0593	0.9528	No	
Construction & Demolition	2.7%	2.4%	-0.3% ⬇	0.1830	0.8551	No	
Hazardous	0.3%	0.5%	0.1% ⬆	0.6033	0.5474	No	
Number of Samples	53	78					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 76. Commercially Collected Single Family Residential T-test Results, 2007 vs. 2015

Material Grouping	Composition+ 2007	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	2.5%	1.7%	-0.8% ⬇	1.8449	0.0674	No	
Newspaper	2.6%	2.1%	-0.5% ⬇	0.7108	0.4785	No	
Other Curbside Paper	7.5%	4.3%	-3.1% ⬇	4.2925	0.0000 *	**Yes**	Statistically Significant
Curbside Containers	7.8%	5.8%	-2.0% ⬇	2.5750	0.0112 *	**Yes**	Statistically Significant
Organics	39.4%	36.5%	-2.8% ⬇	1.1053	0.2711	No	
Wood Waste	1.4%	2.6%	1.2% ⬆	0.6053	0.5460	No	
Construction & Demolition	3.6%	2.4%	-1.2% ⬇	0.6874	0.4931	No	
Hazardous	0.6%	0.5%	-0.1% ⬇	0.4843	0.6290	No	
Number of Samples	40	78					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 77. Commercially Collected Multifamily Residential T-test Results, 2011 vs. 2015

Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	4.5%	3.7%	-0.8% ⬇	0.7059	0.4825	No	
Newspaper	2.9%	2.0%	-0.9% ⬇	0.9354	0.3526	No	
Other Curbside Paper	8.2%	5.4%	-2.9% ⬇	2.3680	0.0205	No	Strong Trend
Curbside Containers	11.2%	8.3%	-2.9% ⬇	1.3531	0.1801	No	
Organics	33.5%	35.2%	1.7% ⬆	0.5568	0.5793	No	
Wood Waste	3.6%	4.9%	1.4% ⬆	0.6890	0.4929	No	
Construction & Demolition	2.4%	1.7%	-0.7% ⬇	0.6068	0.5458	No	
Hazardous	0.4%	0.4%	0.0% ⬌	0.0388	0.9691	No	
Number of Samples	48	29					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 78. Commercially Collected Multifamily Residential T-test Results, 2007 vs. 2015

Material Grouping	Composition⁺ 2007	Composition⁺ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	4.8%	3.7%	-1.2% ↓	1.3173	0.1917	No	
Newspaper	2.5%	2.0%	-0.5% ↓	0.8167	0.4167	No	
Other Curbside Paper	10.0%	5.4%	-4.6% ↓	4.2794	0.0001 *	**Yes**	Statistically Significant
Curbside Containers	9.2%	8.3%	-0.9% ↓	0.7045	0.4833	No	
Organics	34.9%	35.2%	0.3% ↑	0.0788	0.9374	No	
Wood Waste	2.7%	4.9%	2.2% ↑	1.2328	0.2215	No	
Construction & Demolition	2.1%	1.7%	-0.3% ↓	0.2756	0.7836	No	
Hazardous	1.1%	0.4%	-0.6% ↓	1.2256	0.2242	No	
Number of Samples	60	29					

⁺ *Composition data is unweighted for the t-test*

**Cut-off for statistically significant difference = 0.0125*

Table 79. Commercially Collected Nonresidential T-test Results, 2011 vs. 2015

Material Grouping	Composition⁺ 2011	Composition⁺ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	5.6%	4.8%	-0.7% ↓	0.9216	0.3574	No	
Newspaper	1.1%	1.6%	0.6% ↑	2.4792	0.0137	No	Strong Trend
Other Curbside Paper	9.7%	6.0%	-3.8% ↓	3.9294	0.0001 *	**Yes**	Statistically Significant
Curbside Containers	8.2%	7.2%	-1.0% ↓	1.0550	0.2922	No	
Organics	40.2%	37.3%	-2.9% ↓	1.0915	0.2759	No	
Wood Waste	5.3%	6.6%	1.4% ↑	0.9220	0.3572	No	
Construction & Demolition	3.2%	5.3%	2.1% ↑	1.6792	0.0941	No	
Hazardous	1.5%	1.3%	-0.1% ↓	0.1253	0.9004	No	
Number of Samples	160	154					

⁺ *Composition data is unweighted for the t-test*

**Cut-off for statistically significant difference = 0.0125*

Table 80. Commercially Collected Nonresidential T-test Results, 2007 vs. 2015

Material Grouping	Composition⁺ 2007	Composition⁺ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	9.1%	4.8%	-4.3% ↓	3.0094	0.0028 *	**Yes**	Statistically Significant
Newspaper	2.0%	1.6%	-0.3% ↓	1.0988	0.2727	No	
Other Curbside Paper	8.7%	6.0%	-2.7% ↓	3.0768	0.0023 *	**Yes**	Statistically Significant
Curbside Containers	6.8%	7.2%	0.4% ↑	0.3884	0.6980	No	
Organics	31.8%	37.3%	5.6% ↑	2.0601	0.0402	No	
Wood Waste	7.4%	6.6%	-0.8% ↓	0.4671	0.6408	No	
Construction & Demolition	5.5%	5.3%	-0.2% ↓	0.1364	0.8916	No	
Hazardous	0.7%	1.3%	0.7% ↑	1.0635	0.2884	No	
Number of Samples	161	154					

⁺ *Composition data is unweighted for the t-test*

**Cut-off for statistically significant difference = 0.0125*

Table 81. Self-haul T-test Results, 2011 vs. 2015

Material Grouping	Composition+ 2011	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	2.0%	2.5%	0.4% ⬆	0.6161	0.5383	No	
Newspaper	0.3%	0.6%	0.2% ⬆	1.1541	0.2493	No	
Other Curbside Paper	2.3%	2.3%	0.0% ⬌	0.0461	0.9633	No	
Curbside Containers	8.5%	6.0%	-2.5% ⬇	1.3759	0.1698	No	
Organics	16.7%	10.9%	-5.8% ⬇	1.9587	0.0510	No	
Wood Waste	21.7%	32.7%	11.0% ⬆	3.0685	0.0023 *	**Yes**	Statistically Significant
Construction & Demolition	18.5%	18.4%	-0.1% ⬇	0.0287	0.9771	No	
Hazardous	1.0%	0.4%	-0.6% ⬇	1.4513	0.1477	No	
Number of Samples	159	160					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Table 82. Self-haul T-test Results, 2007 vs. 2015

Material Grouping	Composition+ 2007	Composition+ 2015	Change in Composition	t-Statistic	p-Value	Statistically Significant Change*	Strength of Results
Cardboard and Kraft	3.6%	2.5%	-1.2% ⬇	1.5949	0.1117	No	
Newspaper	0.5%	0.6%	0.1% ⬆	0.5964	0.5513	No	
Other Curbside Paper	3.0%	2.3%	-0.7% ⬇	0.7550	0.4508	No	
Curbside Containers	7.1%	6.0%	-1.2% ⬇	0.7637	0.4456	No	
Organics	13.5%	10.9%	-2.6% ⬇	1.0001	0.3180	No	
Wood Waste	22.6%	32.7%	10.1% ⬆	2.8308	0.0049 *	**Yes**	Statistically Significant
Construction & Demolition	15.8%	18.4%	2.6% ⬆	0.8638	0.3884	No	
Hazardous	1.0%	0.4%	-0.6% ⬇	0.9446	0.3456	No	
Number of Samples	160	160					

+ Composition data is unweighted for the t-test

**Cut-off for statistically significant difference = 0.0125*

Appendix G. Quality Control Plan

This quality control plan throughout the 2015 King County Waste Monitoring study was executed to help ensure quality and consistency throughout fieldwork, data entry, and reporting.

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 December 2015. 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 covers safety procedures, sorting techniques, and quality control procedures.

The gatekeeper (the person who selects vehicles for sampling) was a Cascadia staff member trained in survey methods and familiar with transfer station protocol, safety procedures, and vehicle types. 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 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 card and the gatekeeper form. When the driver proceeded to the sorting area, the Sort Crew Manager collected the pink card from the vehicles driver.

Sample Waste

The crew sorted the waste samples by hand into plastic laundry baskets until only a small amount of homogeneous fine material 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. By combining the Cascadia designed tally sheet, database, and corresponding electronic data-entry forms together, Cascadia was able to ensure accuracy, consistency among forms, and efficient recording of data.

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

Report Preparation

Cascadia calculated waste composition estimates using automated analytical tools that Cascadia staff developed. These automated tools reduced the possibility for human error and were 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 is provided new project staff with ongoing references and instructions.

Appendix H. Health and Safety Plan

The seven-part Health and Safety Plan for Sky Valley Associates, the subcontractor assigned to perform the waste sorting, is detailed below:

Responsibility

Brad Anderson, acting as the designated Safety Officer, has the authority and the responsibility for implementing and maintaining the Health and Safety Program for Sky Valley Associates while working on-site. Managers and supervisors are responsible for implementing and maintaining safe working practices in their work areas and for answering worker questions about the Health and Safety Plan. A copy of this Health and Safety Plan is provided to all Sky Valley Associates employees.

The Health and Safety Plan is not a static plan. As conditions and situations arise, this Health and Safety Plan will be updated and augmented in accordance to OSHA and MSHA standards.

Compliance

All workers, including managers and supervisors, are responsible for complying with safe and healthful work practices. Our goal is to ensure that all workers understand and comply with these practices. To accomplish this, our procedures include informing workers of the provisions of our program, evaluating the on-going safety performance of all workers, and providing additional training to workers whose safety performance may be deficient.

The employees of Sky Valley Associates often perform their duties as guests of many different facilities The procedures described in our program in no way supersede the requirements which may already be in place at these facilities. Instead, this plan is designed to augment and work in conjunction with any site safety plans already existing at these facilities. We follow all host facility safety requirements which are more stringent than our own. Our safety procedures often exceed those of our host. Workers must follow our procedures, regardless of whether the host facility has any such requirements.

Communication

Sky Valley Associates is committed to providing a safe work environment for all of its workers. All managers and supervisors are responsible for communicating with all workers about occupational safety and health in a form readily understandable by all workers. Workers are encouraged to inform their managers and supervisors about workplace hazards without fear of reprisal. If the safety of the entire team could be in jeopardy – or if anything is discovered that could cause injury or is unsafe, workers are advised to tell their manager or supervisor immediately.

Sky Valley Associates routinely communicates with and instructs employees orally about general safe work practices and hazards unique to each employee's job assignment. Our overall communication system includes the following items:

- New worker orientation, including discussion of safety and health policies and procedures,
- Worker training in the specific protocols of our field procedures,
- Scheduled and "tailgate" safety meetings,
- Posted or distributed safety information,
- Periodic review of our Health and Safety Program.

The Safety Officer is responsible for ensuring that all field personnel have read, and understood, the master copy of this Health and Safety Plan document, and that all workers have received orientation and training on the safety protocols to be followed in conducting our work

The Safety Officer delegates daily on-site responsibilities to the Supervisor in charge of the work. Each Supervisor has the duties and responsibilities to:

- Ensure that the procedures in this document are followed for the day's work,
- Be familiar with local emergency services, and maintain a list of emergency phone numbers,
- Conduct "tailgate" health and safety meetings to notify workers of any changes in safety protocol,
- Inspect personal protective equipment and to ensure proper use of such equipment,
- Monitor on-site hazards and the early health warning signs (e.g., heat stress/stroke, dehydration, or fatigue) of site personnel,
- Stop unsafe operations, and to summon emergency services when needed.

Nearly every day we work, we may be at a different facility. The supervisor will brief workers on health and safety protocols of the host site. This will include emergency evacuation and rally point information, to ensure that, in the event of an emergency, all Sky Valley Associates workers will adhere to site-specific evacuation and management procedures.

Hazard Assessment

We perform assessments of possible work hazards, and the procedures to work safely around them, when:

- We initially established our Health & Safety protocols,
- New substances, processes, procedures or equipment which present potential new hazards are introduced into our workplace,
- New, previously unidentified hazards are recognized,
- Workplace conditions warrant an assessment,
- When occupational injuries and illnesses occur.

On a daily basis, Supervisors are to identify and evaluate workplace hazards which may be present at each work site. We routinely encounter the same day-to-day risks when we conduct our work. Yet, every facility is different, which may present unique hazards. These are some possible hazards that may occur during our work:

Physical hazards:

- Cuts and punctures,
- Lifting,
- Slipping and falling,
- Heat stress and fatigue,
- Traffic or heavy equipment movement,
- Noise exposure,
- Animal and/or insect bites.

Airborne contaminants:

- Dust and windblown debris.

Chemical hazards:

- Liquid spills from containers,
- Household and hazardous chemicals.

Biological hazards:

- Household hazardous wastes,
- Medical wastes,
- Blood/body fluid contaminated items,
- Hypodermic needles.

Due to the nature of waste composition sampling, exposures to airborne pathogens and subcutaneous introduction of pathogens are possible. Because of this, all Sky Valley Associates employees will be given the opportunity to be vaccinated with Tetanus and Hepatitis B vaccines at the cost of Sky Valley Associates. Any employee that forfeits having the vaccine will do so in writing.

Accident/Exposures Investigation

Procedures for investigating workplace accidents and hazardous substance exposures include:

- Interviewing injured workers and witnesses,
- Examining the workplace for factors associated with the accident/exposure,
- Determining the cause of the accident/exposure,
- Taking corrective action to prevent the accident/exposure from reoccurring,
- Recording the findings and actions taken.

Hazard Correction

Timely corrective action will be taken to remedy an unsafe condition, practice or procedure. When an imminent hazard exists that cannot be immediately abated without endangering employee(s) and/or property, we will remove all exposed workers from the area.

Training and Instruction

All Sky Valley Associates workers, including managers and supervisors, shall have training and instruction on general and job-specific safety and health practices. Training and instruction is provided:

- To all new workers,
- To all workers given new job assignments for which training has not previously provided,
- Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard,
- Whenever Sky Valley Associates is made aware of a new or previously unrecognized hazard,
- To supervisors to familiarize them with the safety and health hazards to which workers may be exposed,
- To all workers with respect to hazards specific to each employee's job assignment.

Sky Valley Associates provides for its workers the proper safety equipment for performance of duties associated with waste sampling. These items include:

- Coveralls or protective outer wear (optional),
- Rubber gloves and liners (required),
- Lower back support apparatus (optional),
- Hearing protection (optional/based on site requirements),
- Safety glasses (optional/based on site requirements),
- Reflective safety vests (required),
- Hard hats and liners (required),
- Knee pads (optional).

During the conduct of our fieldwork, the following personnel health and safety guidelines are to be followed:

- Workers should be in good physical condition, maintain a current tetanus booster and Hepatitis B shot, and not be over-sensitive to odors and dust. All workers must be able to communicate in English, and be able to read warning signs/labels.
- Workers should routinely check personal protective equipment and work clothing for proper fit and condition and replace or repair defective items immediately.
- Workers must look at what they are picking up or sorting – the most effective way to prevent cuts and punctures is first see the material. Workers must use one of the small rakes or shovels to move material around for sorting.

- Workers must lift properly, and ask for assistance when lifting heavy or bulky items. Be particularly careful when you are tired or fatigued.
- Workers must be on the lookout for slipping and tripping hazards.
- Workers should not attempt to identify unknown chemical substances in unlabeled containers.
- Workers much wash hands and face before eating or drinking, and must smoke only in designated areas.
- Workers should consume plenty of fluids during hot days, and watch for signs of heat-related illness.
- Workers should be aware of the surroundings and alert to the possibility of unexpected hazards.
- Workers must alert the Supervisor if feeling ill, overly fatigued, or injured. Even minor cuts and injuries must be treated immediately.

Appendix I. Example Field Forms

This appendix contains examples of all field forms including:

- Customer Survey Form
- Vehicle Type Identification Form
- Customer Information Sheet
- Daily Vehicle Selection Sheet
- Sample Placard
- Material Weight Tally Sheet

Figure 33. Customer Survey Form, Front

As All Vehicles Approach					*Ask All Vehicles*								*Ask Self-Haul Only*					
																Skip if CB/Landscaper		
ID	Collection Type	Vehicle Type	Trailer	Net Weight	City	Sector					Waste Type	**Contractor or Landscaper**	Trips to Any Station per Time Period		ZIP Code	**Subscribe Curbside Garbage Service?**	**Why Self-Haul?**	Comments
Either a number from a card or a sample ID if chosen for a sample.	C comm'l. S self-haul	1 Rear Packer 2 Front Packer 3 Side Packer 4 DB, Loose 5 DB, Compacted 6 Pick-up, Van, SUV 7 Large Other 8 Car	X if Yes	Record in Pounds (lbs) when possible	If city is not on the list of King County cities, clarify whether it is inside or outside of King County	SF: Single-family residential MF: Multi-family residential RES: Residential NRES: Non-residential If 100%, just check box. If not, fill out percents (must total 100%). If Commercial: %SF, %MF, % NRes If Self-haul: %RES, %NRES					**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	(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 curbside 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 34. Customer Survey Form, Back

Complete this section for every page

Page _____ of _____

Date _____

Surveyor(s) _____

_____

Circle the site:

Algona	Shoreline
Bow Lake	Houghton
Cedar Falls	Renton
Enumclaw	Skykomish
Factoria	Vashon Island

Complete this section for first page only

Inclement Weather? _____

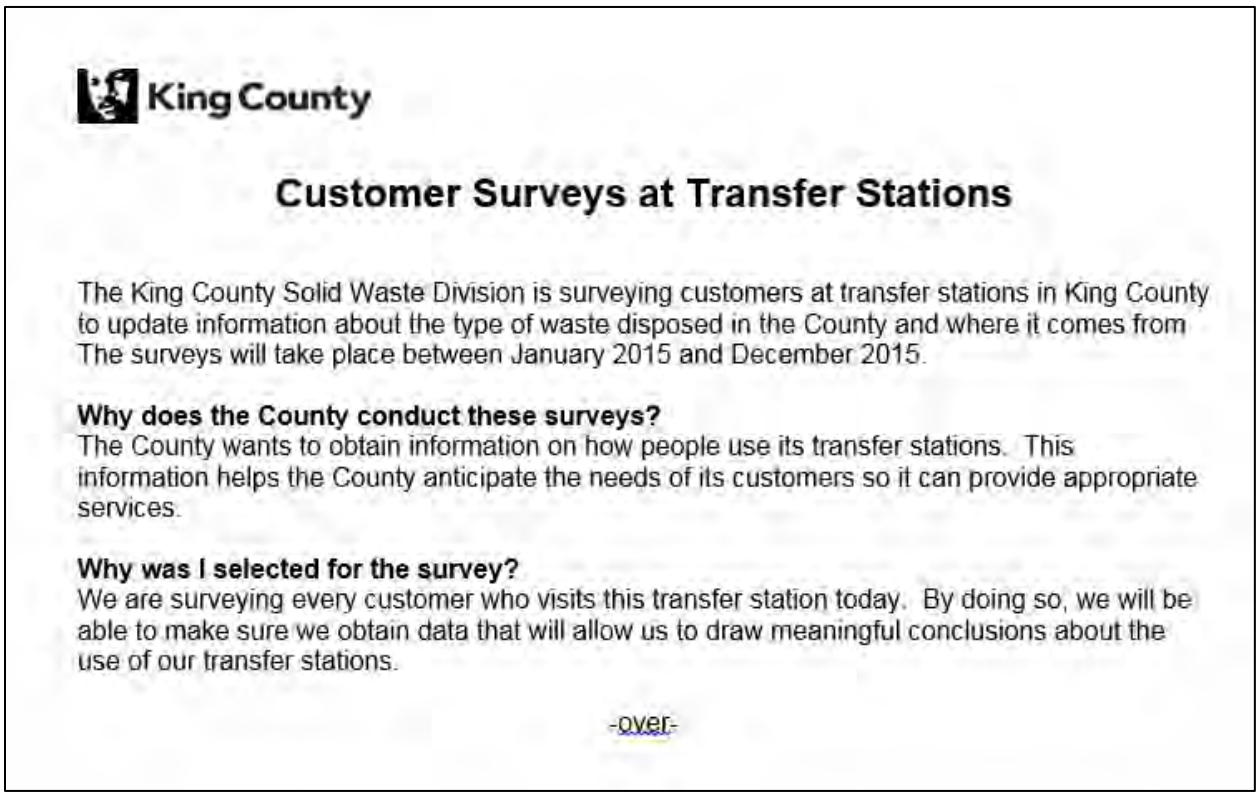
Start Time _____ Stop Time _____

Other Notes about Today's Surveying:

Figure 35. Vehicle Type Identification Form

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**	
		

Figure 36. Customer Information Sheet, Front



King County

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 January 2015 and December 2015.

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 37. Customer Information Sheet, Back

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

How do I get more information?
Call Alexander Rist, King County Solid Waste Division, (206) 477-5253. 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 38. Daily Vehicle Selection Sheet

King County Waste Monitoring Study
Vehicle Selection Form

Site: Factoria

Date: Tuesday, October 20, 2015

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 56-59) **NEED 4 TOTAL - SAMPLE EVERY VEHICLE**

(1)
(1) packer trucks or drop boxes (compacting and loose)
(1)
(1)

FRANCHISED NONRESDROPBOX: (DB 49-51) **NEED 3 TOTAL - SAMPLE EVERY VEHICLE**

(1)
(1) both compacting and loose drop boxes
(1)

FRANCHISED NONRES PACKER: (Com 44-46) **NEED 3 TOTAL - SAMPLE EVERY VEHICLE**

(1)
(1) If enough FRANCHISED NONRESIDENTIAL PACKERS are unavailable,
(1) make up diference with self haul

SELF-HAUL PASSENGER: (SH 83-85) **NEED 3 TOTAL - SAMPLE EVERY 15TH VEHICLE**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 (15)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 (15)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 (15)

SELF-HAUL LARGE OTHER: (SHO 34) **NEED 1 SAMPLE THE 3rd VEHICLE**

1 2 (3)

Figure 39. Sample Placard

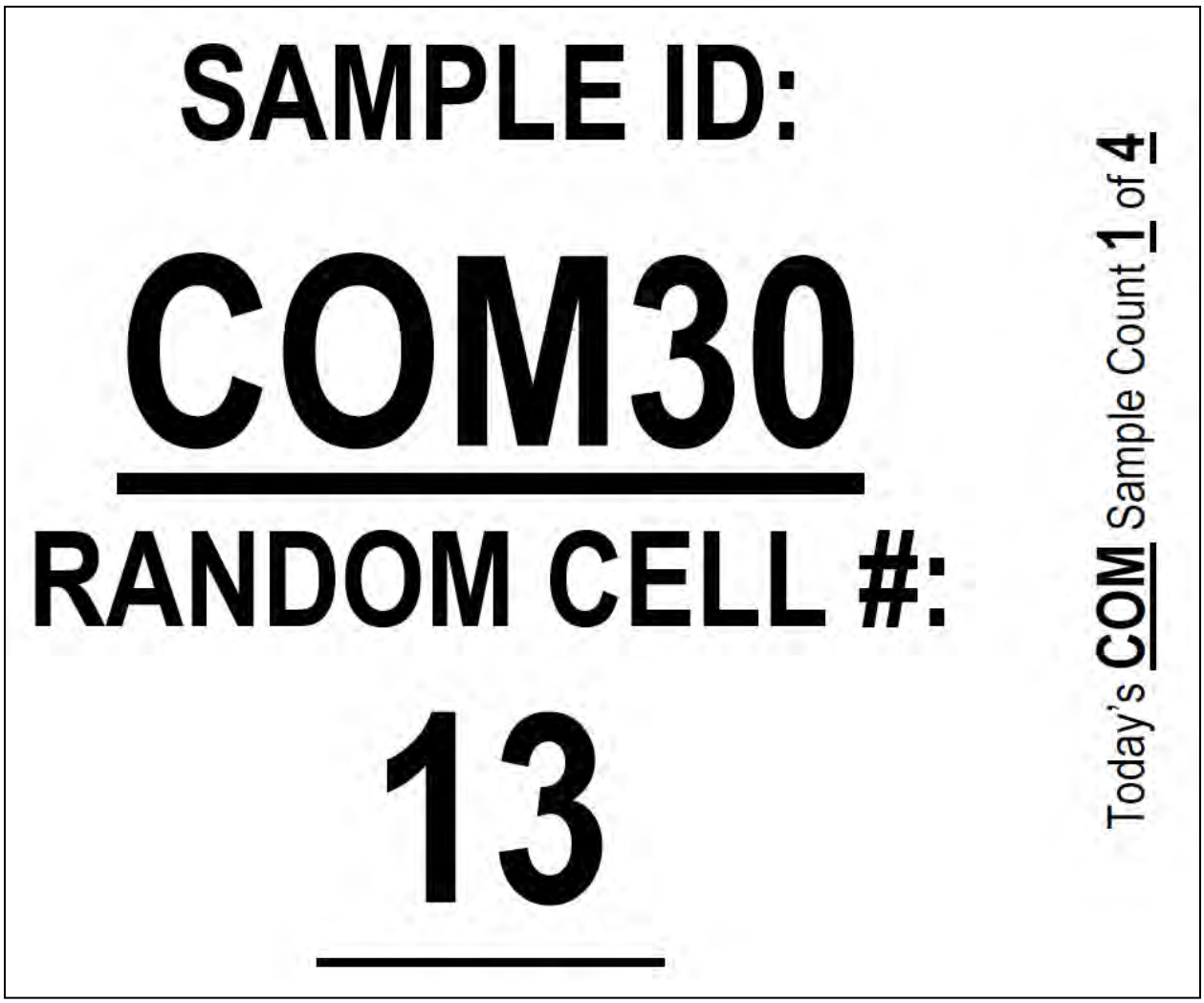
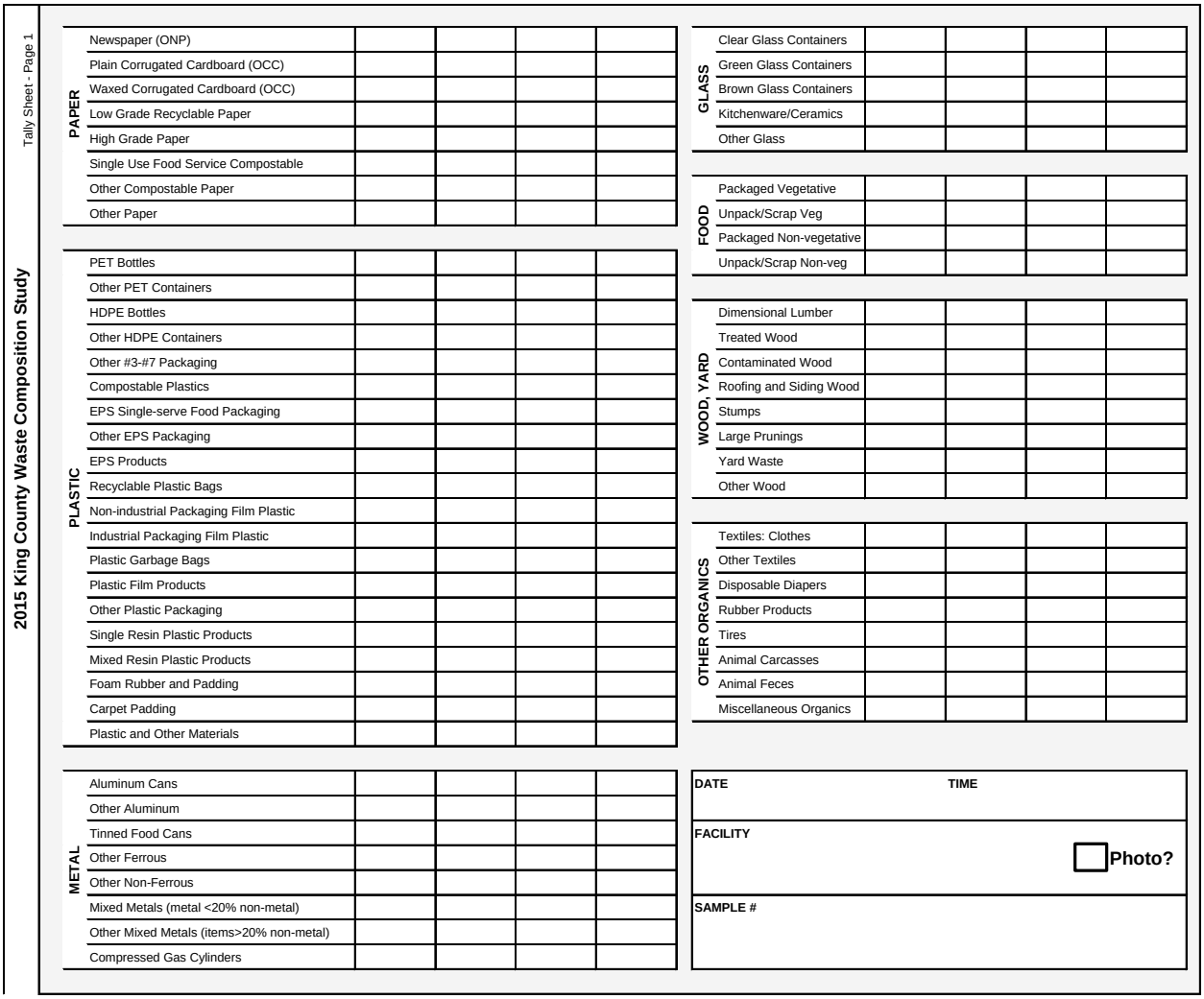


Figure 40. Material Weight Talley Sheet, Front



2015 King County Waste Composition Study

Tally Sheet - Page 1

PAPER	Newspaper (ONP)				
	Plain Corrugated Cardboard (OCC)				
	Waxed Corrugated Cardboard (OCC)				
	Low Grade Recyclable Paper				
	High Grade Paper				
	Single Use Food Service Compostable				
	Other Compostable Paper				
	Other Paper				

PLASTIC	PET Bottles				
	Other PET Containers				
	HDPE Bottles				
	Other HDPE Containers				
	Other #3-#7 Packaging				
	Compostable Plastics				
	EPS Single-serve Food Packaging				
	Other EPS Packaging				
	EPS Products				
	Recyclable Plastic Bags				
	Non-industrial Packaging Film Plastic				
	Industrial Packaging Film Plastic				
	Plastic Garbage Bags				
	Plastic Film Products				
	Other Plastic Packaging				
	Single Resin Plastic Products				
	Mixed Resin Plastic Products				
	Foam Rubber and Padding				
	Carpet Padding				
	Plastic and Other Materials				

METAL	Aluminum Cans				
	Other Aluminum				
	Tinned Food Cans				
	Other Ferrous				
	Other Non-Ferrous				
	Mixed Metals (metal <20% non-metal)				
	Other Mixed Metals (items>20% non-metal)				
	Compressed Gas Cylinders				

GLASS	Clear Glass Containers				
	Green Glass Containers				
	Brown Glass Containers				
	Kitchenware/Ceramics				
	Other Glass				

FOOD	Packaged Vegetative				
	Unpack/Scrap Veg				
	Packaged Non-vegetative				
	Unpack/Scrap Non-veg				

WOOD, YARD	Dimensional Lumber				
	Treated Wood				
	Contaminated Wood				
	Roofing and Siding Wood				
	Stumps				
	Large Prunings				
	Yard Waste				
	Other Wood				

OTHER ORGANICS	Textiles: Clothes				
	Other Textiles				
	Disposable Diapers				
	Rubber Products				
	Tires				
	Animal Carcasses				
	Animal Feces				
	Miscellaneous Organics				

DATE TIME

FACILITY

☐ Photo?

SAMPLE #

Figure 41. Material Weight Talley Sheet, Back

ELECTRONICS	Small Household Appliances				
	A/V Equipment				
	Printers/Copiers/Fax Machines				
	CPU's				
	Computer Peripherals				
	CRT Computer Monitors & TVs				
	Other Computer Monitors & TVs				
	Laptops				
	Cell Phones				
	Tablets				
	Other Electronics				
OTHER WASTES	C&D Wastes				
	Asphalt Shingles				
	Ash				
	Nondistinct Fines				
	Gypsum Wallboard				
	Furniture				
	Mattresses				
	Carpet				
	Miscellaneous Inorganics				
HHW, SPECIAL	Used Oil				
	Vehicle Batteries				
	Household Batteries				
	Latex Paint				
	Oil-based Paint				
	Solvents and Thinners				
	Adhesives and Glue				
	Cleaners and Corrosives				
	Pesticides and Herbicides				
	Gasoline and Fuel Oil				
	Antifreeze/Brake Fluid				
	Medical Waste				
	Pharmaceuticals and Vitamins				
	Compact Flourescent Bulbs				
	Other Flourescent Bulbs/Tubes				
	Other Hazardous Waste				

Tally Sheet - Page 2

If found, please contact Cascadia Consulting Group at (206) 343-9759. Re

Revised 1/23/15

Appendix J. Estimated Changes in GHG Emissions from Diversion

This appendix estimates the potential change in greenhouse gas (GHG) emissions associated with increased diversion of typical curbside recyclable and compostable materials. The GHG emissions calculations were performed using the U.S. EPA's Waste Reduction Model (WARM), a streamlined model that estimates the GHG emissions associated with different materials management options.

The EPA has developed emissions factors for 54 materials that are based on the environmental footprint of each material associated with production and collection through final disposition of each discarded product or packaging material.[17] Not every one of the WARM materials has a direct analogue with the material list used in this study, so Cascadia aggregated 37 study material types into 22 WARM material types. The remaining study material types are modeled as Mixed MSW. For this analysis, Cascadia matched materials in the waste composition study to the materials included in WARM as shown in Table 83 and noted whether they are considered recyclable, compostable, or combustible.

[17] Detailed documentation about the development of lifecycle GHG emissions factors for materials can be found at the following location: https://www3.epa.gov/warm/pdfs/WARM_Documentation.pdf

Table 83. Material Types Included in the GHG Analysis

Study Material Type	WARM Material Type	Recovery Method
Newspaper (ONP)	Newspaper	Recycle
Plain Corrugated Cardboard (OCC)	Corrugated Containers	Recycle
Waxed Corrugated Cardboard (OCC)	Corrugated Containers	Recycle
Low Grade Recyclable Paper	Magazines/Third-class Mail	Recycle
High Grade Paper	Office Paper	Recycle
PET Bottles	PET	Recycle
Other PET Containers	PET	Recycle
HDPE Bottles	HDPE	Recycle
Other HDPE Containers	HDPE	Recycle
Other #3-#7 Packaging	Mixed Plastics	Recycle
Compostable Plastics	PLA	Compost
Recyclable Plastic Bags	Mixed Plastics	Recycle
Aluminum Cans	Aluminum Cans	Recycle
Other Aluminum	Aluminum Ingot	Recycle
Tinned Food Cans	Steel Cans	Recycle
Other Ferrous	Steel Cans	Recycle
Other Non-Ferrous	Aluminum Ingot	Recycle
Clear Glass Containers	Glass	Recycle
Green Glass Containers	Glass	Recycle
Brown Glass Containers	Glass	Recycle
Packaged Vegetative Food	Food Waste (non-meat)	Compost
Unpackaged/Scrap Vegetative Food	Food Waste (non-meat)	Compost
Packaged Non-vegetative Food	Food Waste (meat only)	Compost
Unpackaged/Scrap Non-vegetative Food	Food Waste (meat only)	Compost
Dimensional Lumber	Dimensional Lumber	Combust
Large Prunings	Branches	Compost
Yard Waste	Yard Trimmings	Compost
Tires	Tires	Recycle
Carpet	Carpet	Recycle
Asphalt Shingles	Asphalt Shingles	Recycle
Drywall	Drywall	Recycle
Printers/Copiers/Fax Machines	Personal Computers	Recycle
CPU's	Personal Computers	Recycle
Computer Peripherals	Personal Computers	Recycle
CRT Computer Monitors & Televisions	Personal Computers	Recycle
Other Computer Monitors & Televisions	Personal Computers	Recycle
Laptops	Personal Computers	Recycle

The results from the model depend not only on the composition of materials included in the analysis, but also on the characteristics of the landfill and transportation methods. For the purpose of the analysis, we have assumed the following:

- An emissions factor for electricity based on the average Pacific-region grid; this factor is used to calculate the avoided emissions associated with power production from landfill gas (LFG) capture and recovery. WARM likely overestimates the benefits of LFG capture in Washington State due to the high level of hydroelectric power and low levels of coal power in the grid.

- A landfill gas collection efficiency based on landfill management standards that meet California regulatory requirements.
- A decomposition rate of materials in the landfill based on wet conditions, greater than 40 inches of precipitation per year.
- Transportation distances for materials from the curb to its end-of-life management facility as shown in Table 84. WARM assumes that diesel fuel vehicles are used and calculates emissions factors accordingly. WARM is likely overestimating the impacts of transporting materials in King County since many of our collection vehicles are CNG-fueled. WARM also does not account for the emissions from shipping recyclables to markets overseas.

Table 84: Modeled Transportation Distances

Materials Management Facility	Distance (miles)
Landfill	24.51
Combustion	29.55
Recycling	21.64
Composting	31.46

The GHG emissions analysis also included emissions from:

- Process energy for equipment used to handle materials at compost facilities, recycling processors, and landfills.
- The production and use of petroleum-based fertilizers in accounting for emissions associated with manufacturing.

The GHG emissions reduction analysis also considered:

- Carbon storage in landfills and increase in soil carbon storage from application of compost to soils.[18]
- Forest carbon storage from the recycling of paper products, which cause annual tree harvests to drop below otherwise anticipated levels.
- Fugitive emissions from composting.

Most of the emissions and factors listed above tend to support increased diversion (recycling requires less electricity than production using virgin materials, for instance) but some support landfilling (sending organics to landfill can increase electricity generation from captured LFG, thus displacing petroleum based fuels in the power grid).

[18] EPA determined that neither literature review nor discussion with experts would yield a sufficient basis for quantitative soil carbon estimates for WARM. EPA therefore used Century, a soil organic matter model, to simulate and calculate soil carbon storage from various composting scenarios.

Greenhouse Gas Emissions Estimates

Recovered Tons

WARM modeled the potential changes in GHG emissions when 25%, 50%, and 75% of an individual material was diverted from disposal to composting, recycling, or combustion (as appropriate per material).

Table 85 lists in the "Disposed" column how many tons of each material type franchised haulers and self-haul customers in King County disposed in 2015. The subsequent three columns, "Recovered at 25% Diversion," "Recovered at 50% Diversion," and "Recovered at 75% Diversion," specify the tonnages included in the GHG analysis at each modeled diversion level. The diversion level specifies the quantity of the remaining disposed material that gets diverted. For example, 12,962 tons of Newspaper are disposed annually. If 25% of that Newspaper were recovered, that would be an additional 3,241 tons of Newspaper recovered.

Table 85. Recovered Tons at Each Modeled Diversion Level

	Tons			
WARM Material Types	Disposed	Recovered at 25% Diversion	Recovered at 50% Diversion	Recovered at 75% Diversion
Aluminum Cans	2,582	645	1,291	1,936
Aluminum Ingot	8,781	2,195	4,391	6,586
Steel Cans	13,746	3,437	6,873	10,310
Glass	15,450	3,863	7,725	11,588
HDPE	4,378	1,095	2,189	3,284
PET	7,088	1,772	3,544	5,316
PLA	151	38	76	113
Corrugated Containers	27,908	6,977	13,954	20,931
Magazines/Third-class Mail	31,132	7,783	15,566	23,349
Newspaper	12,962	3,241	6,481	9,722
Office Paper	6,726	1,682	3,363	5,045
Dimensional Lumber	50,389	12,597	25,194	37,792
Food Waste (non-meat)	107,960	26,990	53,980	80,970
Food Waste (meat only)	65,275	16,319	32,638	48,957
Yard Trimmings	34,801	8,700	17,400	26,100
Branches	2,408	602	1,204	1,806
Mixed Plastics	6,824	1,706	3,412	5,118
Carpet	13,830	3,458	6,915	10,373
Personal Computers	1,295	324	648	971
Tires	667	167	334	500
Asphalt Shingles	3,002	751	1,501	2,252
Drywall	14,797	3,699	7,399	11,098
Total	**432,156**	**108,039**	**216,078**	**324,117**

Estimated Changes in GHG Emissions

The change in GHG emissions for each material is measured in metric tons of CO_2 equivalent (MtCO2e) and noted in Table 86. For the emissions associated with the baseline tons, negative values indicate that landfilling is a net carbon sink, and positive values indicate that landfilling is a net carbon source for that materials. In other words, negative values are "good" and positive values are "bad." For example, the negative baseline numbers associated with yard trimmings and increasingly positive values with increased diversion indicate that increased diversion of this material actually increases GHG emissions. Possible reasons for this may include:

- An increase in the fuel used by equipment needed to handle yard trimmings at a compost facility compared to a landfill.
- A high LFG potential for yard trimmings.
- Growing trees remove carbon from the atmosphere, so cutting and trimming woody plants and transporting them for processing causes a net carbon increase.

The magnitude of the reduction (or increase) in GHG emissions per material is dependent on both the quantity of the material diverted and the material itself. Each material has a different GHG emission reduction potential based on how readily it degrades in the landfill, how far it travels to market, and other factors. Corrugated Containers offers the greatest reduction potential (27,992 MtCO2e at 25% diversion).

Diverting 25% of each material in Table 86 from disposal avoids more than 80,000 MtCO2e per year; this is equivalent to the annual emissions from more than 17,000 passenger vehicles or the emissions from the electricity used by more than 12,300 homes for a year.[19]

[19] Equivalencies calculated using the U.S. EPA *Greenhouse Gas Equivalencies Calculator* available at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator and the equivalencies built into the WARM model.

Table 86. Change in MtCO2e Emissions at Each Modeled Diversion Level

WARM Material Types	Under Current Waste Management Practices*	GHG Tons (MtCO2e) from Alternative Scenarios		
		at 25% Diversion	at 50% Diversion	at 75% Diversion
Aluminum Cans	102	-5,803	-11,707	-17,611
Aluminum Ingot	346	-15,521	-31,389	-47,256
Steel Cans	542	-5,818	-12,178	-18,537
Glass	609	-611	-1,831	-3,051
HDPE	173	-834	-1,840	-2,847
PET	279	-1,795	-3,869	-5,943
PLA	-245	-189	-132	-75
Corrugated Containers	-8,311	-27,992	-47,674	-67,355
Magazines/Third-class Mail	3,494	-21,272	-46,038	-70,803
Newspaper	-13,242	-18,845	-24,448	-30,051
Office Paper	2,830	-2,684	-8,199	-13,713
Food Waste (non-meat)	38,043	24,457	10,871	-2,715
Food Waste (meat only)	23,002	14,787	6,573	-1,642
Yard Trimmings	-11,189	-9,447	-7,705	-5,963
Branches	-2,133	-1,673	-1,213	-752
Mixed Plastics	269	-1,559	-3,388	-5,216
Carpet	545	-7,751	-16,047	-24,343
Personal Computers	51	-775	-1,602	-2,428
Tires	26	-45	-116	-187
Asphalt Shingles	118	18	-82	-182
Drywall	-620	-368	-117	135
Total	**34,689**	**-83,719**	**-202,128**	**-320,536**

** For the emissions associated with the baseline tons, negative values indicate that landfilling is a net carbon sink and positive values indicate that landfilling is a net carbon source for that material. Negative values are "good" and positive values are "bad".*