Seattle Public Utilities

2015
Residential Recycling Stream Composition Study
FINAL Report

prepared by
Cascadia Consulting Group, Inc.

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Previous reports on Seattle's residential waste and recycling streams are available on the Seattle Public Utilities website. [1]

Waste Composition Reports

2010 Residential Waste Stream Composition Study

2006 Residential Waste Stream Composition Study

2002 Residential Waste Stream Composition Study

1998-1999 Residential Waste Stream Composition Study

1994-1995 Residential Waste Stream Composition Study

1990 Residential Waste Stream Composition Study

1988-1989 Waste Stream Composition Study

Recycling Composition Reports

2010 Residential Recycling Composition Study

2005 Residential Recycling Composition Study

2000-01 Residential Recycling Composition Study

[1] The complete set of residential waste and recycling composition reports are available online at the following website (link active as of April 2016).
http://www.seattle.gov/util/MyServices/Garbage/AboutGarbage/SolidWasteReports/CompositionStudies/index.htm

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1 Overview

In 1988, Seattle Public Utilities launched a series of waste and recycling composition studies. These studies provide information about quantities and composition of materials, informing solid waste management planning and evaluation. As part of these ongoing material studies, the City of Seattle has conducted recycling composition studies since 1993 to better understand the types and quantities of materials set out by Seattle residents in recycling containers provided by contracted haulers. Recycling composition estimates obtained from these studies are also used to help determine a portion of the payment amounts from the city to the private company that processes Seattle's residential recycling.[2] The previous recycling composition study took place in 2010.

Composition estimates are made by sorting and weighing samples of recycling from randomly selected loads brought to the 3rd and Lander recycling facility. This report summarizes estimates from samples taken between January and December 2015. Cascadia Consulting Group served as the primary contractor for this research; Sky Valley Associates sorted the recyclables.

This report is organized into four sections:

- **Section 1** briefly summarizes the project and includes a description of the sampling populations and study methodology.
- **Section 2** presents an overview of the results.
- **Section 3** compares results from the current study with those from previous studies.
- **Section 4** provides the complete composition results for samples taken during the 2015 study, presented by collection zone and residence type.

Detailed appendices follow the main body of the report.

1.1 Sampling Populations

This study was designed to determine the composition of residential curbside recycling within the city. Recyclable materials that were either self-hauled to transfer stations or hauled from Seattle's commercial sector were excluded from this study. The recyclables set out by residences in Seattle and collected by contracted haulers were divided into eight subpopulations defined by two generator types and four collection zones. The two generator types are defined as follows:

- ***Single-family:*** Describes materials generated primarily from detached single-family, duplex, triplex, or four-plex homes. Recycling is collected from toters.
- ***Multifamily:*** Describes materials generated primarily from apartments and condominiums with five or more units. Recycling is collected primarily from dumpsters though some properties use toters.[3]

Seattle's residential recyclables are collected in four recycling collection zones, shown in Figure 1-1 below. Samples were apportioned evenly across the four collection zones to ensure comparability of data.

[2] These payments depend on the amount of each material collected, current market prices, and other factors.
[3] Through the Clear Alleys Program, multifamily recycling from approximately 100 downtown buildings is collected in bags. This material was excluded from the study due to the difficulty of segregating and obtaining representative samples of this material.

Figure 1-1: Seattle's Collection Zones

Table 1-1 depicts each of the eight residential recycling subpopulations according to generator type and collection zone.

Table 1-1: Residential Recycling Subpopulations, by Residence Type and Collection Zone

		Generator Type *(Single-family)*	*(Multifamily)*
Recycling Collection Zones	*One*	Single-family Zone One	Multifamily Zone One
	Two	Single-family Zone Two	Multifamily Zone Two
	Three	Single-family Zone Three	Multifamily Zone Three
	Four	Single-family Zone Four	Multifamily Zone Four

1.2 Study Methodology

This section provides an overview of four major steps of the 2015 study methodology. Appendix B contains a detailed description of the methodology.

Step 1: Develop Sampling Plan

Samples were allocated across residential sampling groups. Two-thirds of samples were allocated to single-family residential recycling, and the remaining one-third to multifamily residential recycling. This was the same split used in the 2010 sample to ensure comparability of data between study years. Single-family and multifamily samples were evenly split among the four collection zones.

A sampling schedule was constructed for the 2015 calendar year, consisting of either two or three sampling days every other month. Sampling days were randomly selected to ensure a representative distribution across the days of the week and weeks of the month.

Finally, Cascadia obtained a complete list of Seattle's residential recycling routes from the city's contracted recycling haulers.

Step 2: Schedule and Collect Recycling Samples

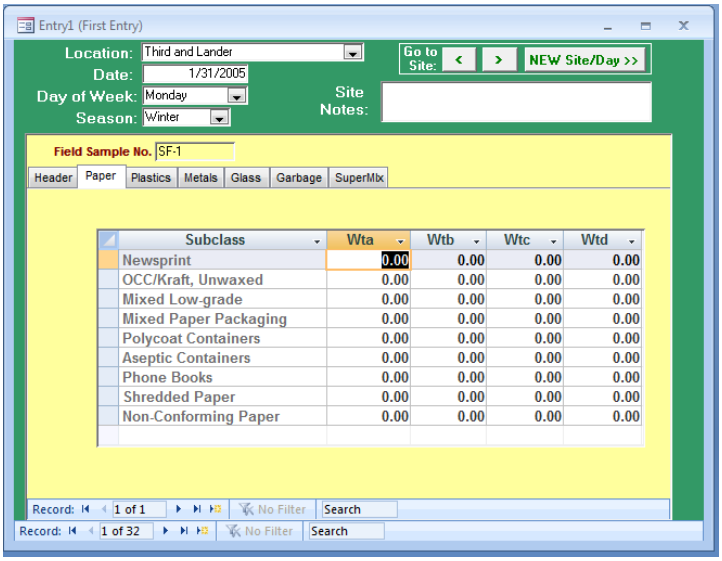
Prior to each sampling event, recycling routes from each zone and both residential types were randomly selected. The field supervisor sent contractors a list of the routes chosen for each day of sampling, and drivers of the selected routes delivered collected curbside recyclables to the 3rd and Lander recycling facility for sampling.

Step 3: Capture and Sort Samples

As each selected route truck entered the facility, a sampling crew member verified that the vehicle was carrying recycling from the expected route and zone. The driver was then instructed to tip (unload material) as usual. A front-loader operator scooped a sample of approximately 250 pounds from the tipped load and placed the sample into a steel container. The container was then carried via forklift to the sorting location where it was transferred to a tarpaulin.
For this study, a total of 270 samples were sorted into 35 distinct component categories, such as *newsprint* or *aluminum cans*. Refer to Appendix A for component definitions and a detailed description of the changes made to the component categories since the 2010 study.

Step 4: Analyze Data and Prepare Report

After each sorting event, the sort data were double-entered into a customized database and reviewed for data-entry errors. At the conclusion of the study, recycling composition estimates were calculated by aggregating sampling data using a weighted average procedure. SPU provided annual recycling tonnages to perform these calculations. Appendix D describes the calculation methodology. This report was prepared based on this data analysis.



2 Summary of Sampling Results

Composition estimates are presented in the following order in this report. First, a pie chart depicts the composition percentages of the five broad material categories: **paper**, **metal**, **plastic**, **glass**, and **contaminants**. Next, a table presents the top ten components. Finally, a table lists the full composition results of all 35 components.[4] Please refer to Appendix A for a list and definitions of the 35 components.

2.1 Overall Recycling Composition

A total of 270 samples were obtained from single-family (177 samples) and multifamily (93 samples) loads between January and December 2015. Recycling samples were sorted by hand into 35 component categories.

The overall composition results are illustrated in Figure 2-1. At approximately 56%, **Paper** made up the largest portion of residential recycling from January to December 2015. **Glass** was also prominent, composing about 26% of the total.

[4] In recycling composition tables and figures, estimated tonnages are rounded to the nearest ton, and estimated percentages are rounded to the nearest tenth of a percent. As a result, estimates may not sum to the subtotals or totals shown. Appendix E presents more detail regarding the calculations.

Figure 2-1: Overview of Composition Estimates: Overall
(January 2015 – December 2015)

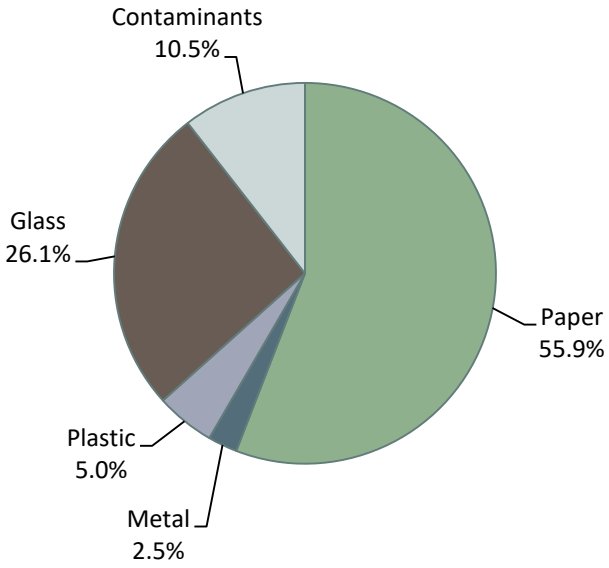


Table 2-1 lists the mean percent, cumulative percent, and tons of the top ten components found in residential recycling samples from January to December 2015. *Mixed low-grade paper* (24.5%) was the largest single component, followed by *unwaxed OCC/Kraft paper* (16.4%) and *newsprint* (13.9%).[5] Table 2-1 presents complete composition results for the overall residential recycling stream. Definitions for all material components are presented in Appendix A.

Table 2-1. Top Ten Components: Overall
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	24.5%	24.5%	21,143
Unwaxed OCC/Kraft Paper	16.4%	40.9%	14,110
Newsprint	13.9%	54.7%	11,963
Mixed Glass Cullet	11.4%	66.1%	9,802
Brown Glass Bottles	4.8%	70.9%	4,104
Green Glass Bottles	4.4%	75.3%	3,816
Clear Glass Bottles	4.2%	79.4%	3,584
Other Non-recyclables	3.1%	82.6%	2,699
Non-conforming Paper	2.7%	85.3%	2,340
Non-conforming Plastic	1.4%	86.6%	1,179
Total	**86.6%**		**74,738**

[5] *OCC/Kraft paper* means unwaxed/uncoated old corrugated container boxes and Kraft paper, and brown paper bags.

Table 2-2. Composition by Weight: Overall
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**48,189**	**55.9%**		
Newsprint	11,963	13.9%	13.2%	14.5%
Unwaxed OCC/Kraft Paper	14,110	16.4%	15.5%	17.2%
Mixed Low-grade Paper	21,143	24.5%	23.5%	25.6%
Polycoat Containers	390	0.5%	0.4%	0.5%
Aseptic Containers	187	0.2%	0.2%	0.2%
Phone Books	290	0.3%	0.2%	0.5%
Shredded Paper	107	0.1%	0.1%	0.2%
Metal	**2,151**	**2.5%**		
Aluminum Cans	673	0.8%	0.7%	0.8%
Aluminum Foil/Containers	121	0.1%	0.1%	0.2%
Tin Food Cans	978	1.1%	1.0%	1.2%
Other Ferrous Metal	379	0.4%	0.3%	0.5%
Plastic	**4,311**	**5.0%**		
Small PET Bottles (24 oz or smaller)	620	0.7%	0.7%	0.8%
Large PET Bottles (greater than 24 oz)	631	0.7%	0.7%	0.8%
PET Jars, Tubs, and Other Containers	588	0.7%	0.6%	0.7%
HDPE Natural Bottles	380	0.4%	0.4%	0.5%
HDPE Colored Bottles	395	0.5%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	129	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	137	0.2%	0.1%	0.2%
Other Plastic Bottles (#3-7)	120	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	251	0.3%	0.3%	0.3%
Plastic Bags and Packaging	764	0.9%	0.8%	1.0%
Bulky Rigid Plastic	296	0.3%	0.3%	0.4%
Glass	**22,542**	**26.1%**		
Clear Glass Bottles	3,584	4.2%	3.9%	4.4%
Green Glass Bottles	3,816	4.4%	4.1%	4.7%
Brown Glass Bottles	4,104	4.8%	4.4%	5.1%
Clear Container Glass	852	1.0%	0.9%	1.1%
Other Glass Containers and Bottles	385	0.4%	0.3%	0.6%
Mixed Glass Cullet	9,802	11.4%	10.7%	12.0%
Contaminants	**9,073**	**10.5%**		
Non-Conforming Paper	2,340	2.7%	2.4%	3.0%
Non-Conforming Metal	717	0.8%	0.6%	1.0%
Non-Conforming Plastic	1,179	1.4%	1.2%	1.5%
Non-Conforming Glass	484	0.6%	0.4%	0.7%
Food, Green Waste, and Wood	1,101	1.3%	1.1%	1.5%
Textiles and Clothing	553	0.6%	0.5%	0.8%
Other non-recyclables	2,699	3.1%	2.8%	3.5%
Total Tons	**86,266**			
Sample Count	**270**			

Confidence intervals calculated at the 90% confidence level.

2.2 Residential Recycling by Subpopulation

In addition to overall residential recycling, composition estimates were calculated for the following recycling subpopulations:[6]

- **Residence type**: single-family and multifamily
- **Collection zone**: Zones 1, 2, 3, and 4
- **Residence type and collection zone**: single-family Zone 1, single-family Zone 2, single-family Zone 3, single-family Zone 4, multifamily Zone 1, multifamily Zone 2, multifamily Zone 3, and multifamily Zone 4
- **Season**: spring, summer, fall, and winter
- **Household income**: low and high
- **Household race**: Lowest and highest percentages of residents of color.

The largest material components for each subpopulation are shown in Table 2-3 (materials that account for more than 5%). Table 2-4 compares 2010 and 2015 contaminant components for overall recycling and the single-family and multifamily subpopulations.

[6] As with the overall estimates, a weighted average procedure was used to calculate composition estimates for each subpopulation (see Appendix D for more detail on weighted averages). Several additional steps were needed to calculate composition by household demographics (income and race). See the Demographic Calculations section in Appendix D for more detail about the steps taken.

Table 2-3: Largest Recycling Components, by Subpopulation
(January – December 2015)

Subpopulation	Paper			Glass		
	Newsprint	Mixed Low-grade	Unwaxed OCC/Kraft	Mixed Cullet	Brown Bottles	Green Bottles
Residence Type						
Single-family	14.4%	25.1%	15.0%	11.5%		
Multifamily	12.6%	23.0%	19.6%	11.1%		
Collection Zone						
Zone 1	14.8%	25.4%	14.6%	11.3%		
Zone 2	13.9%	25.2%	15.5%	11.2%	5.1%	5.1%
Zone 3	12.8%	23.6%	19.1%	11.1%		
Zone 4	14.4%	24.5%	15.1%	11.8%		
Residence Type and Zone						
Single-family Zone 1	14.4%	25.1%	15.0%	11.5%		
Single-family Zone 2	13.9%	25.4%	15.5%	10.9%	5.1%	5.2%
Single-family Zone 3	13.1%	24.2%	18.4%	10.8%		
Single-family Zone 4	14.7%	24.9%	14.1%	12.0%		
Multifamily Zone 1	12.7%	23.5%	20.2%	9.3%	5.3%	
Multifamily Zone 2	13.3%	22.4%	15.4%	14.6%		
Multifamily Zone 3	12.4%	22.9%	19.8%	11.5%	5.1%	
Multifamily Zone 4	13.0%	22.7%	18.9%	11.1%		
Season						
Spring	13.2%	17.2%	15.3%	14.6%	5.4%	
Summer	13.9%	25.1%	15.0%	9.9%	5.4%	
Fall	12.2%	31.0%	15.4%	9.5%		
Winter	16.2%	24.1%	19.6%	11.7%		
Household Demographics						
Low-income	14.6%	22.1%	16.5%	12.9%		
High-income	13.5%	25.6%	14.5%	10.7%	5.3%	5.2%
Low % Residents of Color	15.8%	26.4%	11.9%	12.4%		
High % Residents of Color	14.9%	25.2%	14.9%	10.9%		
Overall Residential	**13.9%**	**24.5%**	**16.4%**	**11.4%**		

The following conclusions can be drawn from the recycling composition estimates of the overall residential substream and for each subpopulation. [7]

- *Newsprint*, *mixed low-grade paper*, *unwaxed OCC/Kraft paper,* and *mixed glass cullet* were large (greater than 5%) components in all groups. For several subpopulations, *brown glass bottles* was also a large component. *Green glass bottles* was a large component in two subpopulations.
- The composition percentages of these material components were very consistent among all subpopulations.

[7] No statistical tests were performed to identify differences among subpopulations. Therefore, the comparisons may not be statistically significant.

- Mixed low-grade paper accounted for the highest percentage of recycled materials in all subpopulations.
- The key differences are presented below by subpopulation type:
    - **Residence type**: Multifamily residents appear to have recycled a higher percentage of *unwaxed OCC/Kraft paper* than single-family residents.
    - **Collection zone**: Zone 3 residents appear to have recycled a higher percentage of *unwaxed OCC/Kraft paper* than residents in the other zones.
    - **Season**: *Mixed low-grade paper* made up a substantially higher percentage of fall recycling samples than spring recycling samples. A higher percentage of *newsprint* and *unwaxed OCC/Kraft paper* was collected in winter than in other seasons. *Mixed glass cullet* was present in smaller portions in summer and fall samples than in spring and winter samples.
    - **Household demographics**: Low-income households appear to have recycled a lower percentage of mixed low-grade paper and a higher percentage of unwaxed OCC/Kraft paper than high-income households. Households with the lowest percentage of residents of color recycled a smaller proportion of unwaxed OCC/Kraft paper than households with the highest percentage of residents of color.

Table 2-4 compares 2010 and 2015 contaminant components for overall recycling and the single-family and multifamily subpopulations.[8] Between 2010 and 2015, the percentage of *non-conforming paper* and *other non-recyclables* increased overall and in both single-family and multifamily recycling.

Table 2-4: Contaminant Components, by Subpopulation (January – December 2015)

Subpopulation & Contaminants	2010	2015	Change in Percentage Points
Overall Residential			
Non-conforming Paper	0.7%	2.7%	2.0%
Non-conforming Metal	0.4%	0.8%	0.4%
Non-conforming Plastic	1.5%	1.4%	-0.1%
Non-conforming Glass	0.3%	0.6%	0.3%
Food, Green Waste, and Wood	1.5%	1.3%	-0.2%
Textiles and Clothing	0.6%	0.6%	0.0%
Other Non-recyclables	0.9%	3.1%	2.2%
Single-family			
Non-conforming Paper	0.7%	2.6%	1.9%
Non-conforming Metal	0.4%	0.8%	0.4%
Non-conforming Plastic	1.5%	1.4%	-0.1%
Non-conforming Glass	0.3%	0.6%	0.3%
Food, Green Waste, and Wood	1.3%	1.3%	0.0%
Textiles and Clothing	0.5%	0.6%	0.1%
Other Non-recyclables	0.8%	2.8%	2.0%
Multifamily			
Non-conforming Paper	0.6%	2.9%	2.3%
Non-conforming Metal	0.5%	1.0%	0.5%
Non-conforming Plastic	1.2%	1.2%	0.0%
Non-conforming Glass	0.3%	0.6%	0.2%
Food, Green Waste, and Wood	2.2%	1.2%	-1.0%
Textiles and Clothing	0.9%	0.8%	-0.1%
Other Non-recyclables	1.2%	3.8%	2.6%

3 Trends in Residential Recycling: 2000/01 to 2015

In this section, results of the 2015 study are compared to those from the 2000/01 and 2010 studies, which followed the same basic methodology.[9] Changes in the amounts and composition percentages of material recycled in each broad material category were analyzed to compare findings between study periods.[10] Section 3.1 provides an overview of the changes in tons recycled since the 2000/01 study.

[8] No statistical tests were performed to identify differences among subpopulations or by year at the material component level. Therefore, the comparisons may not be statistically significant.

[9] Due to differences in the methods used to obtain samples, the results of the more recent recycling studies are not comparable to the ones completed in 1993 and 1998/99.

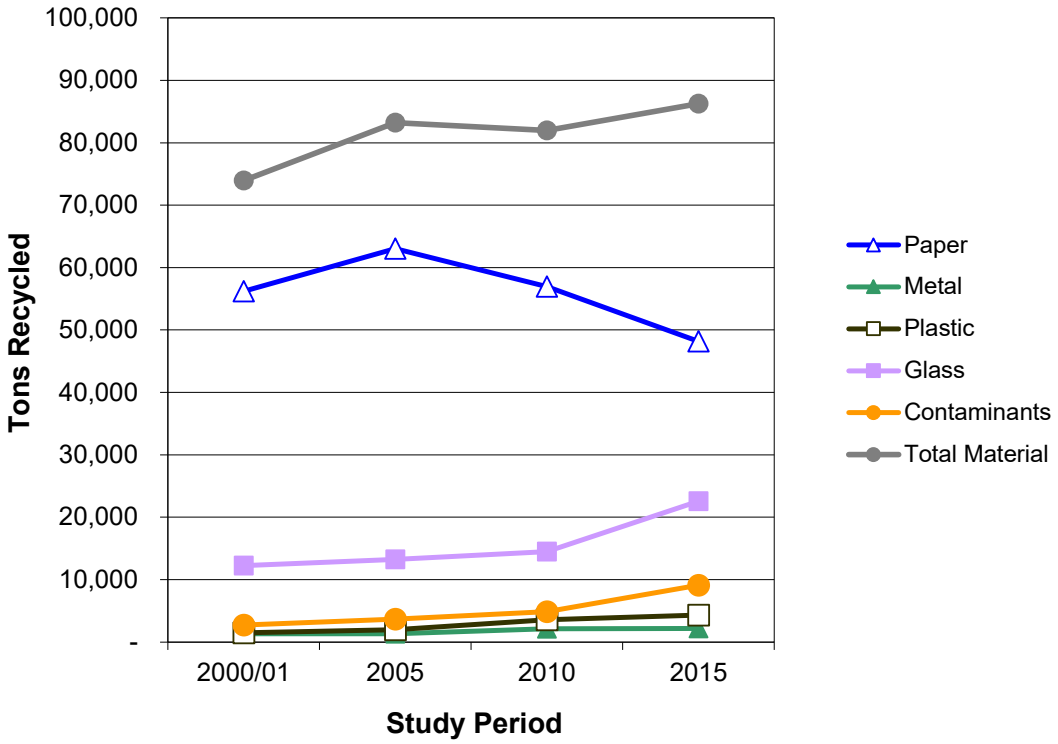
[10] The composition percentages used to analyze the differences in recycled tonnage and to perform statistical tests were calculated using unweighted averages. For this reason, and because number reported in this section are based on a uniform material list that is consistent with prior study years, numbers reported in this section differ slightly from those in other parts of the study. Appendix D provides more detail.

Section 3.2 compares 2015 composition percentages with earlier studies. See Appendix E for details about year-to-year comparison calculations.

3.1 Trends in Tons Recycled Since 2000/01

Figure 3-1 illustrates the changes in residential recycling tons since the 2000/01 study.[11] Overall, the quantity of residential recyclables has increased from about 74,000 tons in 2000/01 to approximately 86,000 tons in 2015. The quantity of recyclables has increased after a slight dip between 2005 and 2010 despite an apparent decrease in the broad material category **Paper**. Since 2010, the quantities of **Glass** and **Contaminants** appear to have increased in overall residential recycling. **Plastic** and **Metal**, though present in smaller quantities, also seem to have increased slightly from 2000/01 to 2015.

Figure 3-1. Changes in Residential Recycling Tons, 2000/01 to 2015



3.2 Changes in Composition Percentages

This section first compares composition percentages between the current study and the 2000/01 study and then compares the current study to the one last completed in in 2010.

3.2.1 Changes in Composition Percentages: 2000/01 to 2015

In Table 3-1, all broad material categories are bolded because they all changed significantly between the 2000/01 and 2015 study periods. **Paper** decreased the most by 20 percentage points from 76 to 56

[11] Sampling for the 2000/01 study took place between November 2000 and October 2001.

percent of all recyclables. **Glass** increased by nearly 10 percentage points and **Contaminants** increased by 7 percentage points.

Table 3-1. Changes in Changes in Composition Percentages: 2000 to 2015

	Percent		Change in	Disposed Tons	
	2000	2015	Composition %	2000	2015
Paper	**76.0%**	**55.9%**	**-20.1%** ⬇	**56,180**	**48,189**
Metal	**1.8%**	**2.5%**	**0.7%** ⬆	**1,303**	**2,151**
Plastic	**2.0%**	**5.0%**	**3.0%** ⬆	**1,493**	**4,311**
Glass	**16.6%**	**26.1%**	**9.6%** ⬆	**12,239**	**22,542**
Contaminants	**3.7%**	**10.5%**	**6.9%** ⬆	**2,710**	**9,073**
Total	**100%**	**100%**		**73,926**	**86,266**

* Bold type indicates statistically significant changes.

3.2.2 Changes in Composition Percentages: 2010 to 2015

In Table 3-2, three broad material categories are bolded because they all changed significantly between the 2010 and 2015 study periods. **Paper** decreased by almost 14 percentage points, **Glass** increased by 8 percentage points, and **Contaminants** increased by nearly 5 percentage points.

Table 3-2. Changes in Recycling: 2010 to 2015

	Percent		Change in	Disposed Tons	
	2010	2015	Composition %	2010	2015
Paper	**69.5%**	**55.9%**	**-13.6%** ⬇	**56,958**	**48,189**
Metal	2.6%	2.5%	-0.1% ⬇	2,098	2,151
Plastic	4.3%	5.0%	0.7% ⬆	3,555	4,311
Glass	**17.7%**	**26.1%**	**8.4%** ⬆	**14,493**	**22,542**
Contaminants	**5.9%**	**10.5%**	**4.6%** ⬆	**4,857**	**9,073**
Total	**100%**	**100%**		**81,961**	**86,266**

* Bold type indicates statistically significant changes.

4 Composition Results by Subpopulation

This section presents composition results by subpopulation. Results are presented in three subsections: first by residence types, then by collection zones, and finally by residence type and collection zone. Each subsection is organized so that pie charts appear first for all subpopulations, followed by top ten component tables for each subpopulation. Detailed composition tables are presented at the end of each results subsection.

A total of 270 loads from residential recycling were sampled from January to December 2015. Table 4-1 summarizes the sample information for each subpopulation as well as the associated recycled tons and number of households. During the sampling period, approximately 86,000 tons were recycled by Seattle residents.

Table 4-1. Description of Samples for Each Subpopulation (January 2015 – December 2015)

Subpopulation	Total Sampling Weight (lbs)	Sample Count	Total Recycling (Tons)	Number of Households
Residence Type				
Single-family	50,354	177	60,434	156,114
Multi-family	25,971	93	25,833	141,924
Collection Zone				
Zone 1	18,644	66	20,495	68,166
Zone 2	18,590	65	13,096	52,097
Zone 3	18,993	67	28,525	104,199
Zone 4	20,098	72	24,150	73,576
Residence Type and Zone				
Single-family Zone 1	11,938	42	14,822	42,341
Single-family Zone 2	13,270	46	12,142	29,868
Single-family Zone 3	11,660	41	14,159	31,393
Single-family Zone 4	13,486	48	19,311	52,512
Multifamily Zone 1	6,705	24	5,673	25,825
Multifamily Zone 2	5,320	19	954	22,229
Multifamily Zone 3	7,333	26	14,366	72,806
Multifamily Zone 4	6,613	24	4,839	21,064
Overall Residential	**76,325**	**270**	**86,266**	**298,038**

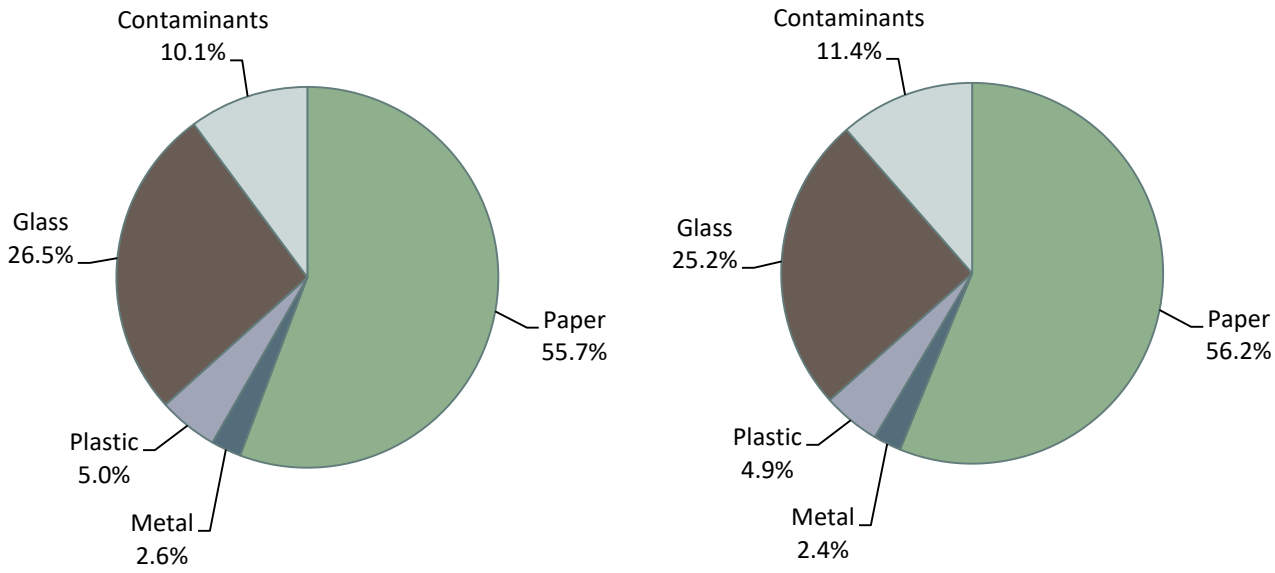
Section 4.1 presents detailed composition estimates for single-family and multifamily residence type, and Section 4.2 provides estimates for Zones 1 through 4. Finally, Section 4.3 gives composition by residence type for each of the four collection zones.

4.1 By Residence Type

Composition estimates for single-family and multifamily recycling are summarized in Figure 4-1. As depicted, **Paper** accounted for more than half of recycling from both residence types. **Glass** made up between 25 and 27 percent, and **Contaminants** made up approximately one-tenth (between 10-12%) of

recycling from single-family and multifamily residences. **Plastic** and **Metal** each made up 5 percent or less of the total for each residence type.

Figure 4-1. Overview of Composition Estimates, by Residence Type
(January 2015 – December 2015)



4.1.1 Single-family Composition

A total of 177 single-family recycling loads were sampled between January and December 2015. Seattle's single-family residents recycled approximately 60,400 tons in 2015. Table 4-2 lists the top ten components by weight in single-family recycling. *Mixed low-grade paper* was the largest single component at about 25 percent, or one quarter of the recycling stream. *Unwaxed OCC/Kraft paper* (15.0%), *newsprint* (14.4%), and *mixed glass cullet* (11.5%) are the next largest components. Table 4-4 shows detailed composition results for single-family recycling.

Table 4-2. Top Ten Components: Single-family
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	25.1%	25.1%	15,198
Unwaxed OCC/Kraft Paper	15.0%	40.1%	9,058
Newsprint	14.4%	54.5%	8,696
Mixed Glass Cullet	11.5%	66.0%	6,942
Brown Glass Bottles	4.7%	70.7%	2,841
Green Glass Bottles	4.5%	75.2%	2,732
Clear Glass Bottles	4.3%	79.6%	2,608
Other non-recyclables	2.8%	82.4%	1,714
Non-Conforming Paper	2.6%	85.0%	1,598
Non-Conforming Plastic	1.4%	86.5%	860
Total	**86.5%**		**52,248**

4.1.2 Multifamily Composition

A total of 93 samples were captured and sorted from multifamily recycling loads for this study. Seattle's multifamily residents recycled approximately 25,800 tons in 2015. As shown in Table 4-3, *mixed low-grade paper* (23.0%), *unwaxed OCC/Kraft paper* (19.6%), *newsprint* (12.6%), *and mixed glass cullet* (11.1%) were the largest component types by weight in multifamily recycling, the same top component types identified in single-family recycling. Table 4-5 shows the full composition results for multifamily recycling.

Table 4-3. Top Ten Components: Multifamily
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	23.0%	23.0%	5,945
Unwaxed OCC/Kraft Paper	19.6%	42.6%	5,051
Newsprint	12.6%	55.2%	3,267
Mixed Glass Cullet	11.1%	66.3%	2,859
Brown Glass Bottles	4.9%	71.2%	1,263
Green Glass Bottles	4.2%	75.4%	1,084
Other non-recyclables	3.8%	79.2%	985
Clear Glass Bottles	3.8%	83.0%	975
Non-Conforming Paper	2.9%	85.8%	742
Non-Conforming Plastic	1.2%	87.1%	319
Total	**87.1%**		**22,490**

4.1.3 Comparison of Residence Types

The top six components in residential recycling loads were the same for single-family and multifamily recycling: *mixed low-grade paper*, *unwaxed OCC/Kraft paper*, *newsprint, mixed glass cullet*, *brown glass bottles*, and *green glass bottles*. Though these components varied in composition ratio, they were present in the same order within both lists.

The remaining four components in the top ten lists were also identical for single-family and multifamily recycling: *clear glass bottles*, *other non-recyclables, non-conforming paper, and non-conforming plastic*. These components varied in both composition ratio and order within the lists.

Table 4-4 and Table 4-5 below show detailed composition data for single-family and multifamily recycling.

Table 4-4. Composition by Weight: Single-family
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**33,680**	**55.7%**		
Newsprint	8,696	14.4%	13.7%	15.1%
Unwaxed OCC/Kraft Paper	9,058	15.0%	14.1%	15.8%
Mixed Low-grade Paper	15,198	25.1%	23.9%	26.4%
Polycoat Containers	277	0.5%	0.4%	0.5%
Aseptic Containers	132	0.2%	0.2%	0.2%
Phone Books	261	0.4%	0.2%	0.6%
Shredded Paper	58	0.1%	0.0%	0.2%
Metal	**1,544**	**2.6%**		
Aluminum Cans	446	0.7%	0.7%	0.8%
Aluminum Foil/Containers	86	0.1%	0.1%	0.2%
Tin Food Cans	708	1.2%	1.1%	1.3%
Other Ferrous Metal	304	0.5%	0.4%	0.6%
Plastic	**3,050**	**5.0%**		
Small PET Bottles (24 oz or smaller)	438	0.7%	0.7%	0.8%
Large PET Bottles (greater than 24 oz)	430	0.7%	0.7%	0.8%
PET Jars, Tubs, and Other Containers	432	0.7%	0.6%	0.8%
HDPE Natural Bottles	261	0.4%	0.4%	0.5%
HDPE Colored Bottles	286	0.5%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	88	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	99	0.2%	0.1%	0.2%
Other Plastic Bottles (#3-7)	90	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	180	0.3%	0.3%	0.3%
Plastic Bags and Packaging	535	0.9%	0.8%	1.0%
Bulky Rigid Plastic	212	0.4%	0.2%	0.5%
Glass	**16,040**	**26.5%**		
Clear Glass Bottles	2,608	4.3%	4.0%	4.6%
Green Glass Bottles	2,732	4.5%	4.1%	4.9%
Brown Glass Bottles	2,841	4.7%	4.3%	5.1%
Clear Container Glass	627	1.0%	0.9%	1.2%
Other Glass Containers and Bottles	290	0.5%	0.3%	0.6%
Mixed Glass Cullet	6,942	11.5%	10.8%	12.2%
Contaminants	**6,120**	**10.1%**		
Non-Conforming Paper	1,598	2.6%	2.3%	3.0%
Non-Conforming Metal	459	0.8%	0.6%	0.9%
Non-Conforming Plastic	860	1.4%	1.2%	1.6%
Non-Conforming Glass	337	0.6%	0.4%	0.7%
Food, Green Waste, and Wood	804	1.3%	1.1%	1.6%
Textiles and Clothing	348	0.6%	0.4%	0.7%
Other non-recyclables	1,714	2.8%	2.5%	3.2%
Total Tons	**60,434**			
Sample Count	**177**			

Confidence intervals calculated at the 90% confidence level.

Table 4-5. Composition by Weight: Multifamily
(January 2015 – December 2015)

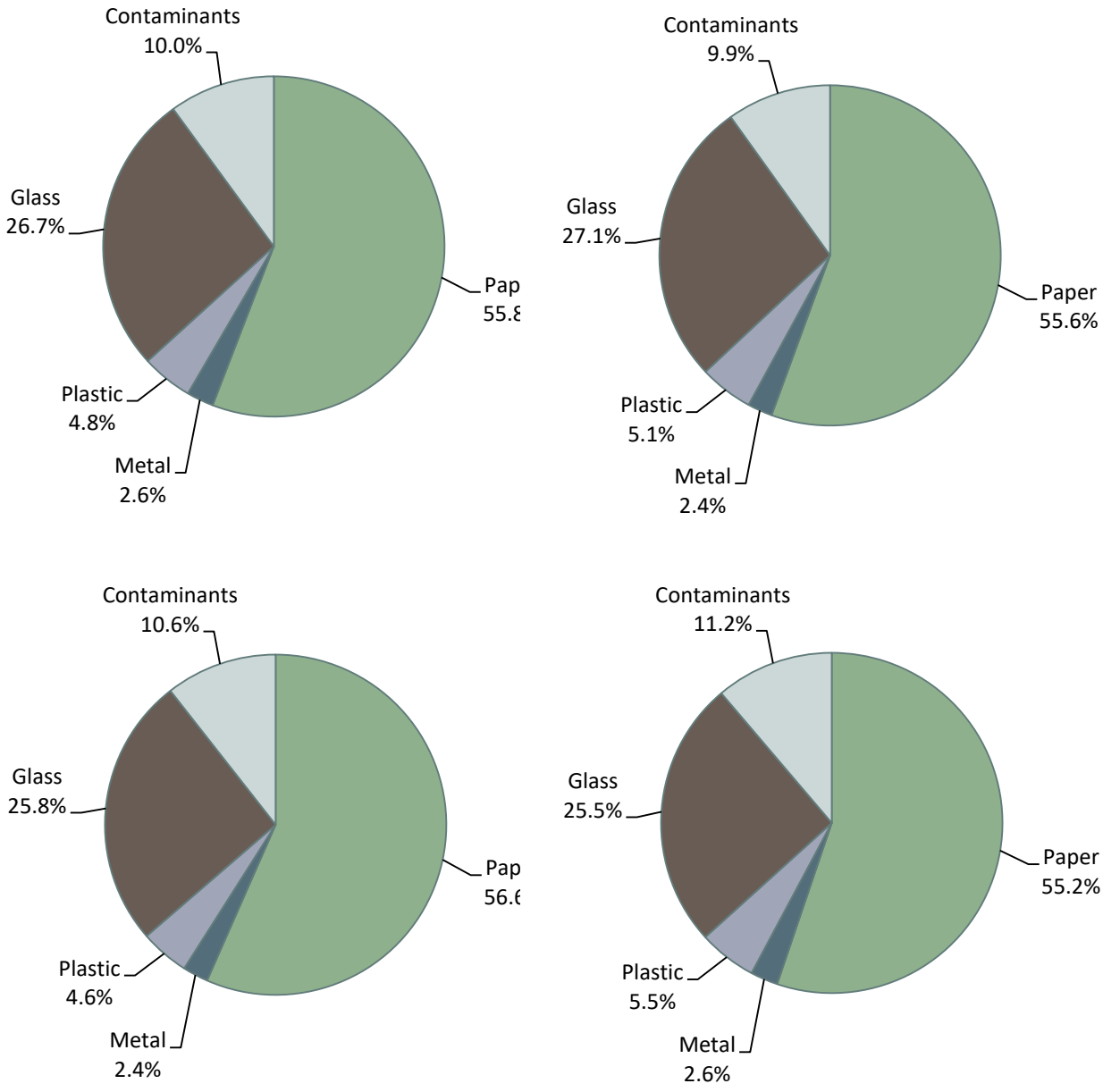
Material	Est. Tons	Est. Percent	Low	High
Paper	**14,509**	**56.2%**		
Newsprint	3,267	12.6%	11.3%	14.0%
Unwaxed OCC/Kraft Paper	5,051	19.6%	17.5%	21.6%
Mixed Low-grade Paper	5,945	23.0%	21.1%	24.9%
Polycoat Containers	113	0.4%	0.4%	0.5%
Aseptic Containers	56	0.2%	0.2%	0.3%
Phone Books	29	0.1%	0.1%	0.2%
Shredded Paper	49	0.2%	0.1%	0.3%
Metal	**608**	**2.4%**		
Aluminum Cans	227	0.9%	0.7%	1.0%
Aluminum Foil/Containers	36	0.1%	0.1%	0.2%
Tin Food Cans	269	1.0%	0.9%	1.2%
Other Ferrous Metal	75	0.3%	0.1%	0.4%
Plastic	**1,260**	**4.9%**		
Small PET Bottles (24 oz or smaller)	182	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	201	0.8%	0.7%	0.9%
PET Jars, Tubs, and Other Containers	156	0.6%	0.5%	0.7%
HDPE Natural Bottles	120	0.5%	0.4%	0.5%
HDPE Colored Bottles	108	0.4%	0.3%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	41	0.2%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	38	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	31	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	71	0.3%	0.2%	0.3%
Plastic Bags and Packaging	229	0.9%	0.7%	1.1%
Bulky Rigid Plastic	84	0.3%	0.2%	0.4%
Glass	**6,502**	**25.2%**		
Clear Glass Bottles	975	3.8%	3.1%	4.4%
Green Glass Bottles	1,084	4.2%	3.7%	4.7%
Brown Glass Bottles	1,263	4.9%	4.3%	5.5%
Clear Container Glass	225	0.9%	0.6%	1.1%
Other Glass Containers and Bottles	96	0.4%	0.2%	0.5%
Mixed Glass Cullet	2,859	11.1%	9.8%	12.4%
Contaminants	**2,953**	**11.4%**		
Non-Conforming Paper	742	2.9%	2.2%	3.6%
Non-Conforming Metal	258	1.0%	0.5%	1.5%
Non-Conforming Plastic	319	1.2%	0.9%	1.6%
Non-Conforming Glass	147	0.6%	0.3%	0.9%
Food, Green Waste, and Wood	297	1.2%	0.8%	1.5%
Textiles and Clothing	205	0.8%	0.6%	1.0%
Other non-recyclables	985	3.8%	3.0%	4.7%
Total Tons	**25,833**			
Sample Count	**93**			

Confidence intervals calculated at the 90% confidence level.

4.2 By Collection Zone

Figure 4-2 depicts the composition results of residential recycling collected for Zones 1 through 4. For all four collection zones, **Paper** made up 55 to 57 percent of the total stream. **Glass** was approximately a quarter of the recycling stream in all four collection zones (from 25.5% in Zone 4 to 27.1% in Zone 2). **Contaminants** were approximately one tenth of the stream in each of the four zones (ranging from 9.9% to 11.2%).

Figure 4-2. Overview of Composition Estimates by Collection Zone
(January 2015 – December 2015)



4.2.1 Zone 1

Cascadia sampled a total of 66 loads of recyclables from Zone 1 between January and December 2015. Seattle's Zone 1 residents set out approximately 20,500 tons for recycling in 2015. Table 4-6 presents the top ten components for this subpopulation. As shown, *mixed low-grade paper* accounted for approximately a quarter of the stream (25.4%), while *newsprint* and *unwaxed OCC/Kraft paper* each made up about 15 percent and *mixed glass cullet* made up an additional 11 percent. The remaining material components in Zone 1 recycling were each less than five percent of the stream. Full composition results for Zone 1 are shown in Table 4-10**.**

Table 4-6. Top Ten Components: Zone 1
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	25.4%	25.4%	5,212
Newsprint	14.8%	40.2%	3,029
Unwaxed OCC/Kraft Paper	14.6%	54.8%	2,995
Mixed Glass Cullet	11.3%	66.1%	2,310
Brown Glass Bottles	4.9%	71.0%	998
Green Glass Bottles	4.8%	75.8%	985
Clear Glass Bottles	4.3%	80.1%	891
Other non-recyclables	2.8%	82.9%	565
Non-Conforming Paper	2.7%	85.5%	544
Tin Food Cans	1.3%	86.8%	267
Total	**86.8%**		**17,796**

4.2.2 Zone 2

For this study, Cascadia sampled 65 recycling loads from Zone 2. Seattle's Zone 2 residents set out approximately 13,100 tons for recycling in 2015. As shown in Table 4-7, *mixed low-grade paper* (25.2%) was the largest component, accounting for approximately a quarter of the stream. *Unwaxed OCC/Kraft paper* (15.5%), *newsprint* (13.9%), and *mixed glass cullet* (11.2%) and were the next largest components. Table 4-11 presents complete results for recycling set-outs collected from Zone 2.

Table 4-7. Top Ten Components: Zone 2
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	25.2%	25.2%	3,295
Unwaxed OCC/Kraft Paper	15.5%	40.6%	2,028
Newsprint	13.9%	54.5%	1,819
Mixed Glass Cullet	11.2%	65.7%	1,467
Green Glass Bottles	5.1%	70.8%	667
Brown Glass Bottles	5.1%	75.9%	664
Clear Glass Bottles	4.6%	80.5%	598
Non-Conforming Paper	2.7%	83.2%	356
Other non-recyclables	2.7%	85.9%	356
Food, Green Waste, and Wood	1.3%	87.2%	171
Total	**87.2%**		**11,420**

4.2.3 Zone 3

For this study, Cascadia sampled 67 recycling loads from Zone 3. Seattle's Zone 3 residents set out approximately 28,500 tons for recycling in 2015. As shown in Table 4-8, *mixed low-grade paper* was the largest single component at about 24 percent, followed by *unwaxed OCC/Kraft paper* (19.1%), *newsprint* (12.8%), and *mixed glass cullet* (11.1%). The remaining material components in Zone 3 recycling were each five percent or less of the stream. Table 4-12 presents complete composition results for recycling set-outs collected from Zone 3.

Table 4-8. Top Ten Components: Zone 3
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	23.6%	23.6%	6,720
Unwaxed OCC/Kraft Paper	19.1%	42.7%	5,451
Newsprint	12.8%	55.5%	3,648
Mixed Glass Cullet	11.1%	66.6%	3,180
Brown Glass Bottles	5.0%	71.6%	1,423
Green Glass Bottles	4.2%	75.8%	1,211
Clear Glass Bottles	4.1%	79.9%	1,159
Other non-recyclables	3.3%	83.2%	945
Non-Conforming Paper	2.8%	86.0%	787
Non-Conforming Plastic	1.5%	87.5%	432
Total	**87.5%**		**24,957**

4.2.4 Zone 4

Cascadia sampled a total of 72 recycling loads from Zone 4. Seattle's Zone 4 residents set out approximately 24,200 tons for recycling in 2015. As shown in Table 4-9, *mixed low-grade paper* (24.5%) was the largest single component, followed by *unwaxed OCC/Kraft paper* (15.1%), *newsprint* (14.4%), and *mixed glass cullet* (11.8%). The remaining material components in Zone 4 recycling were each less than five percent of the stream. Table 4-13 presents the complete results for recycling set-outs collected from Zone 4.

Table 4-9. Top Ten Components: Zone 4
(January 2015 – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	24.5%	24.5%	5,915
Unwaxed OCC/Kraft Paper	15.1%	39.5%	3,636
Newsprint	14.4%	53.9%	3,467
Mixed Glass Cullet	11.8%	65.7%	2,844
Brown Glass Bottles	4.2%	69.9%	1,020
Green Glass Bottles	3.9%	73.8%	952
Clear Glass Bottles	3.9%	77.7%	935
Other Non-recyclables	3.4%	81.2%	833
Non-Conforming Paper	2.7%	83.9%	653
Food, Green Waste, and Wood	1.5%	85.4%	367
Total	**85.4%**		**20,623**

4.2.5 Comparison of Zones

The largest single component in all four collection zones, *mixed low-grade paper* composed about a quarter (23.6% to 25.4%) of recycling for each zone. Also consistent across all four zones, *newsprint* and *unwaxed OCC/Kraft* were the second or third largest components, and *mixed glass cullet* was the fourth largest component observed. Nine components were common to the top ten lists for recycling loads from all four zones: *mixed low-grade paper, newsprint, unwaxed OCC/Kraft paper, mixed glass cullet, clear glass bottles, green glass bottles, brown glass bottles,* and *non-conforming paper*, and *other non-recyclables*.

Food, Green Waste, and Wood was common to the top ten lists in Zone 2 and 4; *non-conforming plastic* was unique to the Zone 3 top ten list; and *tin food cans* was a top ten component unique to the top ten list for Zone 1.

The tables that follow show full composition data for residential recycling for each of the four zones.

Table 4-10. Composition by Weight: Zone 1
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**11,444**	**55.8%**		
Newsprint	3,029	14.8%	13.5%	16.0%
Unwaxed OCC/Kraft Paper	2,995	14.6%	13.0%	16.2%
Mixed Low-grade Paper	5,212	25.4%	23.3%	27.6%
Polycoat Containers	89	0.4%	0.4%	0.5%
Aseptic Containers	42	0.2%	0.2%	0.2%
Phone Books	45	0.2%	0.1%	0.3%
Shredded Paper	32	0.2%	0.0%	0.3%
Metal	**525**	**2.6%**		
Aluminum Cans	159	0.8%	0.7%	0.9%
Aluminum Foil/Containers	29	0.1%	0.1%	0.2%
Tin Food Cans	267	1.3%	1.0%	1.6%
Other Ferrous Metal	69	0.3%	0.2%	0.5%
Plastic	**992**	**4.8%**		
Small PET Bottles (24 oz or smaller)	130	0.6%	0.6%	0.7%
Large PET Bottles (greater than 24 oz)	141	0.7%	0.6%	0.8%
PET Jars, Tubs, and Other Containers	140	0.7%	0.6%	0.8%
HDPE Natural Bottles	96	0.5%	0.4%	0.5%
HDPE Colored Bottles	89	0.4%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	32	0.2%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	31	0.2%	0.1%	0.2%
Other Plastic Bottles (#3-7)	22	0.1%	0.1%	0.1%
Other Jars, Tubs, and Containers (#3-7)	56	0.3%	0.2%	0.3%
Plastic Bags and Packaging	180	0.9%	0.7%	1.0%
Bulky Rigid Plastic	75	0.4%	0.1%	0.6%
Glass	**5,477**	**26.7%**		
Clear Glass Bottles	891	4.3%	3.8%	4.9%
Green Glass Bottles	985	4.8%	4.1%	5.5%
Brown Glass Bottles	998	4.9%	4.0%	5.7%
Clear Container Glass	207	1.0%	0.7%	1.3%
Other Glass Containers and Bottles	86	0.4%	0.2%	0.6%
Mixed Glass Cullet	2,310	11.3%	10.0%	12.5%
Contaminants	**2,057**	**10.0%**		
Non-Conforming Paper	544	2.7%	2.0%	3.3%
Non-Conforming Metal	262	1.3%	0.8%	1.8%
Non-Conforming Plastic	237	1.2%	0.8%	1.5%
Non-Conforming Glass	93	0.5%	0.2%	0.7%
Food, Green Waste, and Wood	266	1.3%	0.9%	1.7%
Textiles and Clothing	91	0.4%	0.3%	0.6%
Other non-recyclables	565	2.8%	2.2%	3.4%
Total Tons	**20,495**			
Sample Count	**66**			

Confidence intervals calculated at the 90% confidence level.

Table 4-11. Composition by Weight: Zone 2
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**7,278**	**55.6%**		
Newsprint	1,819	13.9%	12.6%	15.1%
Unwaxed OCC/Kraft Paper	2,028	15.5%	14.2%	16.8%
Mixed Low-grade Paper	3,295	25.2%	22.8%	27.5%
Polycoat Containers	65	0.5%	0.4%	0.6%
Aseptic Containers	31	0.2%	0.2%	0.3%
Phone Books	28	0.2%	0.1%	0.3%
Shredded Paper	10	0.1%	0.0%	0.1%
Metal	**308**	**2.4%**		
Aluminum Cans	104	0.8%	0.6%	1.0%
Aluminum Foil/Containers	14	0.1%	0.1%	0.1%
Tin Food Cans	137	1.0%	0.9%	1.2%
Other Ferrous Metal	52	0.4%	0.2%	0.6%
Plastic	**667**	**5.1%**		
Small PET Bottles (24 oz or smaller)	94	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	95	0.7%	0.6%	0.8%
PET Jars, Tubs, and Other Containers	96	0.7%	0.6%	0.8%
HDPE Natural Bottles	60	0.5%	0.4%	0.5%
HDPE Colored Bottles	60	0.5%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	15	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	22	0.2%	0.1%	0.2%
Other Plastic Bottles (#3-7)	19	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	41	0.3%	0.2%	0.4%
Plastic Bags and Packaging	127	1.0%	0.8%	1.2%
Bulky Rigid Plastic	38	0.3%	0.2%	0.4%
Glass	**3,550**	**27.1%**		
Clear Glass Bottles	598	4.6%	4.0%	5.1%
Green Glass Bottles	667	5.1%	4.4%	5.8%
Brown Glass Bottles	664	5.1%	4.2%	5.9%
Clear Container Glass	119	0.9%	0.6%	1.2%
Other Glass Containers and Bottles	36	0.3%	0.1%	0.4%
Mixed Glass Cullet	1,467	11.2%	9.7%	12.7%
Contaminants	**1,294**	**9.9%**		
Non-Conforming Paper	356	2.7%	2.2%	3.2%
Non-Conforming Metal	129	1.0%	0.6%	1.4%
Non-Conforming Plastic	152	1.2%	1.0%	1.3%
Non-Conforming Glass	51	0.4%	0.2%	0.6%
Food, Green Waste, and Wood	171	1.3%	0.9%	1.7%
Textiles and Clothing	79	0.6%	0.4%	0.8%
Other non-recyclables	356	2.7%	2.1%	3.3%
Total Tons	**13,096**			
Sample Count	**65**			

Confidence intervals calculated at the 90% confidence level.

Table 4-12. Composition by Weight: Zone 3
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**16,140**	**56.6%**		
Newsprint	3,648	12.8%	11.4%	14.1%
Unwaxed OCC/Kraft Paper	5,451	19.1%	17.4%	20.8%
Mixed Low-grade Paper	6,720	23.6%	21.7%	25.4%
Polycoat Containers	129	0.5%	0.4%	0.5%
Aseptic Containers	56	0.2%	0.2%	0.2%
Phone Books	114	0.4%	0.0%	0.8%
Shredded Paper	21	0.1%	0.0%	0.1%
Metal	**690**	**2.4%**		
Aluminum Cans	227	0.8%	0.7%	0.9%
Aluminum Foil/Containers	42	0.1%	0.1%	0.2%
Tin Food Cans	296	1.0%	0.9%	1.1%
Other Ferrous Metal	125	0.4%	0.3%	0.6%
Plastic	**1,325**	**4.6%**		
Small PET Bottles (24 oz or smaller)	193	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	205	0.7%	0.6%	0.8%
PET Jars, Tubs, and Other Containers	182	0.6%	0.6%	0.7%
HDPE Natural Bottles	106	0.4%	0.3%	0.4%
HDPE Colored Bottles	112	0.4%	0.3%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	37	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	36	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	43	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	82	0.3%	0.2%	0.3%
Plastic Bags and Packaging	248	0.9%	0.7%	1.0%
Bulky Rigid Plastic	83	0.3%	0.2%	0.4%
Glass	**7,354**	**25.8%**		
Clear Glass Bottles	1,159	4.1%	3.5%	4.6%
Green Glass Bottles	1,211	4.2%	3.8%	4.7%
Brown Glass Bottles	1,423	5.0%	4.4%	5.6%
Clear Container Glass	258	0.9%	0.7%	1.2%
Other Glass Containers and Bottles	122	0.4%	0.2%	0.6%
Mixed Glass Cullet	3,180	11.1%	9.9%	12.4%
Contaminants	**3,017**	**10.6%**		
Non-Conforming Paper	787	2.8%	2.1%	3.4%
Non-Conforming Metal	164	0.6%	0.2%	0.9%
Non-Conforming Plastic	432	1.5%	1.1%	1.9%
Non-Conforming Glass	186	0.7%	0.4%	0.9%
Food, Green Waste, and Wood	298	1.0%	0.7%	1.4%
Textiles and Clothing	204	0.7%	0.5%	0.9%
Other non-recyclables	945	3.3%	2.5%	4.1%
Total Tons	**28,525**			
Sample Count	**67**			

Confidence intervals calculated at the 90% confidence level.

Table 4-13. Composition by Weight: Zone 4
(January 2015 – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**13,328**	**55.2%**		
Newsprint	3,467	14.4%	13.2%	15.5%
Unwaxed OCC/Kraft Paper	3,636	15.1%	13.4%	16.7%
Mixed Low-grade Paper	5,915	24.5%	22.4%	26.6%
Polycoat Containers	106	0.4%	0.4%	0.5%
Aseptic Containers	58	0.2%	0.2%	0.3%
Phone Books	103	0.4%	0.3%	0.6%
Shredded Paper	44	0.2%	0.1%	0.3%
Metal	**629**	**2.6%**		
Aluminum Cans	182	0.8%	0.6%	0.9%
Aluminum Foil/Containers	35	0.1%	0.1%	0.2%
Tin Food Cans	278	1.2%	1.0%	1.3%
Other Ferrous Metal	133	0.6%	0.3%	0.8%
Plastic	**1,327**	**5.5%**		
Small PET Bottles (24 oz or smaller)	203	0.8%	0.7%	0.9%
Large PET Bottles (greater than 24 oz)	190	0.8%	0.7%	0.9%
PET Jars, Tubs, and Other Containers	170	0.7%	0.6%	0.8%
HDPE Natural Bottles	118	0.5%	0.4%	0.6%
HDPE Colored Bottles	135	0.6%	0.5%	0.7%
HDPE Natural Jars, Tubs, and Other Containers	44	0.2%	0.1%	0.3%
HDPE Colored Jars, Tubs, and Other Containers	48	0.2%	0.1%	0.3%
Other Plastic Bottles (#3-7)	37	0.2%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	72	0.3%	0.2%	0.3%
Plastic Bags and Packaging	209	0.9%	0.7%	1.0%
Bulky Rigid Plastic	100	0.4%	0.3%	0.5%
Glass	**6,161**	**25.5%**		
Clear Glass Bottles	935	3.9%	3.3%	4.4%
Green Glass Bottles	952	3.9%	3.2%	4.7%
Brown Glass Bottles	1,020	4.2%	3.7%	4.8%
Clear Container Glass	267	1.1%	0.9%	1.3%
Other Glass Containers and Bottles	142	0.6%	0.3%	0.9%
Mixed Glass Cullet	2,844	11.8%	10.6%	13.0%
Contaminants	**2,706**	**11.2%**		
Non-Conforming Paper	653	2.7%	2.1%	3.3%
Non-Conforming Metal	162	0.7%	0.4%	0.9%
Non-Conforming Plastic	357	1.5%	1.2%	1.8%
Non-Conforming Glass	154	0.6%	0.4%	0.9%
Food, Green Waste, and Wood	367	1.5%	1.1%	2.0%
Textiles and Clothing	179	0.7%	0.5%	1.0%
Other non-recyclables	833	3.4%	2.8%	4.1%
Total Tons	**24,150**			
Sample Count	**72**			

Confidence intervals calculated at the 90% confidence level.

4.3 By Residence Type and Collection Zone

Composition estimates by broad material categories single-family Zones 1 through 4 are shown in Figure 4-3. **Paper** was the largest material category present in each zone and accounted for more than half of the recycling set out by each of these subpopulations, between 55 and 57 percent. **Glass** ranged from 26 to 28 percent of loads in each zone. Ten to 11 percent of loads in each zone were **Contaminants**. The remaining broad material categories, **Plastic** and **Metal**, each accounted for approximately five percent or less of the total in all four zones.

Figure 4-3. Overview of Composition Estimates: Single-family by Zone
(January 2015 – December 2015)

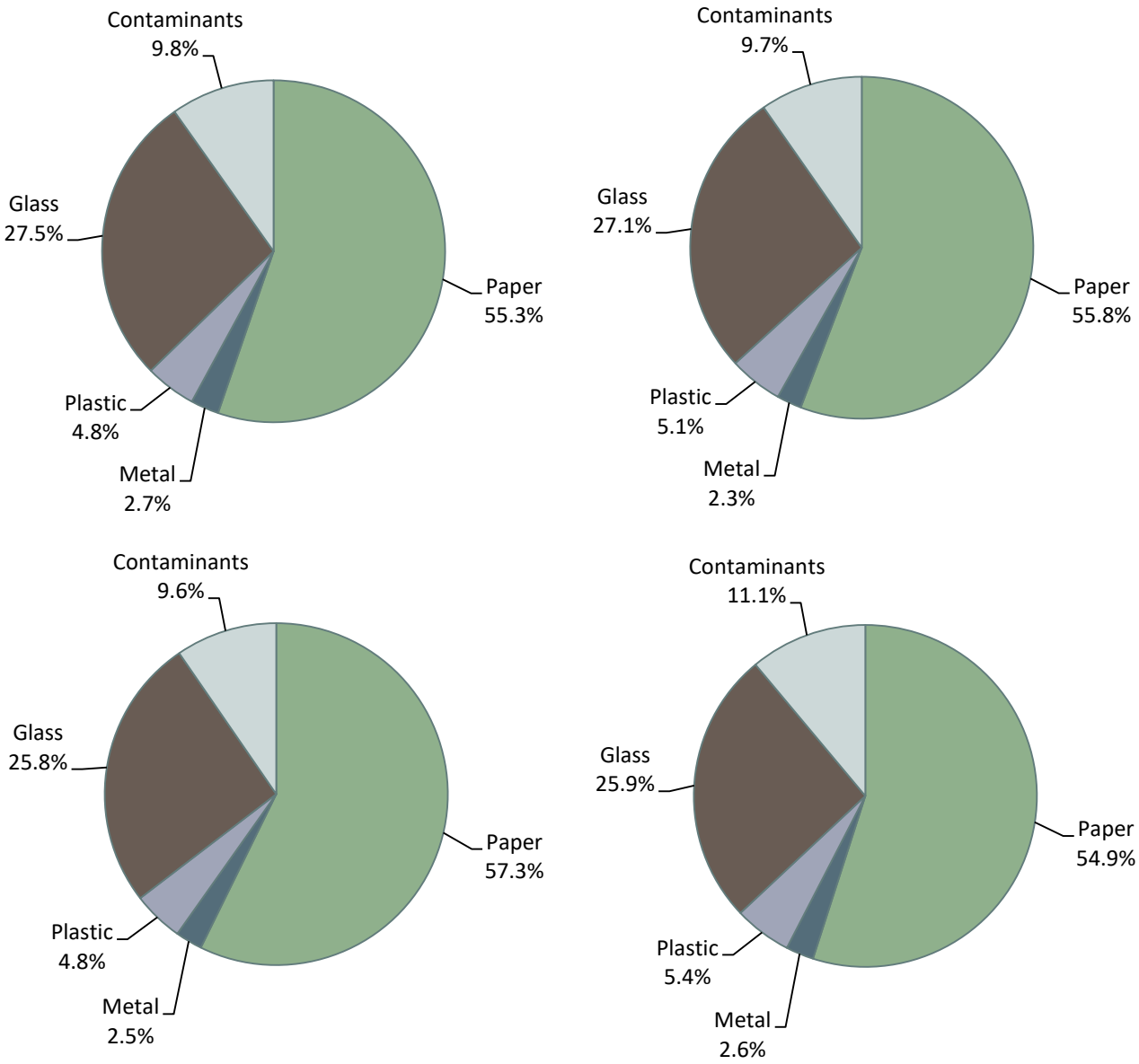
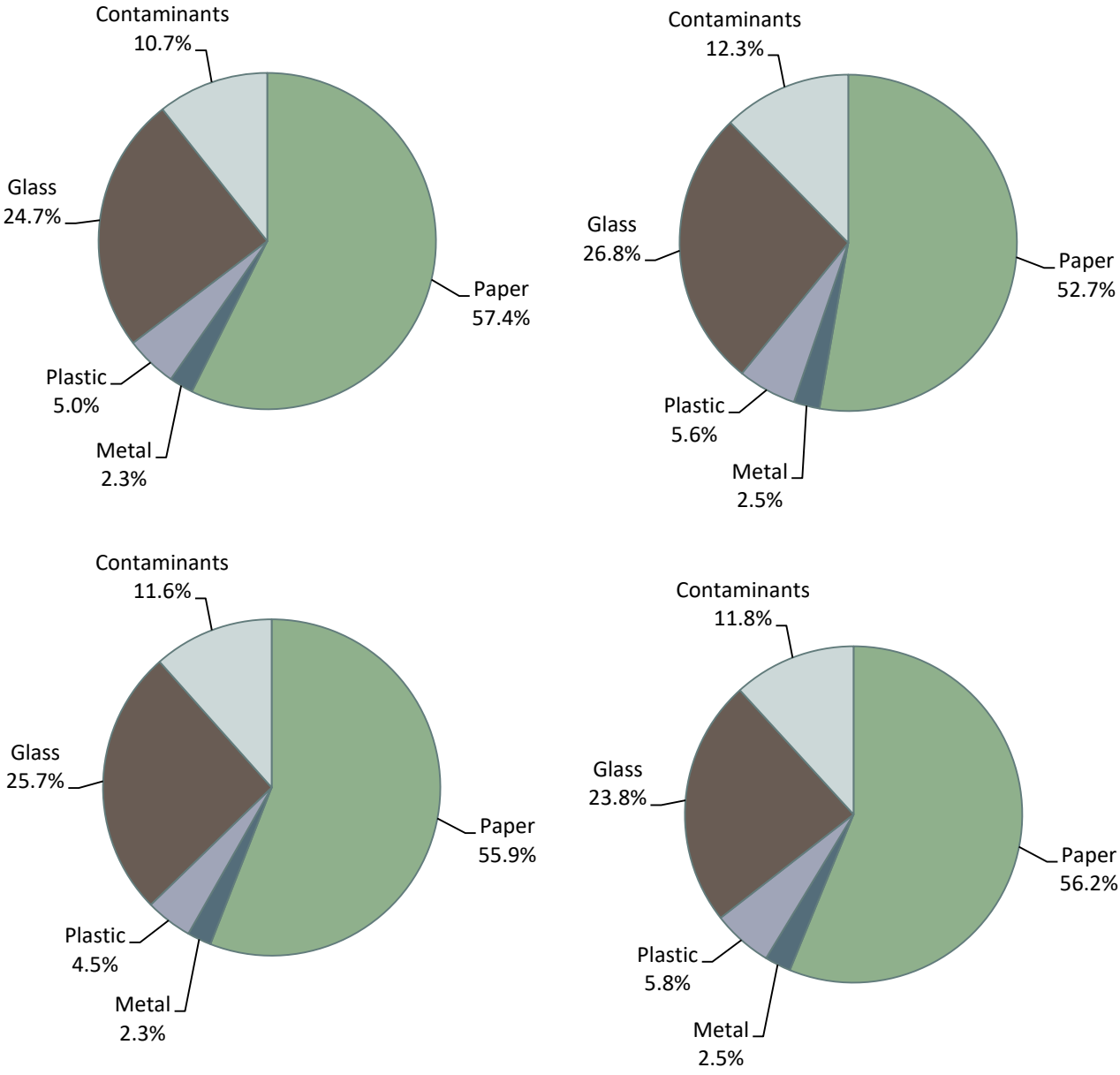


Figure 4-4 summarizes the composition of multifamily recyclables by zone. As with single-family recyclables, **Paper** was the largest material category present, accounting for 53 to 57 percent of recycling set out by each of these subpopulations. **Glass** was approximately a quarter of the recycling set out in each of the zones, ranging from 24 to 27 percent, and **Contaminants** were 11 to 12 percent of recycling set out in each zone. The two remaining broad material categories, **Plastic and Metal**, each accounted for less than six percent of the total for each of the four subpopulations.

Figure 4-4. Overview of Composition Estimates: Multifamily (January – December 2015)



4.3.1 Single-family Zone 1

Cascadia captured and sorted 42 samples from single-family Zone 1 recycling loads between January and December 2015. Seattle's single-family Zone 1 residents set out approximately 14,800 tons for recycling in 2015. As illustrated in Table 4-14, *mixed low-grade paper* (26.2%) was the single largest component, followed by *newsprint* (15.6%), *unwaxed OCC/Kraft paper* (12.5%), and *mixed glass cullet* (12.0%). Table 4-18 presents full composition results for single-family Zone 1 recycling.

Table 4-14. Top Ten Components: Single-family Zone 1
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	26.2%	26.2%	3,877
Newsprint	15.6%	41.7%	2,308
Unwaxed OCC/Kraft Paper	12.5%	54.2%	1,846
Mixed Glass Cullet	12.0%	66.2%	1,780
Green Glass Bottles	4.8%	71.0%	717
Brown Glass Bottles	4.7%	75.7%	696
Clear Glass Bottles	4.4%	80.1%	656
Non-Conforming Paper	2.8%	82.9%	409
Other non-recyclables	2.5%	85.4%	369
Food, Green Waste, and Wood	1.3%	86.7%	193
Total	**86.7%**		**12,850**

4.3.2 Single-family Zone 2

Cascadia sampled 46 recycling loads from single-family Zone 2 residents. Seattle's single-family Zone 2 residents set out approximately 12,100 tons for recycling in 2015. Table 4-15 lists the top ten components by weight for these materials. *Mixed low-grade paper* was the largest component (25.4%), followed by *unwaxed OCC/Kraft paper* (15.5%), *newsprint* (13.9%), and *mixed glass cullet* (10.9%). Table 4-19 presents the full composition results for single-family Zone 2 recycling.

Table 4-15. Top Ten Components: Single-family Zone 2
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	25.4%	25.4%	3,081
Unwaxed OCC/Kraft Paper	15.5%	40.9%	1,881
Newsprint	13.9%	54.8%	1,693
Mixed Glass Cullet	10.9%	65.7%	1,328
Green Glass Bottles	5.2%	71.0%	633
Brown Glass Bottles	5.1%	76.1%	623
Clear Glass Bottles	4.7%	80.7%	566
Non-Conforming Paper	2.7%	83.4%	323
Other non-recyclables	2.6%	86.0%	318
Food, Green Waste, and Wood	1.3%	87.3%	158
Total	**87.3%**		**10,603**

4.3.3 Single-family Zone 3

Cascadia captured and sorted 41 samples from single-family Zone 3 recycling loads. Seattle's single-family Zone 3 residents set out approximately 14,200 tons for recycling in 2015. As shown in Table 4-16, *mixed low-grade paper* was the largest single component, composing about 24 percent of the total. The next largest components present in this subpopulation were *unwaxed OCC/Kraft paper* (18.4%), *newsprint* (13.1%), and *mixed glass cullet* (10.8%). The remaining material components in Zone 3 recyclables were each five percent or less of the stream. Table 4-20 lists the full composition results for single-family Zone 3 recycling.

Table 4-16. Top Ten Components: Single-family Zone 3
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	24.2%	24.2%	3,424
Unwaxed OCC/Kraft Paper	18.4%	42.6%	2,611
Newsprint	13.1%	55.8%	1,860
Mixed Glass Cullet	10.8%	66.5%	1,525
Brown Glass Bottles	4.9%	71.4%	694
Green Glass Bottles	4.4%	75.8%	617
Clear Glass Bottles	4.3%	80.1%	615
Other non-recyclables	2.8%	83.0%	402
Non-Conforming Paper	2.3%	85.3%	323
Non-Conforming Plastic	1.7%	87.0%	242
Total	**87.0%**		**12,313**

4.3.4 Single-family Zone 4

Cascadia captured a total of 48 samples from single-family Zone 4 loads during the 2015 study. Seattle's single-family Zone 4 residents set out approximately 19,300 tons for recycling. As presented in Table 4-17, *mixed low-grade paper* (24.9%) was the largest component, nearly a quarter of the Zone 4 recycling stream. *Newsprint* (14.7%) and *unwaxed OCC/Kraft paper* (14.1%), and *mixed glass cullet* (12.0%) were the next three largest components. Table 4-21 lists the detailed composition results for single-family Zone 4.

Table 4-17. Top Ten Components: Single-family Zone 4
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	24.9%	24.9%	4,816
Newsprint	14.7%	39.6%	2,836
Unwaxed OCC/Kraft Paper	14.1%	53.7%	2,721
Mixed Glass Cullet	12.0%	65.7%	2,310
Brown Glass Bottles	4.3%	70.0%	829
Clear Glass Bottles	4.0%	74.0%	772
Green Glass Bottles	4.0%	77.9%	764
Other non-recyclables	3.2%	81.2%	626
Non-Conforming Paper	2.8%	84.0%	543
Non-Conforming Plastic	1.5%	85.5%	299
Total	**85.5%**		**16,514**

4.3.5 Comparison of Single-family Zones 1 Through 4

Many of the same components can be found in the top ten tables for single-family recycling in all four zones. *Mixed low-grade paper* was the largest component for each subpopulation. The next two most prevalent components were *newsprint* and *unwaxed OCC/Kraft paper* for all four zones, though their order (as the second or third largest components) varied by zone; and *mixed glass cullet* was the fourth largest component in all four zones. Five additional components appeared in the top ten lists for all four zones: *green glass bottles*, *brown glass bottles*, *clear glass bottles, non-conforming paper,* and *other non-recyclables*.

Two materials were common to two top ten lists: *food, green waste, and wood* (Zones 1 and 2) and *non-conforming plastic* (Zones 3 and 4). No components in any single-family top ten list was unique to a single zone.

Table 4-18 through Table 4-21 provide full composition data for each of the single-family zones included in the study.

Table 4-18. Composition by Weight: Single-family Zone 1
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**8,189**	**55.3%**		
Newsprint	2,308	15.6%	14.0%	17.1%
Unwaxed OCC/Kraft Paper	1,846	12.5%	10.7%	14.2%
Mixed Low-grade Paper	3,877	26.2%	23.3%	29.0%
Polycoat Containers	61	0.4%	0.3%	0.5%
Aseptic Containers	28	0.2%	0.1%	0.2%
Phone Books	42	0.3%	0.1%	0.4%
Shredded Paper	28	0.2%	0.0%	0.4%
Metal	**394**	**2.7%**		
Aluminum Cans	111	0.7%	0.6%	0.9%
Aluminum Foil/Containers	23	0.2%	0.1%	0.2%
Tin Food Cans	193	1.3%	0.9%	1.7%
Other Ferrous Metal	68	0.5%	0.3%	0.6%
Plastic	**710**	**4.8%**		
Small PET Bottles (24 oz or smaller)	93	0.6%	0.5%	0.7%
Large PET Bottles (greater than 24 oz)	96	0.6%	0.5%	0.7%
PET Jars, Tubs, and Other Containers	103	0.7%	0.5%	0.8%
HDPE Natural Bottles	66	0.4%	0.4%	0.5%
HDPE Colored Bottles	65	0.4%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	22	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	17	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	17	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	35	0.2%	0.2%	0.3%
Plastic Bags and Packaging	135	0.9%	0.7%	1.1%
Bulky Rigid Plastic	61	0.4%	0.1%	0.8%
Glass	**4,077**	**27.5%**		
Clear Glass Bottles	656	4.4%	3.7%	5.1%
Green Glass Bottles	717	4.8%	4.0%	5.6%
Brown Glass Bottles	696	4.7%	3.6%	5.8%
Clear Container Glass	159	1.1%	0.7%	1.5%
Other Glass Containers and Bottles	70	0.5%	0.2%	0.7%
Mixed Glass Cullet	1,780	12.0%	10.4%	13.6%
Contaminants	**1,452**	**9.8%**		
Non-Conforming Paper	409	2.8%	2.0%	3.5%
Non-Conforming Metal	180	1.2%	0.8%	1.7%
Non-Conforming Plastic	149	1.0%	0.5%	1.5%
Non-Conforming Glass	84	0.6%	0.2%	0.9%
Food, Green Waste, and Wood	193	1.3%	0.8%	1.8%
Textiles and Clothing	69	0.5%	0.2%	0.7%
Other non-recyclables	369	2.5%	1.8%	3.2%
Total Tons	**14,822**			
Sample Count	**42**			

Table 4-19. Composition by Weight: Single-family Zone 2
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**6,774**	**55.8%**		
Newsprint	1,693	13.9%	12.6%	15.3%
Unwaxed OCC/Kraft Paper	1,881	15.5%	14.1%	16.9%
Mixed Low-grade Paper	3,081	25.4%	22.8%	27.9%
Polycoat Containers	58	0.5%	0.4%	0.5%
Aseptic Containers	30	0.2%	0.2%	0.3%
Phone Books	26	0.2%	0.1%	0.3%
Shredded Paper	6	0.0%	0.0%	0.1%
Metal	**284**	**2.3%**		
Aluminum Cans	97	0.8%	0.6%	1.0%
Aluminum Foil/Containers	13	0.1%	0.1%	0.1%
Tin Food Cans	126	1.0%	0.9%	1.2%
Other Ferrous Metal	48	0.4%	0.2%	0.6%
Plastic	**613**	**5.1%**		
Small PET Bottles (24 oz or smaller)	87	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	87	0.7%	0.6%	0.8%
PET Jars, Tubs, and Other Containers	90	0.7%	0.6%	0.9%
HDPE Natural Bottles	55	0.5%	0.4%	0.5%
HDPE Colored Bottles	57	0.5%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	13	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	20	0.2%	0.1%	0.2%
Other Plastic Bottles (#3-7)	18	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	38	0.3%	0.2%	0.4%
Plastic Bags and Packaging	118	1.0%	0.8%	1.2%
Bulky Rigid Plastic	31	0.3%	0.1%	0.4%
Glass	**3,294**	**27.1%**		
Clear Glass Bottles	566	4.7%	4.1%	5.2%
Green Glass Bottles	633	5.2%	4.4%	6.0%
Brown Glass Bottles	623	5.1%	4.2%	6.1%
Clear Container Glass	112	0.9%	0.6%	1.2%
Other Glass Containers and Bottles	33	0.3%	0.1%	0.4%
Mixed Glass Cullet	1,328	10.9%	9.4%	12.5%
Contaminants	**1,176**	**9.7%**		
Non-Conforming Paper	323	2.7%	2.1%	3.2%
Non-Conforming Metal	117	1.0%	0.5%	1.4%
Non-Conforming Plastic	139	1.1%	1.0%	1.3%
Non-Conforming Glass	47	0.4%	0.2%	0.6%
Food, Green Waste, and Wood	158	1.3%	0.9%	1.7%
Textiles and Clothing	74	0.6%	0.3%	0.9%
Other non-recyclables	318	2.6%	2.0%	3.2%
Total Tons	**12,142**			
Sample Count	**46**			

Confidence intervals calculated at the 90% confidence level.

Table 4-20. Composition by Weight: Single-family Zone 3
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**8,106**	**57.3%**		
Newsprint	1,860	13.1%	11.7%	14.6%
Unwaxed OCC/Kraft Paper	2,611	18.4%	16.8%	20.0%
Mixed Low-grade Paper	3,424	24.2%	22.1%	26.3%
Polycoat Containers	74	0.5%	0.4%	0.6%
Aseptic Containers	27	0.2%	0.1%	0.2%
Phone Books	106	0.7%	0.0%	1.5%
Shredded Paper	3	0.0%	0.0%	0.1%
Metal	**359**	**2.5%**		
Aluminum Cans	102	0.7%	0.6%	0.8%
Aluminum Foil/Containers	19	0.1%	0.1%	0.2%
Tin Food Cans	161	1.1%	1.0%	1.3%
Other Ferrous Metal	77	0.5%	0.3%	0.8%
Plastic	**679**	**4.8%**		
Small PET Bottles (24 oz or smaller)	103	0.7%	0.6%	0.9%
Large PET Bottles (greater than 24 oz)	100	0.7%	0.6%	0.8%
PET Jars, Tubs, and Other Containers	104	0.7%	0.6%	0.9%
HDPE Natural Bottles	48	0.3%	0.3%	0.4%
HDPE Colored Bottles	63	0.4%	0.4%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	20	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	16	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	24	0.2%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	47	0.3%	0.2%	0.4%
Plastic Bags and Packaging	116	0.8%	0.7%	1.0%
Bulky Rigid Plastic	39	0.3%	0.1%	0.5%
Glass	**3,659**	**25.8%**		
Clear Glass Bottles	615	4.3%	3.7%	4.9%
Green Glass Bottles	617	4.4%	3.8%	4.9%
Brown Glass Bottles	694	4.9%	4.1%	5.7%
Clear Container Glass	148	1.0%	0.7%	1.4%
Other Glass Containers and Bottles	60	0.4%	0.1%	0.7%
Mixed Glass Cullet	1,525	10.8%	9.4%	12.1%
Contaminants	**1,355**	**9.6%**		
Non-Conforming Paper	323	2.3%	1.6%	2.9%
Non-Conforming Metal	63	0.4%	0.2%	0.7%
Non-Conforming Plastic	242	1.7%	1.1%	2.3%
Non-Conforming Glass	100	0.7%	0.4%	1.0%
Food, Green Waste, and Wood	165	1.2%	0.8%	1.6%
Textiles and Clothing	62	0.4%	0.2%	0.6%
Other non-recyclables	402	2.8%	2.3%	3.4%
Total Tons	**14,159**			
Sample Count	**41**			

Confidence intervals calculated at the 90% confidence level.

Table 4-21. Composition by Weight: Single-family Zone 4
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**10,610**	**54.9%**		
Newsprint	2,836	14.7%	13.4%	16.0%
Unwaxed OCC/Kraft Paper	2,721	14.1%	12.4%	15.8%
Mixed Low-grade Paper	4,816	24.9%	22.5%	27.4%
Polycoat Containers	83	0.4%	0.4%	0.5%
Aseptic Containers	47	0.2%	0.2%	0.3%
Phone Books	87	0.5%	0.2%	0.7%
Shredded Paper	21	0.1%	0.0%	0.2%
Metal	**507**	**2.6%**		
Aluminum Cans	135	0.7%	0.6%	0.8%
Aluminum Foil/Containers	31	0.2%	0.1%	0.2%
Tin Food Cans	229	1.2%	1.1%	1.3%
Other Ferrous Metal	111	0.6%	0.2%	0.9%
Plastic	**1,048**	**5.4%**		
Small PET Bottles (24 oz or smaller)	155	0.8%	0.7%	0.9%
Large PET Bottles (greater than 24 oz)	147	0.8%	0.7%	0.9%
PET Jars, Tubs, and Other Containers	136	0.7%	0.6%	0.8%
HDPE Natural Bottles	92	0.5%	0.4%	0.6%
HDPE Colored Bottles	101	0.5%	0.4%	0.6%
HDPE Natural Jars, Tubs, and Other Containers	33	0.2%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	45	0.2%	0.1%	0.3%
Other Plastic Bottles (#3-7)	31	0.2%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	60	0.3%	0.3%	0.4%
Plastic Bags and Packaging	166	0.9%	0.7%	1.0%
Bulky Rigid Plastic	82	0.4%	0.3%	0.6%
Glass	**5,010**	**25.9%**		
Clear Glass Bottles	772	4.0%	3.4%	4.6%
Green Glass Bottles	764	4.0%	3.1%	4.8%
Brown Glass Bottles	829	4.3%	3.7%	4.9%
Clear Container Glass	209	1.1%	0.8%	1.4%
Other Glass Containers and Bottles	128	0.7%	0.3%	1.0%
Mixed Glass Cullet	2,310	12.0%	10.6%	13.3%
Contaminants	**2,136**	**11.1%**		
Non-Conforming Paper	543	2.8%	2.1%	3.5%
Non-Conforming Metal	130	0.7%	0.4%	1.0%
Non-Conforming Plastic	299	1.5%	1.2%	1.9%
Non-Conforming Glass	106	0.5%	0.3%	0.8%
Food, Green Waste, and Wood	288	1.5%	0.9%	2.0%
Textiles and Clothing	144	0.7%	0.4%	1.0%
Other non-recyclables	626	3.2%	2.4%	4.0%
Total Tons	**19,311**			
Sample Count	**48**			

Confidence intervals calculated at the 90% confidence level.

4.3.6 Multifamily Zone 1

Cascadia captured and sorted a total of 24 samples from multifamily Zone 1 recycling loads between January and December 2015. Seattle's multifamily Zone 1 residents set out approximately 5,700 tons in 2015. As shown in Table 4-22, the largest component, *mixed low-grade paper*, composed almost a quarter (23.5%) of the recycling for this subpopulation. The next two largest components were *unwaxed OCC/Kraft paper* (20.2%) and *newsprint* (12.7%). Please see Table 4-26 for full composition results for multifamily Zone 1 recycling.

Table 4-22. Top Ten Components: Multifamily Zone 1
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	23.5%	23.5%	1,336
Unwaxed OCC/Kraft Paper	20.2%	43.8%	1,149
Newsprint	12.7%	56.5%	721
Mixed Glass Cullet	9.3%	65.8%	530
Brown Glass Bottles	5.3%	71.2%	302
Green Glass Bottles	4.7%	75.9%	268
Clear Glass Bottles	4.1%	80.0%	235
Other non-recyclables	3.5%	83.5%	196
Non-Conforming Paper	2.4%	85.9%	136
Non-Conforming Metal	2.0%	87.9%	113
Total	**87.9%**		**4,985**

4.3.7 Multifamily Zone 2

Nineteen loads were sampled from multifamily Zone 2. Seattle's multifamily Zone 2 residents set out approximately 1,000 tons of recycling in 2015. Table 4-23 lists the top ten components for this subpopulation. *Mixed low-grade paper* was the largest observed component and accounted for over one fifth (22.4%) of Zone 2 recycling. *Unwaxed OCC/Kraft paper* (15.4%), *mixed glass cullet* (14.6%), and *newsprint* (13.3%) were the next largest components. Table 4-27 presents the full composition results for multifamily Zone 2 recycling.

Table 4-23. Top Ten Components: Multifamily Zone 2
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	22.4%	22.4%	214
Unwaxed OCC/Kraft Paper	15.4%	37.8%	147
Mixed Glass Cullet	14.6%	52.4%	139
Newsprint	13.3%	65.7%	127
Brown Glass Bottles	4.3%	70.0%	41
Other non-recyclables	4.0%	73.9%	38
Green Glass Bottles	3.6%	77.5%	34
Non-Conforming Paper	3.5%	81.0%	33
Clear Glass Bottles	3.4%	84.3%	32
Non-Conforming Plastic	1.3%	85.7%	13
Total	**85.7%**		**818**

4.3.8 Multifamily Zone 3

Cascadia captured and sorted a total of 26 samples from multifamily Zone 3 recycling loads. Seattle's multifamily Zone 3 residents set out approximately 14,400 tons for recycling in 2015. As shown in Table 4-24, *mixed low-grade paper* (22.9%) and *unwaxed OCC/Kraft paper* (19.8%) were the largest components in Zone 3 recycling, each accounting for approximately one fifth of the total. The next largest components were *newsprint* (12.4%) and *mixed glass cullet* (11.5%). Table 4-28 lists the full composition results for multifamily Zone 3 recycling.

Table 4-24. Top Ten Components: Multifamily Zone 3
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	22.9%	22.9%	3,296
Unwaxed OCC/Kraft Paper	19.8%	42.7%	2,840
Newsprint	12.4%	55.2%	1,788
Mixed Glass Cullet	11.5%	66.7%	1,655
Brown Glass Bottles	5.1%	71.8%	729
Green Glass Bottles	4.1%	75.9%	594
Clear Glass Bottles	3.8%	79.7%	545
Other non-recyclables	3.8%	83.5%	543
Non-Conforming Paper	3.2%	86.7%	464
Non-Conforming Plastic	1.3%	88.0%	191
Total	**88.0%**		**12,644**

4.3.9 Multifamily Zone 4

Cascadia captured 24 samples from multifamily Zone 4 loads during the 2015 study. Seattle's multifamily Zone 4 residents set out approximately 4,800 tons of recycling in 2015. As shown in Table 4-25, *mixed low-grade paper* was more than one fifth (22.7%) of the total. *Unwaxed OCC/Kraft paper* (18.9%), *newsprint* (13.0%), and *mixed glass cullet* (11.1%) were the next largest components in the recycling for this subpopulation. The detailed composition results for multifamily Zone 4 are listed in Table 4-29.

Table 4-25. Top Ten Components: Multifamily Zone 4
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	22.7%	22.7%	1,099
Unwaxed OCC/Kraft Paper	18.9%	41.6%	915
Newsprint	13.0%	54.7%	631
Mixed Glass Cullet	11.1%	65.7%	535
Other non-recyclables	4.3%	70.0%	208
Brown Glass Bottles	3.9%	74.0%	191
Green Glass Bottles	3.9%	77.9%	188
Clear Glass Bottles	3.4%	81.2%	163
Non-Conforming Paper	2.3%	83.5%	110
Food, Green Waste, and W	1.6%	85.1%	79
Total	**85.1%**		**4,119**

4.3.10 Comparison of Multifamily Zones 1 Through 4

Many of the same components can be found in the top ten tables for multifamily recycling across all zones. *Mixed low-grade paper* was the largest component in all four zones. *Unwaxed OCC/ Kraft paper*, *newsprint, and mixed glass cullet* were among the next three largest components across all zones, though their order of appearance within lists varied. Five additional materials were common to all top ten lists: *green glass bottles*, *brown glass bottles*, *clear glass bottles*, *non-conforming paper,* and *other non-recyclables*.

Non-conforming plastic was present as a top ten component in loads from Zones 2 and Zone 3 only. *Non-conforming metal* was unique to a top ten list for Zone 1; and *food, green waste, and wood* was unique to a top ten list for Zone 4 only.

Table 4-26. Composition by Weight: Multifamily Zone 1
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**3,255**	**57.4%**		
Newsprint	721	12.7%	10.7%	14.7%
Unwaxed OCC/Kraft Paper	1,149	20.2%	16.7%	23.8%
Mixed Low-grade Paper	1,336	23.5%	21.6%	25.5%
Polycoat Containers	28	0.5%	0.3%	0.7%
Aseptic Containers	14	0.2%	0.2%	0.3%
Phone Books	4	0.1%	0.0%	0.1%
Shredded Paper	4	0.1%	0.0%	0.2%
Metal	**131**	**2.3%**		
Aluminum Cans	49	0.9%	0.7%	1.0%
Aluminum Foil/Containers	7	0.1%	0.1%	0.2%
Tin Food Cans	74	1.3%	0.8%	1.8%
Other Ferrous Metal	2	0.0%	0.0%	0.1%
Plastic	**281**	**5.0%**		
Small PET Bottles (24 oz or smaller)	37	0.6%	0.5%	0.7%
Large PET Bottles (greater than 24 oz)	45	0.8%	0.7%	0.9%
PET Jars, Tubs, and Other Containers	37	0.7%	0.5%	0.8%
HDPE Natural Bottles	31	0.5%	0.4%	0.7%
HDPE Colored Bottles	23	0.4%	0.3%	0.5%
HDPE Natural Jars, Tubs, and Other Containers	11	0.2%	0.1%	0.3%
HDPE Colored Jars, Tubs, and Other Containers	14	0.2%	0.1%	0.4%
Other Plastic Bottles (#3-7)	5	0.1%	0.0%	0.1%
Other Jars, Tubs, and Containers (#3-7)	21	0.4%	0.3%	0.5%
Plastic Bags and Packaging	44	0.8%	0.6%	0.9%
Bulky Rigid Plastic	14	0.2%	0.1%	0.4%
Glass	**1,401**	**24.7%**		
Clear Glass Bottles	235	4.1%	3.1%	5.2%
Green Glass Bottles	268	4.7%	3.5%	5.9%
Brown Glass Bottles	302	5.3%	4.3%	6.4%
Clear Container Glass	49	0.9%	0.5%	1.2%
Other Glass Containers and Bottles	16	0.3%	0.0%	0.5%
Mixed Glass Cullet	530	9.3%	7.5%	11.2%
Contaminants	**605**	**10.7%**		
Non-Conforming Paper	136	2.4%	1.4%	3.3%
Non-Conforming Metal	113	2.0%	0.7%	3.3%
Non-Conforming Plastic	57	1.0%	0.8%	1.2%
Non-Conforming Glass	9	0.2%	0.0%	0.3%
Food, Green Waste, and Wood	73	1.3%	0.5%	2.1%
Textiles and Clothing	22	0.4%	0.1%	0.7%
Other non-recyclables	196	3.5%	2.2%	4.8%
Total Tons	**5,673**			
Sample Count	**24**			

Table 4-27. Composition by Weight: Multifamily Zone 2
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**503**	**52.7%**		
Newsprint	127	13.3%	11.2%	15.4%
Unwaxed OCC/Kraft Paper	147	15.4%	12.8%	18.0%
Mixed Low-grade Paper	214	22.4%	20.4%	24.5%
Polycoat Containers	7	0.7%	0.3%	1.2%
Aseptic Containers	2	0.2%	0.1%	0.3%
Phone Books	2	0.2%	0.1%	0.3%
Shredded Paper	4	0.5%	0.2%	0.7%
Metal	**24**	**2.5%**		
Aluminum Cans	7	0.8%	0.6%	0.9%
Aluminum Foil/Containers	1	0.2%	0.1%	0.3%
Tin Food Cans	12	1.2%	0.7%	1.7%
Other Ferrous Metal	3	0.4%	0.0%	0.7%
Plastic	**54**	**5.6%**		
Small PET Bottles (24 oz or smaller)	7	0.8%	0.6%	0.9%
Large PET Bottles (greater than 24 oz)	8	0.8%	0.6%	1.0%
PET Jars, Tubs, and Other Containers	6	0.6%	0.4%	0.7%
HDPE Natural Bottles	5	0.5%	0.4%	0.7%
HDPE Colored Bottles	3	0.3%	0.2%	0.4%
HDPE Natural Jars, Tubs, and Other Containers	2	0.2%	0.1%	0.3%
HDPE Colored Jars, Tubs, and Other Containers	1	0.1%	0.0%	0.2%
Other Plastic Bottles (#3-7)	1	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	3	0.4%	0.2%	0.5%
Plastic Bags and Packaging	9	1.0%	0.7%	1.3%
Bulky Rigid Plastic	8	0.8%	0.0%	1.7%
Glass	**256**	**26.8%**		
Clear Glass Bottles	32	3.4%	2.0%	4.7%
Green Glass Bottles	34	3.6%	2.9%	4.3%
Brown Glass Bottles	41	4.3%	2.7%	5.8%
Clear Container Glass	7	0.7%	0.4%	1.0%
Other Glass Containers and Bottles	3	0.3%	0.2%	0.4%
Mixed Glass Cullet	139	14.6%	12.0%	17.1%
Contaminants	**118**	**12.3%**		
Non-Conforming Paper	33	3.5%	2.6%	4.3%
Non-Conforming Metal	12	1.2%	0.4%	2.0%
Non-Conforming Plastic	13	1.3%	1.1%	1.6%
Non-Conforming Glass	4	0.4%	0.2%	0.7%
Food, Green Waste, and Wood	13	1.3%	0.7%	1.9%
Textiles and Clothing	5	0.6%	0.2%	0.9%
Other non-recyclables	38	4.0%	2.8%	5.2%
Total Tons	**954**			
Sample Count	**19**			

Table 4-28. Composition by Weight: Multifamily Zone 3
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**8,033**	**55.9%**		
Newsprint	1,788	12.4%	10.2%	14.7%
Unwaxed OCC/Kraft Paper	2,840	19.8%	16.8%	22.7%
Mixed Low-grade Paper	3,296	22.9%	19.9%	26.0%
Polycoat Containers	55	0.4%	0.3%	0.5%
Aseptic Containers	29	0.2%	0.1%	0.3%
Phone Books	8	0.1%	0.0%	0.1%
Shredded Paper	17	0.1%	0.0%	0.2%
Metal	**331**	**2.3%**		
Aluminum Cans	125	0.9%	0.6%	1.1%
Aluminum Foil/Containers	23	0.2%	0.0%	0.3%
Tin Food Cans	135	0.9%	0.8%	1.1%
Other Ferrous Metal	48	0.3%	0.1%	0.6%
Plastic	**646**	**4.5%**		
Small PET Bottles (24 oz or smaller)	89	0.6%	0.5%	0.7%
Large PET Bottles (greater than 24 oz)	105	0.7%	0.6%	0.9%
PET Jars, Tubs, and Other Containers	78	0.5%	0.5%	0.6%
HDPE Natural Bottles	58	0.4%	0.3%	0.5%
HDPE Colored Bottles	48	0.3%	0.2%	0.4%
HDPE Natural Jars, Tubs, and Other Containers	17	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	20	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	19	0.1%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	35	0.2%	0.2%	0.3%
Plastic Bags and Packaging	133	0.9%	0.6%	1.2%
Bulky Rigid Plastic	44	0.3%	0.1%	0.5%
Glass	**3,695**	**25.7%**		
Clear Glass Bottles	545	3.8%	2.8%	4.8%
Green Glass Bottles	594	4.1%	3.4%	4.8%
Brown Glass Bottles	729	5.1%	4.1%	6.0%
Clear Container Glass	110	0.8%	0.4%	1.1%
Other Glass Containers and Bottles	62	0.4%	0.2%	0.7%
Mixed Glass Cullet	1,655	11.5%	9.5%	13.6%
Contaminants	**1,661**	**11.6%**		
Non-Conforming Paper	464	3.2%	2.1%	4.4%
Non-Conforming Metal	101	0.7%	0.1%	1.3%
Non-Conforming Plastic	191	1.3%	0.7%	1.9%
Non-Conforming Glass	87	0.6%	0.1%	1.1%
Food, Green Waste, and Wood	133	0.9%	0.4%	1.4%
Textiles and Clothing	143	1.0%	0.6%	1.4%
Other non-recyclables	543	3.8%	2.4%	5.2%
Total Tons	**14,366**			
Sample Count	**26**			

Table 4-29. Composition by Weight: Multifamily Zone 4
(January – December 2015)

Material	Est. Tons	Est. Percent	Low	High
Paper	**2,718**	**56.2%**		
Newsprint	631	13.0%	11.1%	15.0%
Unwaxed OCC/Kraft Paper	915	18.9%	14.3%	23.5%
Mixed Low-grade Paper	1,099	22.7%	18.1%	27.3%
Polycoat Containers	23	0.5%	0.4%	0.6%
Aseptic Containers	11	0.2%	0.1%	0.3%
Phone Books	16	0.3%	0.1%	0.5%
Shredded Paper	23	0.5%	0.1%	0.8%
Metal	**122**	**2.5%**		
Aluminum Cans	47	1.0%	0.5%	1.4%
Aluminum Foil/Containers	4	0.1%	0.1%	0.1%
Tin Food Cans	49	1.0%	0.8%	1.2%
Other Ferrous Metal	22	0.5%	0.2%	0.7%
Plastic	**279**	**5.8%**		
Small PET Bottles (24 oz or smaller)	49	1.0%	0.7%	1.3%
Large PET Bottles (greater than 24 oz)	43	0.9%	0.6%	1.1%
PET Jars, Tubs, and Other Containers	35	0.7%	0.6%	0.9%
HDPE Natural Bottles	26	0.5%	0.4%	0.7%
HDPE Colored Bottles	34	0.7%	0.4%	1.0%
HDPE Natural Jars, Tubs, and Other Containers	11	0.2%	0.0%	0.5%
HDPE Colored Jars, Tubs, and Other Containers	3	0.1%	0.0%	0.1%
Other Plastic Bottles (#3-7)	5	0.1%	0.0%	0.2%
Other Jars, Tubs, and Containers (#3-7)	12	0.3%	0.2%	0.3%
Plastic Bags and Packaging	43	0.9%	0.7%	1.0%
Bulky Rigid Plastic	18	0.4%	0.2%	0.6%
Glass	**1,151**	**23.8%**		
Clear Glass Bottles	163	3.4%	2.4%	4.4%
Green Glass Bottles	188	3.9%	3.1%	4.6%
Brown Glass Bottles	191	3.9%	2.7%	5.2%
Clear Container Glass	59	1.2%	0.8%	1.6%
Other Glass Containers and Bottles	14	0.3%	0.0%	0.6%
Mixed Glass Cullet	535	11.1%	8.5%	13.6%
Contaminants	**569**	**11.8%**		
Non-Conforming Paper	110	2.3%	1.6%	3.0%
Non-Conforming Metal	33	0.7%	0.2%	1.1%
Non-Conforming Plastic	58	1.2%	0.8%	1.6%
Non-Conforming Glass	48	1.0%	0.1%	1.8%
Food, Green Waste, and Wood	79	1.6%	0.8%	2.4%
Textiles and Clothing	35	0.7%	0.4%	1.0%
Other non-recyclables	208	4.3%	3.1%	5.4%
Total Tons	**4,839**			
Sample Count	**24**			

4.4 By Demographics

Waste compositions for various demographic groups were calculated by considering the median household income and percentage of residents of color for each sampled recycling route. Median household income for each route was calculated based on information from the 2009-2013 American Community Survey 5-year estimates, at the Census Block Group level of geography.[12] The total population and number residents of color for each route were calculated using information from the 2010 Census, at the Census Block level of geography. Sampled routes were divided into quartiles based on the median income and percentage of residents of color for each recycling route. Recycling samples from the first (0 - 25%) quartile of routes were used to calculate waste compositions for low-income and routes with the lowest percentage of residents of color (separately). Samples from the top quartile (75% - 100%) were used to calculate composition profiles for high-income and routes with the highest percentage of residents of color. See Appendix D for more details on demographic calculations.

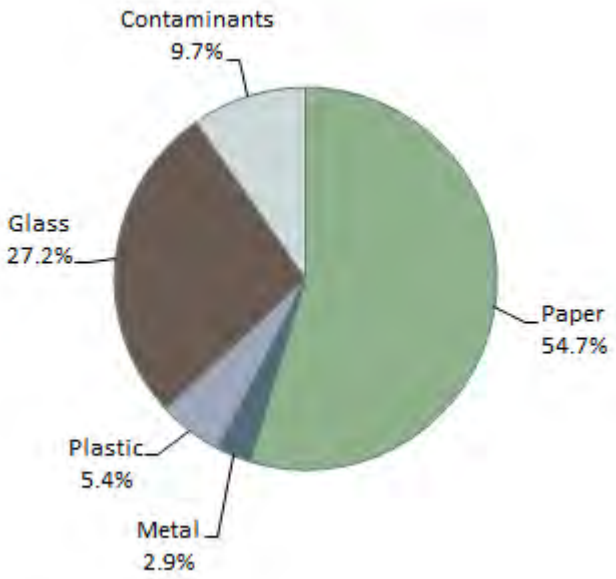
4.4.1 By Household Income

Figure 4-5 summarizes the composition by broad material category for each household income type. **Paper** accounted for between 53% and 55% of both low and high-income recycling. The second largest broad material category in both recycling streams, **Glass**, contributed approximately 27% to recycling from both residence types. **Contaminants** was more prevalent (12.0%) in low-income households than in high-income households (9.7%).

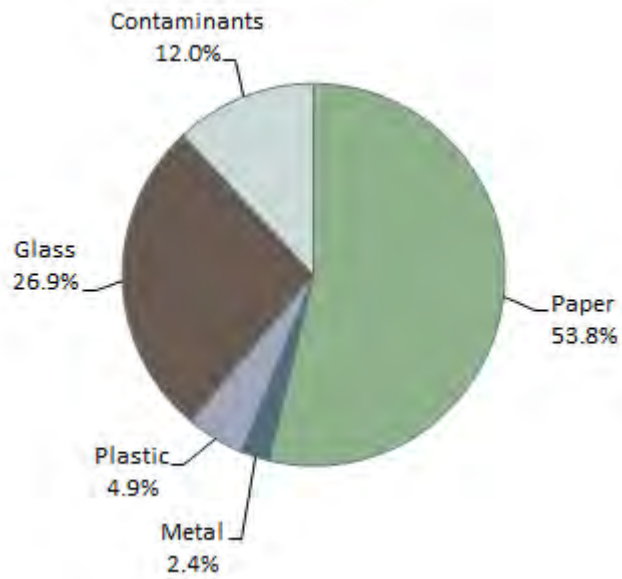
[12] A Census Block is generally equivalent to a city block. A Block Group is a collection of Blocks. For reference, a Tract is a collection of Block Groups. There are approximately 9,200 Census Blocks; 570 Block Groups; and 126 Tracts in Seattle.

Figure 4-5: Composition Summary, by Household Income
(January – December 2015)

High-income Households



Low-income Households



4.4.1.1 High-income Households

A total of 45 samples were collected and sorted from recycling routes with high-income households during 2015. Table 4-30 lists the top ten components, which sum to approximately 86% of the total. The largest component, *mixed low-grade paper*, accounted for about 26% of the recycling stream. *Unwaxed OCC/Kraft paper*, *newsprint*, and *mixed glass cullet* each accounted for at least 10% of the recycling stream for this residence type. The detailed composition results for high-income households are listed in Table 4-32.

Table 4-30: Top Ten Components – High-income Households
(January – December 2015)

Component	Mean	Cum. %
Mixed Low-grade Paper	25.6%	25.6%
Unwaxed OCC/Kraft Paper	14.5%	40.1%
Newsprint	13.5%	53.6%
Mixed Glass Cullet	10.7%	64.3%
Brown Glass Bottles	5.3%	69.6%
Green Glass Bottles	5.2%	74.8%
Clear Glass Bottles	4.6%	79.4%
Non-Conforming Paper	2.7%	82.1%
Other non-recyclables	2.2%	84.3%
Non-Conforming Plastic	1.8%	86.1%
Total	**86.1%**	

4.4.1.2 Low-income Households

A total of 28 samples were collected and sorted from recycling routes with low-income households during 2015. The top ten components of these samples are listed in Table 4-31. *Mixed low-grade paper* made up about 22% of the total recycling, followed by *unwaxed OCC/Kraft paper* (16.5%) and *newsprint* (14.6%). The top ten components amounted to approximately 87% of this recycling stream. Table 4-33 details the recycling composition results for low-income routes.

Table 4-31: Top Ten Components – Low-income Households
(January – December 2015)

Component	Mean	Cum. %
Mixed Low-grade Paper	22.1%	22.1%
Unwaxed OCC/Kraft Paper	16.5%	38.6%
Newsprint	14.6%	53.1%
Mixed Glass Cullet	12.9%	66.0%
Brown Glass Bottles	4.5%	70.5%
Clear Glass Bottles	4.1%	74.6%
Green Glass Bottles	4.0%	78.6%
Other non-recyclables	3.8%	82.4%
Non-Conforming Paper	3.1%	85.5%
Food, Green Waste, and Woo	1.6%	87.1%
Total	**87.1%**	

4.4.1.3 Comparisons between High- and Low-income Households

Mixed low-grade paper, *unwaxed OCC/Kraft paper*, *newsprint*, and *mixed glass cullet* were the first through fourth most prevalent component categories for both income types. *Brown glass bottles*, *clear glass bottles*, *green glass bottles*, *other non-recyclables*, and *non-conforming paper* were among the remaining top ten components for both high- and low-income households although the rankings were not identical. The unique components, ranked tenth for both residence types, were *non-conforming plastic* (high-income) and *food, green waste, and wood* (low-income).

Table 4-32: Composition by Weight – High-income Households (January – December 2015)

Material	Est. Percent	Low	High
Paper	**54.7%**		
Newsprint	13.5%	12.2%	14.9%
Unwaxed OCC/Kraft Paper	14.5%	12.9%	16.1%
Mixed Low-grade Paper	25.6%	23.3%	27.9%
Polycoat Containers	0.5%	0.4%	0.6%
Aseptic Containers	0.2%	0.2%	0.3%
Phone Books	0.3%	0.1%	0.4%
Shredded Paper	0.0%	0.0%	0.1%
Metal	**2.9%**		
Aluminum Cans	0.9%	0.7%	1.1%
Aluminum Foil/Containers	0.2%	0.1%	0.3%
Tin Food Cans	1.2%	1.1%	1.4%
Other Ferrous Metal	0.6%	0.3%	1.0%
Plastic	**5.4%**		
Small PET Bottles (24 oz or smaller)	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	0.8%	0.7%	0.9%
PET Jars, Tubs, and Other Containers	0.9%	0.7%	1.0%
HDPE Natural Bottles	0.5%	0.4%	0.6%
HDPE Colored Bottles	0.5%	0.4%	0.6%
HDPE Natural Jars, Tubs, and Other Containers	0.1%	0.1%	0.2%
HDPE Colored Jars, Tubs, and Other Containers	0.1%	0.1%	0.2%
Other Plastic Bottles (#3-7)	0.2%	0.1%	0.2%
Other Jars, Tubs, and Containers (#3-7)	0.3%	0.2%	0.4%
Plastic Bags and Packaging	1.0%	0.7%	1.2%
Bulky Rigid Plastic	0.3%	0.1%	0.5%
Glass	**27.2%**		
Clear Glass Bottles	4.6%	4.0%	5.2%
Green Glass Bottles	5.2%	4.5%	5.9%
Brown Glass Bottles	5.3%	4.4%	6.1%
Clear Container Glass	1.1%	0.7%	1.5%
Other Glass Containers and Bottles	0.4%	0.2%	0.5%
Mixed Glass Cullet	10.7%	9.3%	12.0%
Contaminants	**9.7%**		
Non-Conforming Paper	2.7%	2.0%	3.4%
Non-Conforming Plastic	1.8%	1.1%	2.4%
Non-Conforming Metal	0.7%	0.3%	1.0%
Non-Conforming Glass	0.7%	0.4%	1.0%
Food, Green Waste, and Wood	1.2%	0.7%	1.7%
Textiles and Clothing	0.4%	0.2%	0.6%
Other non-recyclables	2.2%	1.7%	2.8%
Sample Count	**45**		

Table 4-33: Composition by Weight – Low-income Households
(January – December 2015)

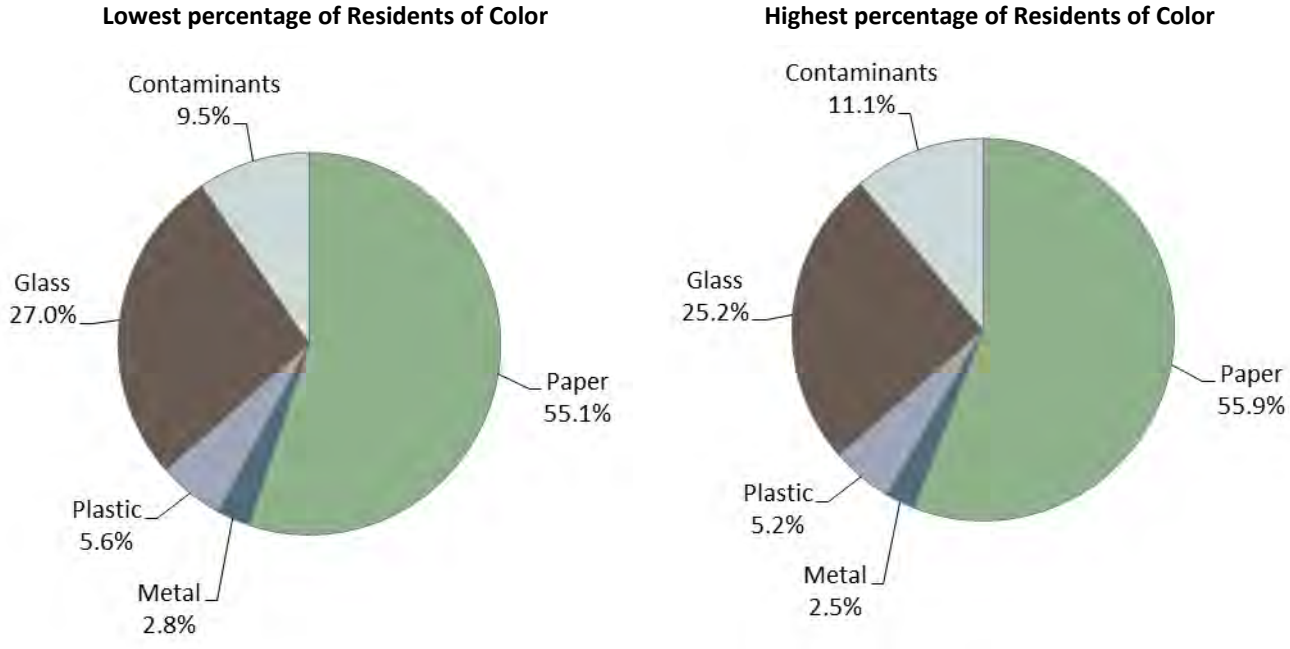
Material	Est. Percent	Low	High
Paper	**53.8%**		
Newsprint	14.6%	13.1%	16.1%
Unwaxed OCC/Kraft Paper	16.5%	14.5%	18.5%
Mixed Low-grade Paper	22.1%	19.0%	25.2%
Polycoat Containers	0.3%	0.3%	0.4%
Aseptic Containers	0.2%	0.1%	0.2%
Phone Books	0.1%	0.0%	0.1%
Shredded Paper	0.0%	0.0%	0.1%
Metal	**2.4%**		
Aluminum Cans	0.6%	0.5%	0.7%
Aluminum Foil/Containers	0.2%	0.1%	0.3%
Tin Food Cans	1.0%	0.8%	1.1%
Other Ferrous Metal	0.7%	0.3%	1.0%
Plastic	**4.9%**		
Small PET Bottles (24 oz or smaller)	0.6%	0.5%	0.7%
Large PET Bottles (greater than 24 oz)	0.6%	0.5%	0.7%
PET Jars, Tubs, and Other Containers	0.5%	0.3%	0.6%
HDPE Natural Bottles	0.4%	0.3%	0.5%
HDPE Colored Bottles	0.5%	0.3%	0.6%
HDPE Natural Jars, Tubs, and Other Containers	0.1%	0.0%	0.1%
HDPE Colored Jars, Tubs, and Other Containers	0.2%	0.1%	0.3%
Other Plastic Bottles (#3-7)	0.2%	0.1%	0.3%
Other Jars, Tubs, and Containers (#3-7)	0.2%	0.2%	0.3%
Plastic Bags and Packaging	1.1%	0.9%	1.4%
Bulky Rigid Plastic	0.6%	0.3%	0.8%
Glass	**26.9%**		
Clear Glass Bottles	4.1%	3.6%	4.6%
Green Glass Bottles	4.0%	3.5%	4.6%
Brown Glass Bottles	4.5%	3.7%	5.3%
Clear Container Glass	1.0%	0.6%	1.4%
Other Glass Containers and Bottles	0.4%	0.1%	0.8%
Mixed Glass Cullet	12.9%	11.0%	14.7%
Contaminants	**12.0%**		
Non-Conforming Paper	3.1%	2.2%	4.0%
Non-Conforming Plastic	1.1%	0.8%	1.4%
Non-Conforming Metal	1.0%	0.4%	1.5%
Non-Conforming Glass	0.6%	0.3%	0.8%
Food, Green Waste, and Wood	1.6%	0.9%	2.4%
Textiles and Clothing	0.9%	0.5%	1.2%
Other non-recyclables	3.8%	2.8%	4.8%
Sample Count	**28**		

Confidence intervals calculated at the 90% confidence level.

4.4.2 By Race

Figure 4-6 presents the recycling composition summary by broad material category for recycling disposed by the households with the lowest and highest percentages of residents of color. For both residence types, **Paper** made up about 55% of the total. Recycling percentages by broad material categories are very similar for both household types. **Glass** accounted for a slightly larger percentage from households with the lowest percentage of residents of color (27.0%) than from households with the highest percentage of residents of color (25.2%). Households with the highest percentage of residents of color (11.1%) had a slightly higher percentage of **Contaminants** than those with the lowest percentage of residents of color (9.5%).

Figure 4-6: Composition Summary, Percentage of Residents of Color
(January – December 2015)



4.4.2.1 Lowest Percentage of Residents of Color

A total of 17 samples were collected and sorted from households with the lowest percentage of residents of color. Table 4-34 lists the top ten components for this residence type. The most prevalent component was *mixed low-grade paper* (26.4%). *Newsprint, mixed glass cullet,* and *unwaxed OCC/Kraft paper* each accounted for between 11% and 16% of the total. The top ten components, together, represented approximately 86% of the total recycling. The full composition results for this recycling are listed in Table 4-36.

Table 4-34: Top Ten Components – Lowest Percentage of Residents of Color
(January – December 2015)

Component	Mean	Cum. %	Tons
Mixed Low-grade Paper	26.4%	26.4%	11,009
Newsprint	15.8%	42.2%	6,565
Mixed Glass Cullet	12.4%	54.7%	5,181
Unwaxed OCC/Kraft Paper	11.9%	66.6%	4,950
Clear Glass Bottles	4.8%	71.3%	1,985
Green Glass Bottles	4.4%	75.8%	1,844
Brown Glass Bottles	4.3%	80.1%	1,804
Non-Conforming Paper	2.8%	82.9%	1,156
Other non-recyclables	1.8%	84.7%	750
Food, Green Waste, and Wood	1.4%	86.1%	588
Total	**86.1%**		**35,832**

4.4.2.2 Highest Percentage of Residents of Color

A total of 28 samples were collected and sorted from households with the lowest percentage of residents of color. Table 4-35 lists the top ten components for this residence type. The most prevalent component was *mixed low-grade paper* (25.2%) followed by *newsprint* and *unwaxed OCC/Kraft paper*, both of which accounted for about 15% of the total. *Mixed glass cullet* made up almost 11% of recycling for this residence type. The top ten components, together, represented approximately 87% of the total recycling. The full composition results for this recycling are listed in Table 4-37.

Table 4-35: Top Ten Components – Highest Percentage of Residents of Color
(January – December 2015)

Component	Mean	Cum. %
Mixed Low-grade Paper	25.2%	25.2%
Newsprint	14.9%	40.1%
Unwaxed OCC/Kraft Paper	14.9%	55.0%
Mixed Glass Cullet	10.9%	66.0%
Brown Glass Bottles	4.8%	70.7%
Clear Glass Bottles	4.2%	74.9%
Other non-recyclables	4.0%	78.9%
Green Glass Bottles	3.8%	82.7%
Non-Conforming Paper	2.8%	85.5%
Non-Conforming Plastic	1.3%	86.8%
Total	**86.8%**	

4.4.2.3 Comparisons between Lowest Percentage of Residents of Color and Highest Percentage of Residents of Color

The first two components in both top ten lists for recycling collected from households with the lowest and highest percentages of residents of color were the same: *mixed low-grade paper* and *newsprint*. Seven of the other components are common to both lists, though they are ranked differently: *mixed glass cullet*, *unwaxed OCC/Kraft paper*, *clear glass bottles*, *green glass bottles*, *brown glass bottles*, *non-conforming paper*, and *other non-recyclables*. *Food, green waste, and wood* was unique to the households with the lowest percentage of residents of color and *non-conforming plastic* was unique to the households with the highest percentage of residents of color.

Table 4-36: Composition by Weight – Lowest Percentage of Residents of Color (January – December 2015)

Material	Est. Percent	Low	High
Paper	**55.1%**		
Newsprint	15.8%	12.1%	19.5%
Unwaxed OCC/Kraft Paper	11.9%	9.4%	14.4%
Mixed Low-grade Paper	26.4%	22.5%	30.4%
Polycoat Containers	0.5%	0.3%	0.6%
Aseptic Containers	0.2%	0.1%	0.2%
Phone Books	0.2%	0.0%	0.3%
Shredded Paper	0.2%	0.0%	0.4%
Metal	**2.8%**		
Aluminum Cans	0.9%	0.6%	1.3%
Aluminum Foil/Containers	0.1%	0.1%	0.2%
Tin Food Cans	1.1%	0.9%	1.3%
Other Ferrous Metal	0.6%	0.1%	1.1%
Plastic	**5.6%**		
Small PET Bottles (24 oz or smaller)	0.7%	0.5%	0.8%
Large PET Bottles (greater than 24 oz)	0.8%	0.6%	1.0%
PET Jars, Tubs, and Other Containers	0.8%	0.5%	1.1%
HDPE Natural Bottles	0.6%	0.5%	0.8%
HDPE Colored Bottles	0.5%	0.4%	0.7%
HDPE Natural Jars, Tubs, and Other Containers	0.2%	0.1%	0.3%
HDPE Colored Jars, Tubs, and Other Containers	0.1%	0.0%	0.2%
Other Plastic Bottles (#3-7)	0.1%	0.0%	0.2%
Other Jars, Tubs, and Containers (#3-7)	0.3%	0.2%	0.4%
Plastic Bags and Packaging	0.9%	0.6%	1.2%
Bulky Rigid Plastic	0.5%	0.0%	0.9%
Glass	**27.0%**		
Clear Glass Bottles	4.8%	3.9%	5.6%
Green Glass Bottles	4.4%	3.4%	5.4%
Brown Glass Bottles	4.3%	3.3%	5.4%
Clear Container Glass	0.7%	0.3%	1.2%
Other Glass Containers and Bottles	0.3%	0.0%	0.5%
Mixed Glass Cullet	12.4%	10.5%	14.4%
Contaminants	**9.5%**		
Non-Conforming Paper	2.8%	1.7%	3.9%
Non-Conforming Plastic	1.1%	0.7%	1.5%
Non-Conforming Metal	1.2%	0.5%	1.9%
Non-Conforming Glass	0.6%	0.2%	1.0%
Food, Green Waste, and Wood	1.4%	0.4%	2.4%
Textiles and Clothing	0.6%	0.2%	1.1%
Other non-recyclables	1.8%	1.1%	2.5%
Sample Count	**17**		

Confidence intervals calculated at the 90% confidence level.

Table 4-37: Composition by Weight – Highest Percentage of Residents of Color
(January – December 2015)

Material	Est. Percent	Low	High
Paper	**55.9%**		
Newsprint	14.9%	13.4%	16.4%
Unwaxed OCC/Kraft Paper	14.9%	12.8%	17.0%
Mixed Low-grade Paper	25.2%	21.5%	28.8%
Polycoat Containers	0.4%	0.3%	0.4%
Aseptic Containers	0.2%	0.1%	0.3%
Phone Books	0.2%	0.0%	0.4%
Shredded Paper	0.1%	0.0%	0.3%
Metal	**2.5%**		
Aluminum Cans	0.6%	0.5%	0.7%
Aluminum Foil/Containers	0.1%	0.1%	0.2%
Tin Food Cans	1.1%	0.9%	1.3%
Other Ferrous Metal	0.7%	0.3%	1.1%
Plastic	**5.2%**		
Small PET Bottles (24 oz or smaller)	0.7%	0.6%	0.8%
Large PET Bottles (greater than 24 oz)	0.7%	0.5%	0.8%
PET Jars, Tubs, and Other Containers	0.6%	0.4%	0.8%
HDPE Natural Bottles	0.4%	0.3%	0.5%
HDPE Colored Bottles	0.5%	0.4%	0.6%
HDPE Natural Jars, Tubs, and Other Containers	0.1%	0.0%	0.1%
HDPE Colored Jars, Tubs, and Other Containers	0.2%	0.1%	0.3%
Other Plastic Bottles (#3-7)	0.2%	0.1%	0.3%
Other Jars, Tubs, and Containers (#3-7)	0.3%	0.2%	0.4%
Plastic Bags and Packaging	1.0%	0.7%	1.3%
Bulky Rigid Plastic	0.6%	0.3%	0.9%
Glass	**25.2%**		
Clear Glass Bottles	4.2%	3.6%	4.7%
Green Glass Bottles	3.8%	3.2%	4.4%
Brown Glass Bottles	4.8%	4.0%	5.6%
Clear Container Glass	1.1%	0.7%	1.5%
Other Glass Containers and Bottles	0.5%	0.1%	0.8%
Mixed Glass Cullet	10.9%	9.0%	12.9%
Contaminants	**11.1%**		
Non-Conforming Paper	2.8%	1.9%	3.7%
Non-Conforming Plastic	1.3%	1.0%	1.6%
Non-Conforming Metal	0.9%	0.4%	1.4%
Non-Conforming Glass	0.4%	0.2%	0.5%
Food, Green Waste, and Wood	1.1%	0.6%	1.7%
Textiles and Clothing	0.6%	0.3%	0.9%
Other non-recyclables	4.0%	2.9%	5.0%
Sample Count	**28**		

Appendix A. Recycling Components

Recycling samples were sorted by hand into 35 component categories for the 2015 study. A list of the component categories and definitions is below, followed by a description of component changes between the 2015 and 2010 studies.

Paper

1. NEWSPRINT: Printed newsprint. (Advertising "slicks" (glossy paper) were included in this category if found mixed with newspaper; otherwise, ad slicks are included with mixed low grade paper.)

2. OCC/KRAFT, UNWAXED: Unwaxed/uncoated old corrugated container boxes and Kraft paper, and brown paper bags. Clean bags and boxes only; soiled are "non-conforming."

3. MIXED LOW GRADE: Mixed recyclable papers, including junk mail, magazines, colored papers, bleached Kraft, boxboard, mailing tubes, and paperback books. May also contain white or lightly colored sulfite/sulfate bond, copy papers, computer printouts, hard-back books, and envelopes. These items may contain small metal or plastic components (e.g., metal edge on aluminum foil box, plastic handle on laundry detergent box).

4. POLYCOATED CONTAINERS: Bleached polycoated milk, to-go hot and cold beverage cups, take-out containers, ice cream, and frozen food containers. Clean containers only; soiled are "non-conforming."

5. ASEPTIC CONTAINERS: Juice, soy/rice milk, and soup broth containers. Clean containers only; soiled are "non-conforming."

6. PHONE BOOKS: Telephone directories.

7. SHREDDED PAPER: Long shreds (at least 8 ½ inches long and ¼ inch wide) in a clear plastic bag, tied off. Does not include confetti or crosscut shreds.

Metal

8. ALUMINUM CANS: Aluminum beverage cans (UBC) and bi-metal cans made mostly of aluminum.

9. ALUMINUM FOIL/CONTAINERS: Aluminum food containers, trays, and foil. Clean material only; soiled is "non-conforming."

10. TIN FOOD CANS: Tinned steel food containers, including bi-metal cans mostly of steel. Includes attached lids.

11. OTHER FERROUS: Ferrous and alloyed ferrous scrap metals to which a magnet adheres and which are not significantly contaminated with other metals or materials and are smaller than 2 ft. x 2 ft. x 2 ft.

Plastic

12. SMALL PET BOTTLES: Polyethylene terephthalate bottles (containers with a narrow neck), such as soda pop and other beverage less than or equal to 24 ounces.

13. LARGE PET BOTTLES: Polyethylene terephthalate bottles (containers with a narrow neck), such as soda pop and other beverage bottles greater than 24 ounces.

14. PET JARS, TUBS, AND OTHER CONTAINERS: Polyethylene terephthalate containers bearing a #1 in the triangular recycling symbol. Includes lids 3 inches in diameter or larger.

15. HDPE NATURAL BOTTLES: Translucent high-density polyethylene bottles (containers with a narrow neck), such as milk, juice, and detergent containers.

16. HDPE COLORED BOTTLES: Colored high-density polyethylene bottles (containers with a narrow neck), such as milk, juice, and detergent containers.

17. HDPE NATURAL JARS, TUBS, AND OTHER CONTAINERS: Translucent high-density polyethylene items bearing a #2 in the triangular recycling symbol. Includes lids 3 inches in diameter or larger.

18. HDPE COLORED JARS, TUBS, AND OTHER CONTAINERS: Colored high-density polyethylene items bearing a #2 in the triangular recycling symbol. Includes lids 3 inches in diameter or larger.

19. OTHER PLASTIC BOTTLES (#3-7): Plastic bottles made of types of plastic other than HDPE or PETE. When marked for identification, these items may bear the number "3," "4," "5," "6,"or "7" in the triangular recycling symbol and all lids larger than 3" in diameter. Excludes expanded polystyrene (i.e., Styrofoam).

20. OTHER JARS, TUBS, AND RIGID FOOD CONTAINERS (#3-7): Clean plastic items made of types of plastic other than HDPE or PETE. When marked for identification, these items may bear the number "3," "4," "5," "6", or "7" in the triangular recycling symbol. Includes lids larger than 3" in diameter, single-use plant pots, deli and bakery trays with or without attached lids, tray lids, hinged containers ("clamshells")", cold beverage cups, and takeout containers. Excludes prescription containers and expanded polystyrene (i.e., Styrofoam).

21. BULKY RIGID PLASTICS: Durable plastic products made of plastic such as toys, lawn furniture, car parts, buckets, and plant pots. Items must be clean and can contain incidental amounts of other materials (e.g., metal lid on a plastic bucket).

22. PLASTIC BAGS AND PACKAGING: Clean plastic retail, grocery, garbage, newspaper, drycleaner bags, and plastic shrink-wrap. Excludes all food and freezer bags, bags that are soiled or contain other items (i.e. paper advertisement, cosmetic samples, computer disks), and plastic kitchen wrap. Bags with non-plastic handles (e.g. string) are also excluded.

Glass

23. CLEAR BOTTLES: Includes clear pop, liquor, wine, juice, beer, and vinegar bottles.

24. GREEN BOTTLES: Includes green pop, liquor, wine, beer, and lemon juice bottles.

25. BROWN BOTTLES: Includes brown pop, beer, liquor, juice, vanilla extract bottles.

26. CLEAR CONTAINER GLASS: All glass containers that are clear-colored and hold materials such as mayonnaise and non-dairy creamer.

27. OTHER GLASS CONTAINERS AND BOTTLES: All glass containers (of colors except clear) holding materials such as facial cream. All bottles of colors other than clear, green or brown. Examples include blue wine and liquor bottles.

28. MIXED CULLET. Glass bottles and containers that are broken into pieces less than one square inch and of multiple colors.

Contaminants

29. NON-CONFORMING PAPER: Any paper not described in the paper category and not meeting the requirements for Seattle's recycling program, such as tissue, photographs, soiled paper, food-soiled polycoated containers, waxed cardboard, and paper bags with plastic lining (i.e. dog or cat food bags).

30. NON-CONFORMING PLASTIC: Any plastic not described in the plastics category and not meeting the requirements for Seattle's recycling program such as tarps, bubble wrap, bags with hard plastic or rope handles, all expanded polystyrene (i.e., Styrofoam), plastic food bags (e.g., produce bags, Ziploc pouches), and plastic lids smaller than 3" in diameter.

31. NON-CONFORMING METAL: Any metal not described in the metals category and not meeting the requirements for Seattle's recycling program, such as products containing a mixture of metals, detached metal can lids, aerosol containers, metal larger than 2 ft. x 2 ft. x 2 ft., and other materials.

32. NON-CONFORMING GLASS: Any glass from glass loads not described in the glass category and not meeting the requirements for Seattle's recycling program, such as window glass, light bulbs, and glassware.

33. FOOD/GREEN WASTE/CLEAN WOOD: Includes all food, green waste, and other clean wood.

34. TEXTILES AND CLOTHING ACCESSORIES: Includes all organic and synthetic textiles, clothing items, purses, belts, shoes, and other clothing-related items.

35. OTHER NON-RECYCLABLES: Any item that does not meet the requirements for Seattle's recycling program in either compartment, such as organic wastes, construction debris, soil, and hazardous wastes.

The component categories used to characterize Seattle's recycling stream have been refined over the years. Table A-1 tracks these changes. (An "X" signifies that the component remains the same from the previous study period; an outline border reflects how components were split apart or grouped together.)

Table A-1. Changes to Recycling Component Categories, 1998/99 to 2015

	1998/99	2000/01	2005	2010	2015
PAPER					
Newsprint	X	X	X	X	X
Corrugated/Kraft, Unwaxed	X	X	X	X	X
Phone Books	X	X	X	X	X
Mixed Low Grade	X	X	X	X	X
Non-conforming Paper	X	Polycoated Containers	X	X	X
		Aseptic Containers	X	X	X
		X	X	Shredded Paper	X
				X	X
PLASTICS					
PET Bottles	X	Small PET Bottles (24 oz or smaller)	X	X	X
		Large PET Bottles (greater than 24 oz)	X	X	X
HDPE Bottles	X	X	X	X	HDPE Natural
					HDPE Colored
Non-conforming Plastic	X	X	X	*#6 containers moved to "Other Plastic Bottles" and "Other Plastic Jars, Tubs…"*	Bulky Rigid Plastics
					Non-conforming Plastic
		PET Jars, Tubs, and Other Containers	X	X	X
		HDPE Jars, Tubs, and Other Containers	X	X	HDPE Natural Jars, Tubs, and Other Containers
					HDPE Colored Jars, Tubs, and Other Containers

	1998/99	2000/01	2005	2010	2015
		Other Plastic Bottles (#3-7, excluding #6)	X	Renamed "Other Plastic Bottles (#3-7)"	X
		Other Plastic Jars, Tubs, and Containers (#3-7, excluding #6)	X	Renamed "Other Jars, Tubs, and Rigid Food Containers (#3-7)"	X
		Plastic Bags and Packaging	X	X	X
GLASS					
Clear Beverage	X	Clear Glass Bottles	X	X	X
Green Beverage	X	Green Glass Bottles	X	X	X
Brown Beverage	X	Brown Glass Bottles	X	X	X
Container Glass	X	Clear Container Glass	X	X	X
		Other Glass Containers and Bottles	X	X	X
Mixed Cullet	X	X	X	X	X
Non-conforming Glass (Glass Compartment)	X	X	X	Renamed "Non-conforming Glass"	X
METALS					
Aluminum Cans	X	X	X	X	X
Tin Food Cans	X	X	X	X	X
Other Ferrous	X	X	X	X	X
Non-conforming Metal	X	X	X	Aluminum Foil/Containers	X
				X	X
GARBAGE					
				Food/Green Waste/Clean Wood	X
			Other Non-Recyclables	Textiles and Clothing Accessories	X

<table>
<tr><th></th><th>1998/99</th><th>2000/01</th><th>2005</th><th>2010</th><th>2015</th></tr>
<tr><td rowspan="2">Garbage</td><td rowspan="2">X</td><td rowspan="2">X</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Recyclable Glass (Commingled Compartment)</td><td colspan="2">Category no longer needed as glass is not collected separately.</td></tr>
</table>

Appendix B. Sampling Methodology

Overview

The objective of the 2015 Seattle Recycling Composition Study was to provide statistically significant data on the composition of residential recyclables set out by single-family and multifamily households in the City of Seattle. The residential recycling stream was last sampled in 2010. The current study followed the same basic methodology as the previous study.

This appendix outlines the sampling methodology for the 2015 study.

Sampling Populations

This study was designed to determine the composition of curbside recycling for both single-family and multifamily residences within the city that were hauled to the 3rd and Lander recycling facility. Recyclable materials that were either self-hauled to the city's two transfer stations or hauled from Seattle's commercial sector were excluded from this study.

The recyclables set out by residences in Seattle and collected by the two contracted haulers can be divided into eight subpopulations defined by two generator types and four collection zones. The two generator types are defined as follows:

- ***Single-family:*** Primarily detached single-family, duplex, triplex, and four-plex homes. Recycling is collected from toters.

- ***Multifamily:*** Primarily apartments and condominiums with five or more units. Recycling is primarily collected from dumpsters though some properties use toters.[1]

Seattle's residential recyclables are collected in four recycling collection zones, as seen in **Error! Reference source not found.** below. Samples were apportioned evenly across the four collection zones to ensure comparability of data.

[1] Through the Clear Alleys Program, multifamily recycling from approximately 100 downtown buildings is collected in bags. This material was excluded from the study due to the difficulty of segregating and obtaining representative samples of this material.

Figure B-1: Recycling Collection Zones

Table B-1 depicts each of the eight residential recycling subpopulations according to generator type and collection zone.

Table B-1. Residential Recycling Subpopulations by Generator Type and Collection Zone

		Generator Type *(Single-family)*	Generator Type *(Multifamily)*
Recycling Collection Zones	*One*	Single-family Zone One	Multifamily Zone One
	Two	Single-family Zone Two	Multifamily Zone Two
	Three	Single-family Zone Three	Multifamily Zone Three
	Four	Single-family Zone Four	Multifamily Zone Four

Sample Allocation

To ensure comparability of data between study years, the study was designed to capture a total of 270 samples: 180 single-family and 90 multifamily samples, the same ratio used in the 2010 study. Table B-2 shows the planned and actual number of samples taken from each of the eight subpopulations in this study.

Table B-2. Sampling Distribution

Generator Type	Planned Number of Samples	Actual Number of Samples
Single-family		
Zone One	45	42
Zone Two	45	46
Zone Three	45	41
Zone Four	45	48
Multi-family		
Zone One	22-23	24
Zone Two	22-23	19
Zone Three	22-23	26
Zone Four	22-23	24
Total	270	**270**

Sampling Calendar

The sorting crew was able to sample a total of 15 samples per day; therefore, 18 sampling days were necessary to capture all 270 samples during the course of this study. In order to capture seasonal variations, three sampling days were assigned to each of six months in 2015.

Sampling dates at each facility were selected using a random process and then adjusted in several instances for the following reasons: to avoid one holiday, accommodate the sorting crew's availability, and improve the distribution across days of the week and weeks of the month. The sampling calendar was developed using the following steps.

- **Step 1: Selected weeks for sampling events.** Initially, weeks were randomly selected within each month, with the exception of February, when the sorting crew was available only during one week of the month. Since recycling is collected every other week in Seattle, alternating weeks are referred to as "A" or "B." Two weeks were reassigned to create a balance between A and B, and a third week in December was moved earlier to avoid Christmas.

- **Step 2: Selected days within each sampling week.** After weeks were assigned, start days were selected. Sampling occurs over three consecutive days so a sampling event could begin either Monday, Tuesday, or Wednesday. The start days were randomly selected for each sampling month.

The 2015 sampling calendar is provided in Table B-3. On a typical sampling day, ten single-family loads and five multifamily loads were sampled.

Table B-3. Sampling Calendar

Date	*Number of Samples*		Total
	SF	MF	
2/18/2015	10	5	**15**
2/19/2015	10	5	**15**
2/20/2015	10	5	**15**
4/27/2015	10	5	**15**
4/28/2015	10	5	**15**
4/29/2015	10	5	**15**
6/9/2015	10	5	**15**
6/10/2015	10	5	**15**
6/11/2015	10	5	**15**
8/26/2015	10	5	**15**
8/27/2015	10	5	**15**
8/28/2015	10	5	**15**
10/6/2015	10	5	**15**
10/7/2015	10	5	**15**
10/8/2015	10	5	**15**
12/14/2015	10	5	**15**
12/15/2015	10	5	**15**
12/16/2015	10	5	**15**
Total	**180**	**90**	**270**

Table B-4 shows the distribution of recycling sampling days for the year.

Table B-4. Distribution of Recycling Sampling Days

	Day of the Week					Overall
	Monday	Tuesday	Wednesday	Thursday	Friday	
3rd and Lander	2	4	6	4	2	**18**

"Universe" of Recycling Loads

The universe of recycling loads included in the study was all residential recycling routes within the City of Seattle. To compile the universe, detailed route information was collected from Seattle Public Utilities (SPU) and CleanScapes, Waste Management, and their subcontractor, West Seattle Recycling. This information included collection zone, route number, collection day, and generator type.[2]

Hauler and Transfer Station Participation

At the outset of the study, meetings were held with hauler and transfer station staff to communicate study objectives and explain all sampling procedures. Additionally, hauler and transfer station contacts received a schedule of all the sampling events for the year.

[2] Through the Clear Alleys Program, multifamily recycling from approximately 100 downtown buildings is collected in bags. This material was excluded from the study due to the difficulty of segregating and obtaining representative samples of this material.

Haulers were sent reminders one week prior to each sampling event. Several days prior to each selected sampling day, the routes selected for the sampling day were sent to each hauler. The hauler verified that route numbers were correct; added truck numbers, driver names, and vehicle arrival times; and returned the list. From the lists of routes, the target number of routes were randomly selected to correspond to the number of samples required from each subpopulation on each sampling day. The list of vehicles selected for sampling were forwarded to the hauler and verified verbally. In addition, the haulers were reminded to notify drivers of selected vehicles that they were to participate in the sampling activities.

Affected 3rd and Lander personnel were contacted using a similar process as used with haulers: affected staff were notified the week and the day prior to sampling to ensure that all staff were aware of the sampling event and that there were no conflicts.

Sample Selection

To select which loads would be sampled on a given sampling day, a random number was assigned to every load that was expected to arrive at the 3rd and Lander facility on that day. These random numbers were sorted, and the loads with the lowest random number were selected in sequence until the target number of samples was achieved for each subpopulation. For subsequent sampling days, a new random number was assigned to each load, and the process was repeated. One or more additional single-family and/or multifamily routes were added to the list of routes scheduled on each sampling day. The additional routes provided "contingency samples" that could be obtained and sorted if one of the vehicles for the regularly-planned collection route failed to arrive on time or was not intercepted in time to obtain a sample.

As the study progressed, key planning assumptions were monitored. When necessary, the sampling plan was modified to meet the objectives of the study. For example, if more trucks were scheduled for collection during a particular season or month, such as the Christmas holiday season, they would be added to the "universe" of trucks and selected from according to the procedures outlined above.

Field Procedures

The field supervisor coordinated all logistics involving truck diversion, sample extraction, sorting area, and recycling of sorted materials with the transfer station manager. When a selected load arrived at Third & Lander, a gatekeeper scanned truck numbers as trucks arrived at the facility against the *Vehicle Selection Sheet*. When truck with a number listed on the sheet arrived, the gatekeeper verified the zone, route number, and generator type with the driver. If the load contained recycling from more than the targeted generator type, the gatekeeper ensured that it was possible to obtain a pure sample, and, if so, identified which part of the load contained the targeted generator type's recycling. If the load was too mixed (e.g., multifamily and commercial recycling were mixed throughout the load), the gatekeeper excluded that load from sampling. If the load was acceptable for sampling, the gatekeeper directed the driver to tip the load in the sample capture area.

When the load arrived at the tipping area, the field supervisor instructed the loader operator to extract approximately one to two cubic yards (approximately 250 pounds) of the material that represented a cross-section of the load and deposit it on a tarp for sorting. The field supervisor performed a visual check to verify that the sampled material appeared to be from the targeted generator type. If it did not appear to be from the correct generator type, the sample was discarded.

Each sample was sorted by hand into the component categories as defined in Appendix A. Components were placed in plastic laundry baskets to be weighed and recorded. The field supervisor monitored the homogeneity of the component baskets as material accumulated, rejecting items that may have been improperly classified. Open laundry baskets allowed the field supervisor to see the material at all times.

The weights of all materials were recorded on tally sheets, an example of which is shown in Appendix F.

Changes in Methodology from 2010 Study

The 2015 study was conducted using the same methodology as the 2010 study, with one exception. Sampling events included only recycling sample days. In 2010, the recycling study and the waste study were carried out concurrently.

Appendix C. Sampling Progress Reports

This section presents progress reports that were sent to the SPU project manager every other month throughout the project period. Each summary presents dates of sampling, the total number of samples sorted compared to the goal for that sampling event, and whether any samples were missed or replaced by a different zone or sector. Each section also includes a table detailing the number of samples that were actually sorted versus the number planned, by sector and zone.[3]

February

Sampling took place from Wednesday, 2/18 through Friday, 2/20. The table below compares the number of samples that were sorted to the number originally planned by generator and zone. One greater single-family Zone 3 and one fewer single-family Zone 2 sample were sorted than planned. As planned, 45 total samples were sorted.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	7	7	0
	Zone 2	7	8	-1
	Zone 3	8	7	1
	Zone 4	8	8	0
Subtotal, Single-family		*30*	*30*	*0*
Multifamily	Zone 1	4	4	0
	Zone 2	4	4	0
	Zone 3	4	4	0
	Zone 4	3	3	0
Subtotal, Multifamily		*15*	*15*	*0*
Total		**45**	**45**	**0**

April

Sampling took place from Monday, 4/27/15 through Wednesday, 4/29/15. **Error! Reference source not found.**The table below compares the number of samples that were sorted to the number originally planned by generator and zone. The number of samples completed differs from the targets by zone and generator type by 1 or 2 samples for the sampling event.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	8	7	1
	Zone 2	8	7	1
	Zone 3	7	8	-1
	Zone 4	7	6	1

[3] For several months, the number of planned samples differs from planned samples in the study design, as listed in Table B-2 were revised during the year to make up for variances from prior months' goals.

Subtotal, Single-family		*30*	*28*	*2*
Multifamily	Zone 1	4	4	0
	Zone 2	4	5	-1
	Zone 3	3	5	-2
	Zone 4	4	3	1
Subtotal, Multifamily		*15*	*17*	*-2*
Total		**45**	**45**	**0**

June

Sampling took place from Tuesday, 6/9/15 through Thursday, 6/11/15. The table below compares the number of samples that were sorted to the number originally planned by generator type and zone. The number of samples completed differs from the targets by zone and generator type by 1 or 2 samples for the sampling event.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	7	7	0
	Zone 2	7	7	0
	Zone 3	8	6	-2
	Zone 4	8	10	2
Subtotal, Single-family		*30*	*30*	*0*
Multifamily	Zone 1	3	4	1
	Zone 2	4	3	-1
	Zone 3	4	4	0
	Zone 4	4	4	0
Subtotal, Multifamily		*15*	*15*	*0*
Total		**45**	**45**	**0**

August

Sampling took place from Wednesday, 8/26/15 through Friday, 8/28/15. The table below compares the number of samples that were sorted to the number originally planned by generator type and zone. The number of samples completed differs from the targets by zone and generator type by 1 or 2 samples by generator and zone for the sampling event. One greater single-family sample and one fewer multifamily sample was sorted than planned.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	8	7	-1
	Zone 2	8	9	1
	Zone 3	7	7	0

	Zone 4	7	8	1
Subtotal, Single-family		*30*	*31*	*1*
Multifamily	Zone 1	4	4	0
	Zone 2	3	2	-1
	Zone 3	4	5	1
	Zone 4	4	3	-1
Subtotal, Multifamily		*15*	*14*	*-1*
Total		**45**	**45**	**0**

October

Sampling took place from Tuesday, 10/6/15 through Thursday, 10/8/15. **Error! Reference source not found.**The table below compares the number of samples that were sorted to the number originally planned by generator type and zone. The number of samples completed differs from the targets by zone and generator type by 1 sample at the most for the sampling event. As planned, 30 single-family samples and 15 multifamily sample were sorted.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	7	6	-1
	Zone 2	7	8	1
	Zone 3	8	7	-1
	Zone 4	8	9	1
Subtotal, Single-family		*30*	*30*	*0*
Multifamily	Zone 1	4	5	1
	Zone 2	4	3	-1
	Zone 3	4	4	0
	Zone 4	3	3	0
Subtotal, Multifamily		*15*	*15*	*0*
Total		**45**	**45**	**0**

December

Sampling took place from Monday, 12/14/15 through Wednesday, 12/16/15. The table below compares the number of samples that were sorted to the number originally planned by generator type and zone. The number of samples completed differs from the targets by zone and generator type by 3 samples at the most for the sampling event. In total, 28 single-family samples and 17 multifamily samples were sorted, compared to the plan of 30 single-family and 15 multifamily.

Generator	Zone	Planned	Actual	Difference
Single-family	Zone 1	8	8	0
	Zone 2	8	7	-1
	Zone 3	7	6	-1
	Zone 4	7	7	0

Subtotal, Single-family		*30*	*28*	*-2*
Multifamily	Zone 1	3	3	0
	Zone 2	3	2	-1
	Zone 3	4	4	0
	Zone 4	5	8	3
Subtotal, Multifamily		*15*	*17*	*2*
Total		**45**	**45**	**0**

Appendix D. Recycling Composition Calculations

Composition Calculations

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

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

where:

c = weight of particular component

w = sum of all component weights

for i 1 to n where n = number of selected samples

for j 1 to m where m = number of components

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

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

where:

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

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

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

where:

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

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

Weighted Averages

Recycling composition estimates were calculated by using a weighted average procedure. For example, to develop composition estimates for Seattle's single-family residential recycling, sample data from all

four zones were combined, with slightly more importance given to the single-family Zone 4 samples (contributing approximately 32% of total single-family recycling tons).

Seattle Public Utilities provided the estimate of tonnage disposed by each of the eight subpopulations. The composition estimates were applied to the relevant tonnages to estimate the amount of recycling for each component category for each residence type and collection zone.

The **weighted average for a composition estimate** was performed as follows:

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

where:

p = the proportion of tonnage contributed by the noted group

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

for j 1 to m

where m = number of components

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

$$\mathrm{Var}E_j = (p_1^2 * \hat{V}_{rj1}) + (p_2^2 * \hat{V}_{rj2}) + (p_3^2 * \hat{V}_{rj3}) + \ldots$$

The weighting percentages that were used to perform the composition calculations for the 2015 study are listed in Table D-1 below.

Table D-1. Weighting Percentages: Overall
(January – December 2015)

Generator	Zone	Season	Tons Disposed	Percent of Total
Single-family	Zone 1	Winter	4,041	4.93%
	Zone 1	Spring	3,702	4.52%
	Zone 1	Summer	3,872	4.72%
	Zone 1	Fall	3,770	4.60%
	Zone 2	Winter	3,181	3.88%
	Zone 2	Spring	2,941	3.59%
	Zone 2	Summer	3,065	3.74%
	Zone 2	Fall	3,026	3.69%
	Zone 3	Winter	3,732	4.55%
	Zone 3	Spring	3,446	4.21%
	Zone 3	Summer	3,601	4.39%
	Zone 3	Fall	3,527	4.30%
	Zone 4	Winter	4,974	6.07%
	Zone 4	Spring	4,605	5.62%
	Zone 4	Summer	4,839	5.90%
	Zone 4	Fall	4,641	5.66%
Multifamily	Zone 1	Winter	1,204	1.47%
	Zone 1	Spring	1,147	1.40%
	Zone 1	Summer	1,222	1.49%
	Zone 1	Fall	1,237	1.51%
	Zone 2	Winter	734	0.90%
	Zone 2	Spring	677	0.83%
	Zone 2	Summer	700	0.85%
	Zone 2	Fall	737	0.90%
	Zone 3	Winter	2,516	3.07%
	Zone 3	Spring	2,429	2.96%
	Zone 3	Summer	2,513	3.07%
	Zone 3	Fall	2,542	3.10%
	Zone 4	Winter	835	1.02%
	Zone 4	Spring	824	1.01%
	Zone 4	Summer	817	1.00%
	Zone 4	Fall	865	1.06%
			81,961	**100.00%**

Comparison Calculations

Identifying statistically significant differences requires a two-step calculation. First, assuming that the two groups to be compared have the same variance, a **pooled sample variance** was calculated:

$$S_{pool}{}^{2} = \frac{\left[(n1-1)\cdot\left(n1\cdot \bar{V}_{r_j 1}^{2}\right)\right]+\left[(n2-1)\cdot\left(n2\cdot \bar{V}_{r_j 2}^{2}\right)\right]}{n1+n2-2}$$

Next, the **t-statistic** was constructed:

$$t = \frac{(r1-r2)}{\sqrt{\frac{S_{pool}{}^{2}}{n1}+\frac{S_{pool}{}^{2}}{n2}}}$$

The **p-value** of the t-statistic was calculated based on (n1+n2 -2) degrees of freedom.

Demographic Calculations

Recycling compositions for different demographic groups were calculated by considering the median household income and percentage of residents of color within each sampled recycling route. Single-family recycling samples were grouped according to whether they were collected from recycling routes with high-income, low-income, large household size, or small household size. Once the recycling samples were identified as belonging to one of these four demographic groups, recycling composition calculations were performed as described above under "Composition Calculations."

Calculations of each recycling route's **percentage of residents of color** were performed as follows:

Population and number of households were obtained for each Census Block in Seattle via the 2010 Census Redistricting Data Summary Files. Geographic locations for Census Blocks in Seattle were obtained in GIS shapefile format from the Census website.[4]

1. Census Blocks were identified by the Seattle single-family recycling route (serviced by Cleanscapes and Waste Management) that covered that Block area. These companies provided GIS shapefiles of their recent recycling routes. The total population and total number of residents of color for each recycling route were then calculated by summing the population and number of residents of color for all Census Blocks contained within each route.
2. Percentage of residents of color was calculated by dividing the total population of each route by the total number residents of color.

Calculations of each recycling route's **median income** were performed as follows, using information from the 2009-2013 American Community Survey 5-year estimates Summary File.[5]

[4] http://www.census.gov/rdo/data/2010_census_redistricting_data_pl_94-171_summary_files.html
[5] http://www.census.gov/acs/www/data_documentation/summary_file/

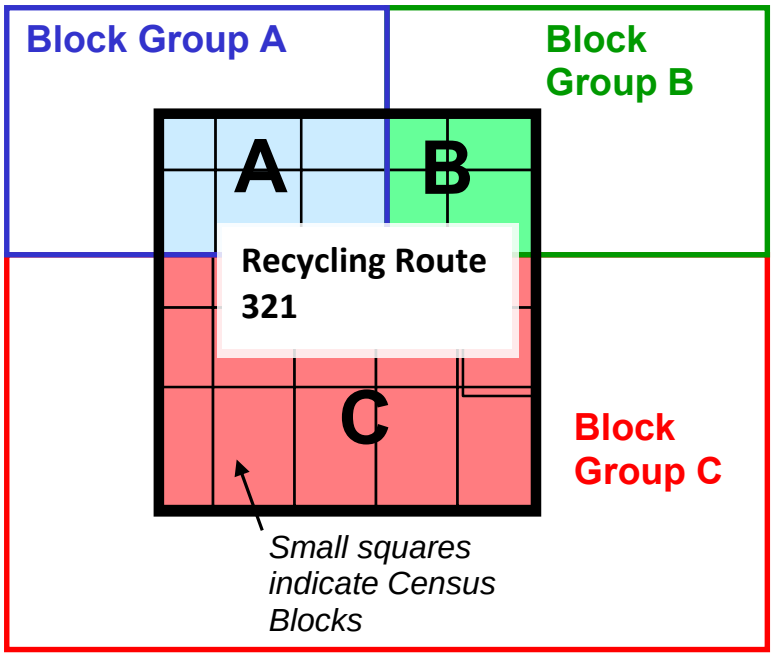
Each Census Block Group was identified by the recycling route that covers that Block Group. Figure D-1 presents an example where Block Groups A, B, and C are identified by one designated recycling route, Recycling Route 321.

The number of households in each Census Block Group was used to calculate a weighted median income for the route. For instance, because Block Group C contains more households than Block Groups A and B, the median income of Block Group C would be given more importance than the other two Block Groups in calculating the median income for the designated garbage route, Recycling Route 321. The weighting was carried out as follows, where "Households" refers to the number of households in each Block Group, and "Income" refers to the median income of each Block Group within the designated route.

$$\textbf{Estimated Median Income of Recycling Route 321} = \frac{\textbf{A} \text{ Households} * \textbf{A} \text{ Income} + \textbf{B} \text{ Households} * \textbf{B} \text{ Income} + \textbf{C} \text{ Households} * \textbf{C} \text{ Income}}{\textbf{A} \text{ Households} + \textbf{B} \text{ Households} + \textbf{C} \text{ Households}}$$

1. The result of this weighting is an approximation of the median income for the designated route.

Figure D-1: Geographies Used in Demographic Calculations



Sampled routes were then divided into quartiles based on the median income and mean household size of each garbage route. Recycling samples from the first (0 - 25%) quartile were used to calculate "low income" and "lowest percentage of residents of color" recycling compositions and samples from the top quartile (75% - 100%) were used to calculate "high income" and "highest percentage of residents of color" recycling compositions.

Appendix E. Year-to-Year Comparison Calculations

This section outlines the technical issues involved with the year-to-year comparison calculations. The calculation formulae are outlined in Appendix D.

Background

In an ongoing effort to monitor the types and amounts of residential recycling, Seattle has performed several residential recycling composition studies. Differences are often apparent between study periods. In this appendix, results from the year 2010 study are compared to 2000/01 and 2005 findings.[6] Composition variations in the percentage of each broad material category were measured for the two study years.

In order to control for population changes and other factors that may influence the total amount of material recycled from year to year, the tests described in this appendix measure recycling proportions, and not actual tonnage. For example, if newspaper accounts for 5% of a particular substream's recycling each year, and that substream recycled a total of 1,000 tons of material in one year and 2,000 tons of material in the next, while the amount of newspaper increased from 50 to 100 tons, the percentage remained the same. Therefore, the tests would indicate that there had been no change.

The purpose of conducting these comparison tests was to identify statistically significant changes in the percentage of broad material categories of recycling in each substream over time. One specific example is as follows:

Hypothesis: "There is no statistically significant difference, between the 2000/01 and 2010 study periods, in the percentage of paper recycled."

Statistics are then employed to look for evidence disproving the hypothesis. A "significant" result means that there is enough evidence to disprove the hypothesis, and it can be concluded that there is a true difference across years. "Insignificant" results indicate that either a) there is no true difference, or b) even though there may be a difference, there is not enough evidence to prove it.

The purpose of these tests was to identify changes across years. However, the study did not attempt to investigate *why* or *how* these changes occurred. The changes may be due to a variety of factors. For example, a decrease in paper recycled could be due to any combination of the following:

- Consumer preferences might have shifted so that electronic media might have captured some of the market previously held by paper.
- Technology might have changed so that manufacturers might use thinner paper than in the past, which would decrease the weight of paper, even if the same number of sheets of paper was recycled.
- Fewer residents may participate in paper recycling programs.

[6] The 2000/01 study was also conducted by Cascadia Consulting Group and followed the same basic methodology as the 2005 study. Conversely, the methodologies used in the 1993 and 1998/99 resulted in findings that are not comparable to the more recent studies.

- An increase in the recycling of another, non-paper material which would cause the percentage of recycling that is paper to decrease, even if there was no change in the tons of paper that were recycled.

Statistical Considerations

The analyses are based on the component percentages, by weight, for each selected substream. As described in Appendix D, 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 year-to-year variation.

Normality

The distribution of some of the broad material categories (particularly the hazardous materials) is 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, the broad material categories are sums of several individual recycling components, which improve our ability to meet the assumptions of normality.

Dependence

There may be dependence between recycling components (if a person recycles component A, they always recycle component 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 component A increases, the percentage of some other component must decrease). This type of dependence is somewhat controlled by choosing only a portion of the recycling categories for the analyses.

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 recycling broad material class) **each** of which carries that risk. However, we were willing to accept only a 2% chance for each individual test of making an incorrect conclusion. Therefore, each test was adjusted by setting the significance threshold to $\frac{0.10}{w}$ (w = the number of t-tests).

The adjustment can be explained as follows:

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

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

The chance of a "false positive" for the year-to-year comparisons made in this study is restricted to 10% overall, or 2.00% for each test (10% divided by the five tests equals 2.00%).

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).

Interpreting the Calculation Results

This section interprets the statistical results for year-to-year comparisons. Tables E-1 and E-2 presents results of the comparisons; an asterisk indicates the statistically significant differences.

For the purposes of this study, only those calculation results with a p-value of less than 2.00% are considered to be statistically significant. 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 E-1: Changes in Residential Recycling Composition: 2000/01 to 2010 the proportion of *plastic* increased from 1.4% to 2.6 % across the study periods. The t-statistic is relatively large (11.66) and the probability (p-value) of observing that t-statistic if there had been no true difference between years is approximately 0.0%. This value is less than the study's pre-determined threshold for statistically significant results (alpha-level of 2.00%); thus the increase in *plastic* is considered to be a true difference.

Changes in Residential Recycling

In Table E-1, all broad material categories, **Paper**, **Metal**, **Plastic**, **Glass**, and **Contaminants** showed significant changes across study periods. **Paper** showed a decreasing trend while the other categories showed increasing trends.

Table E-1: Changes in Residential Recycling Composition: 2000/01 to 2010

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.02)
	2000	*2015*		
Paper	**78.2%**	**55.5%**	**15.1752**	**0.0000 ***
Metal	**1.8%**	**2.3%**	**3.4336**	**0.0006 ***
Plastic	**1.4%**	**2.4%**	**9.6297**	**0.0000 ***
Glass	**13.3%**	**25.8%**	**8.3174**	**0.0000 ***
Contaminants	**5.2%**	**14.1%**	**18.4126**	**0.0000 ***
Number of Samples	*549*	*270*		

Note: An asterisk indicates statistically significant differences.

As displayed in Table E-2**Error! Reference source not found.**Table E-1, three broad material categories showed significant changes since the 2010 study period. **Paper** showed a decreasing trend over the last 5 years while **Glass** and **Contaminants** showed increasing trends.

Table E-2. Changes in Residential Recycling Composition: 2010 to 2015

	Mean Ratio (Material Wt/Total Wt)		t-Statistic	p-Value (Cut-off for statistically valid difference = 0.02)
	2010	*2015*		
Paper	**68.4%**	**55.5%**	**13.5654**	**0.0000 ***
Metal	**2.4%**	**2.3%**	**0.7627**	**0.4460**
Plastic	**2.6%**	**2.4%**	**2.0626**	**0.0396**
Glass	**17.9%**	**25.8%**	**10.7267**	**0.0000 ***
Contaminants	**8.7%**	**14.1%**	**10.0642**	**0.0000 ***
Number of Samples	*270*	*270*		

Note: An asterisk indicates statistically significant differences.

Appendix F. Field Forms

Examples of field forms used in this study are included in the following order:

- Vehicle Selection Sheet
- Sample Placard
- Tally Sheet

Figure F-1: Vehicle Selection Sheet

Vehicle Selection Sheet

Sampling Date: **Wednesday, June 10, 2015**

Seattle Residential RECYCLING Composition Study

Facility: **3rd and Lander**

Sample ID	SF/MF	Zone	Hauler	Truck No.	Driver	Route	Load	Notes	# of Trips
	SF	2	Recology	3035	Allen	325			
	SF	2	Recology	3062	Burnett	321			
	SF	2	Recology	3064	Campos	323			
	SF	3	Recology	3009	N/A	341			
	SF	3	Recology	3010	Zermeno	342			
contingency	SF	3	Recology	3011	Orellana	343			
	MF	3	Recology	3015	Hernandez	SE-442			
	MF	2*	Recology	3045	Stroud	SE-445		*Mixed route - want Zone 2*	
contingency	MF	2	Recology	3016	Roper	SE-443			
	SF	1	WM	362978	Jim Jacobsen	3899			
	SF	1	WM	152546	Patrick O'Toole	3808			
	SF	1	WM	152550	Terrell Elmore	3809			
	SF	4	WM	152552	Lance Franklin	3831			
	SF	4	WM	152554	Victor Betancourt	3830			
	MF	1	WM-West S.	362953	Jason Holaday	3853			
	MF	4	WM-West S.	362952	Braunsen Goebels	3852			
	MF	4	WM-West S.	362954	Troy Pempeit	3855			

Today's Sampling Plan 10 SF, 5 MF

Figure F-2. Sample Placard

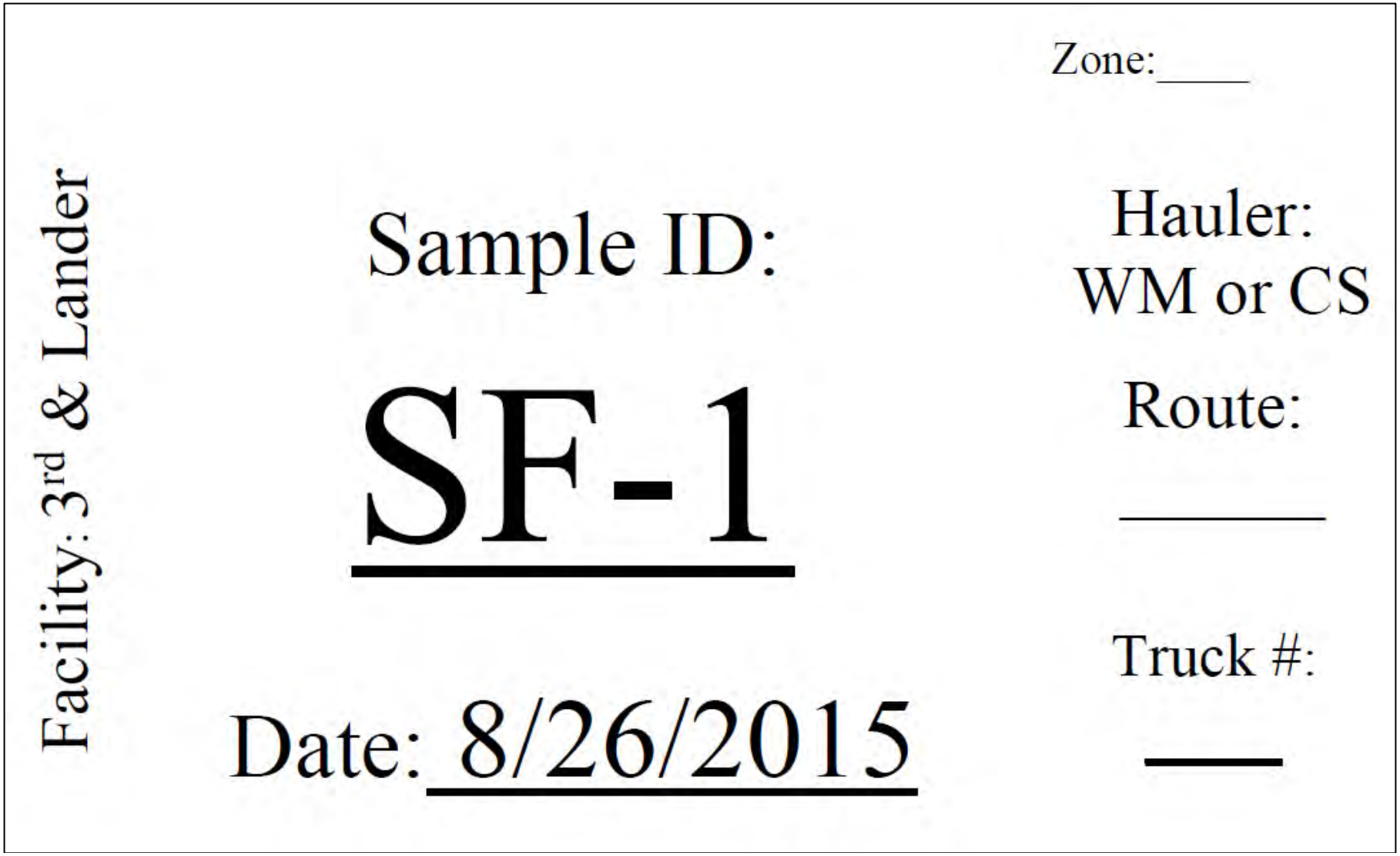


Figure F-3. Recycling Tally Sheet

Paper	Weight A	Weight B	Weight C	Weight D
Newsprint				
OCC/Kraft, Unwaxed				
Mixed Low-grade				
Polycoat Containers				
Aseptic Containers				
Phone Books				
Shredded Paper				
Non-conforming Paper				
Plastic				
Small PET Bottles (24 oz or smaller)				
Large PET Bottles (greater than 24 oz)				
PET Jars, Tubs and Other Containers				
HDPE Natural Bottles				
HDPE Colored Bottles				
HDPE Natural Plastic Jars, Tubs, and Other Containers				
HDPE Colored Plastic Jars, Tubs, and Other Containers				
Other Plastic Bottles (#3-7)				
Other Jars, Tubs, and Rigid Food Containers (#3-7)				
Plastic Bags and Packaging				
Bulky Rigid Plastics				
Non-conforming Plastic				
Metal				
Aluminum Cans				
Aluminum Foil/Containers				
Tin Food Cans				
Other Ferrous				
Non-conforming Metal				
Glass				
Clear Bottles				
Green Bottles				
Brown Bottles				
Clear Container Glass				
Other Glass Containers and Bottles				
Mixed Cullet				
Non-conforming Glass				
Garbage				
Food/Green Waste/Clean Wood				
Textiles and Clothing Accessories				
Garbage				

Sample ID:

Sorting Date:

Generator Type:

Single-family

Multi-family

Hauler:

Waste Mgt. (incl West Seattle)

CleanScapes

Truck #:

Route #:

Zone #:

Load #: