2020

Seattle Public Utilities

Residential Garbage and Recycling Stream Composition Study

Prepared by

CASCADIA CONSULTING GROUP

ACKNOWLEDGMENTS

To the management and staff in the following facilities and organizations, we thank you for your support and guidance during these challenging times.

- Seattle Public Utilities (SPU) – Solid Waste, Finance, Transfer Station Operations
- Waste Management (WM) – Routing and hauling
- Recology – Routing and hauling
- Republic Services – Third & Lander recycling processing facility
- CanDo – Collection carts for sampling
- Sky Valley Associates (SVA)
- Eco-Logica

LINKS TO PREVIOUS REPORTS

Earlier reports on Seattle's residential garbage and recycling streams are available on the Seattle Public Utilities website.

RESIDENTIAL GARBAGE COMPOSITION REPORTS[1]

2014 Residential Waste Stream Composition Study

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

RESIDENTIAL RECYCLING COMPOSITION REPORTS[2]

2015 Residential Recycling Composition Study

2010 Residential Recycling Composition Study

2005 Residential Recycling Composition Study

2000-01 Residential Recycling Composition Study

1998/1999 Residential Recycling Composition Study[3]

1993 Residential Recycling Composition Study[4]

[1] https://www.seattle.gov/utilities/about/reports/solid-waste-reports/composition-studies
[2] https://www.seattle.gov/utilities/about/reports/solid-waste-reports/composition-studies
[3] This report is not available online.
[4] This report is not available online.

GLOSSARY OF TERMS

Garbage	For the purposes of this study, "garbage" is defined as material disposed by single-family and multifamily dwellings and that is collected by two haulers contracted by the City.
Recycling	For the purposes of this study, "recycling" is defined as material put into the recycling bin, or set aside on the curb, by single-family and multifamily dwellings residents and that is collected by two haulers contracted by the City. Recycling is defined by the way residents set them out, not by the composition of the material itself.
Single-family	Mainly includes single-family, duplex, triplex, and four-plex homes. The contracted haulers collect garbage, recycling, and organics from carts set out on the curbside.
Multifamily	Mainly includes apartments and condominiums with five or more units. The contracted haulers collect garbage, recycling, and organics from dumpsters and carts.
Recoverability	Recoverability refers to recoverability potential of the materials, either through City's curbside programs or through non-curbside means. Material types included in this study were grouped into four Recoverability classes.
Curbside Recyclable	Recoverability class that includes materials that are currently accepted (as of 2020) in residential curbside and multifamily recycling programs in the City of Seattle or are recycled through commercial sector collection programs. For example, corrugated cardboard and aluminum cans fall in this category.
Compostable	Recoverability class that includes materials that are currently accepted (as of 2020) in residential curbside and multifamily compost programs in the City of Seattle or are composted through commercial sector collection programs. For example, food scraps, compostable food service items, and yard waste fall in this category.
Other Recoverable	Recoverability class that includes materials that can be recovered through programs, markets, or streams other than current standard curbside or commercial recycling programs, such as City-run drop-off and special item collections for scrap metal, appliances and electronics, CFL bulbs and batteries, EPS foam blocks, or used oil.
Non-recoverable	Recoverability class that includes materials that are not readily recyclable or face other market, technology, or programmatic related barriers (e.g., medical waste).
Contaminant	Material types included in this study were grouped into seven Contaminant classes. These "Contaminant" referred to any item (including paper, plastic, glass, and metal items) that did not meet the requirements for Seattle's recycling program (as of 2014-15). Grouping the 2020 material types in the into these Contaminant classes to enabled comparison between 2015 and 2020 lists of contaminants in the recycling stream.
Capture Rate	Capture rate is a measure of recycling program performance. Capture rate shows what portion of a given recyclable material was diverted for recycling rather than disposed.

EXECUTIVE SUMMARY

Below is a summary of objectives, procedures, and key findings by subpopulation and comparisons across subpopulations for the 2020 Seattle Residential Garbage and Recycling Composition Study ("the Study").

Objectives and Procedures

- The objectives of the Study were to:
  - provide statistically reliable data on the composition of garbage and recycling streams collected from single-family and multifamily residences in the City of Seattle; and
  - obtain information about the City's residential garbage and recycling streams to estimate the recycling potential for each.

- COVID 19 pandemic presented a significant challenge to efficiently and effectively conducting fieldwork for this study.
- Cascadia adjusted the sampling calendar and protocols to follow health and safety regulations from public health officials.

- Cascadia characterized a total of 589 samples during the Study, including 289 garbage samples and 300 recycling samples.
- These samples were distributed across two sectors—single-family and multifamily residences—from the four collection zones within Seattle across four seasons. See **Error! Reference source not found.** for more details.

- Field crew hand-sorted samples into 110 distinct material types. See **Error! Reference source not found.** for more details.
- Cascadia used an industry-standard weighted average procedure to calculate composition estimates for overall Seattle and by sectors, zones, seasons. See **Error! Reference source not found.** for more details.

- Current composition estimates were compared with the estimates from earlier Seattle residential garbage and recycling composition studies.
- Cascadia performed additional analyses, such as year-to-year comparisons (**Error! Reference source not found.**), contaminant estimation (**Error! Reference source not found.**), demographic composition estimates (**Error! Reference source not found.**).

- For the first time, the City of Seattle conducted capture rate analysis in this study, to assess the relative diversion of curbside recyclable material into the recycling bin.
- Cascadia classified material types into three classification schemes – classification by "Recoverability" of material, classification by "Contaminant" groups, and by material classes based on past studies ("Uniformity"). See Section 3: **Error! Reference source not found.** for more details. Cascadia conducted additional composition analyses based these classification schemes.
- Organic material (e.g., food and yard material) collected from residents through residential curbside and multifamily compost programs excluded from the Study. Cascadia is conducting residential organics study in 2022.

Results

- The data provided by the City of Seattle shows that 211,567 tons of garbage and recycling was collected from Seattle residents in 2020 (Figure 1).
- About 57% (119,903 tons) was in garbage and 43% (91,664 tons) was in recycling (Figure 1).
- Single-family (SF) sector contributed 128,223 tons of material. Of this, 52% (66,878 tons) was in garbage and 48% (61,345 tons) was in recycling (**Error! Reference source not found.**).
- Multifamily (MF) sector contributed 83,344 tons of material. Of this, 64% (53,026 tons) was in garbage and 36% (30,318 tons) was in recycling (**Error! Reference source not found.**).

- In Seattle's residential garbage, 30% was compostable, 19% of the material was curbside recyclable, 12% was recoverable through non-curbside means, and 39% was non-recoverable material (**Error! Reference source not found.**).
- Materials classified under **Other Organics** (27,207 tons) and **Compostable Organics** (25,021 tons) material classes accounted for about 44% of Seattle's residential garbage.
- Making up nearly 10% (11,181 tons), *Packaged edible food scraps* was the largest material in Seattle's residential garbage.

- In Seattle's residential recycling, 89% of the material was curbside recyclable, about 6% was non-recoverable, 2% other recoverable, and 3% compostable material (**Error! Reference source not found.**).
- The top two materials – *plain OCC and kraft paper* (18,006 tons) and *paper products* (13,003 tons)— made up about 34% of the recycling stream.
- *Non-distinct fines* (about 1.4% of recycling tons) was the most prevalent non-recoverable material in recycling stream.

- Overall, curbside recyclable materials with highest capture rates were *beverage glass bottles (green, brown, and clear); newspaper;* and *plain OCC or Kraft paper* (**Error! Reference source not found.**).
- The color-specific glass bevarage bottle categories (clear, green, and brown) consistently made into the top five curbside recyclable materials with the highest capture rates. This could potentially be a consequence of having multiple glass bottle types (as opposed to one glass bottle type). In addition, much of the glass classified as *mixed cullet* likely began as color-specific glass beverage bottles and containers but, due to breakage during collection, could not be accurately classified, thereby potentially resulting in overestimation of the captures rates for these categories.
- Overall, the bottom five curbside recyclable materials with the lowest capture rates were *non-compostable food service paper packaging; aluminum foil or containers; empty aerosol cans; small durable plastic products;* and *other poly-coated containers* (**Error! Reference source not found.**).

- In single-family garbage, 29% was compostable, 17% material was curbside recyclable, and 11% was recoverable through non-curbside means (**Error! Reference source not found.**).
- Curbside recyclables made up 92% of single-family recycling stream. About 5% was non-recoverable, 1% was other recoverable, and 2% was compostable material.
- *Paper products* (~ 2%) was the top curbside recyclable in SF garbage.
- *Non-distinct fines* (~ 1.5%) was the top non-recoverable material in SF recycling.

- In multifamily garbage, 32% was compostable, 26% of material was curbside recyclable, and 12% was recoverable through non-curbside means (**Error! Reference source not found.**).
- Curbside recyclables made up 84% of Seattle's MF recycling stream. About 6% was non-recoverable, 5% was other recoverable, and 5% was compostable material.
- *Paper products* (~ 3%) was the top curbside recyclable in garbage.
- *Mixed or other paper* (~ 1%) was the top non-recoverable material in MF recycling.

- Cascadia classified samples into Spring (March – May), Summer (June – August), Fall (September – November), and Winter (December – February) seasons (**Error! Reference source not found.** through **Error! Reference source not found.**).
- At least 27% of residential garbage was compostable in each season.
- At least 19% of residential garbage was curbside recyclable materials in each season.
- At least 87% of Seattle's residential recycling was curbside recyclable in each season.
- *Paper products* was the top curbside recyclable in residential garbage in each season.
- *Mixed or other paper* and *non-distinct fines* were the top non-recoverable materials in residential recycling in each season.

- Cascadia collected and characterized samples into four City zones (**Error! Reference source not found.** through **Error! Reference source not found.**).
- Residential garbage and recycling collected ranged from at least 47,823 tons (Zone 1) to 56,606 tons (Zone 2).
- Total garbage ranged from 42% (Zone 3) to 74% (Zone 3) in all four zones.
- Total recycling ranged from 26% (Zone 3) to 58% (Zone 4) in all four zones.
- At least 28% of the residential garbage was compostable in all four zones. *Packaged edible food scraps* or *animal by-products* or *compostable or soiled paper products* were the largest material types in garbage.
- At least 18% of the residential garbage was curbside recyclable in all four zones. *Paper products* or *mixed cullet* were the top curbside recyclables in garbage in all four zones.
- Curbside recyclables made up at least 86% of the residential recycling stream in all four zones. *Plain OCC or kraft paper* and *paper products* made up at least 31% of residential recycling in all four zones. *Non-distinct fines* or *mixed or other paper* were the top non-recoverable material in residential recycling in all four zones.

- Material types in the 2020 study were grouped into "Contaminant" classes and compared with the 2015 contaminant material types in recycling (**Error! Reference source not found.**).

- Contaminant glass and metal decreased, while contaminant plastic increased, overall, for both residential sectors.
- The recycling stream in multifamily sector saw an increase in Contaminants such as *non-conforming paper and plastic; food, green waste, and wood; textiles;* and *other non-recyclables.*

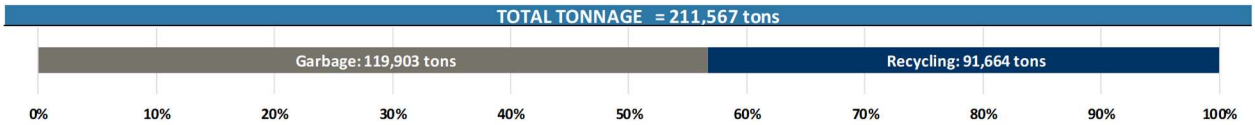
- Overall, residential garbage decreased by about 54% (60,066 tons) from 1988/89 to 2020 (**Error! Reference source not found.**).
- In 2020/21, the annual residential garbage increased to 119,903 tons, an increase of about 7% compared to 2014 tonnages. All material classes showed an increase in tonnage compared to their tonnage in 2014, except for organics that continued to decline (**Error! Reference source not found.** through **Error! Reference source not found.**).
- Overall, tons of residential recycling increased from 73,926 tons in 2000/01 to 91,664 tons in 2020 (**Error! Reference source not found.**).
- Materials classified under Paper material class declined in 2020 recycling compared to their tonnages in 2000/01 (**Error! Reference source not found.** through **Error! Reference source not found.**).
- Materials classified as non-recyclables increased fivefold in recycling over the period of 2000/01 to 2020 (**Error! Reference source not found.** through **Error! Reference source not found.**).

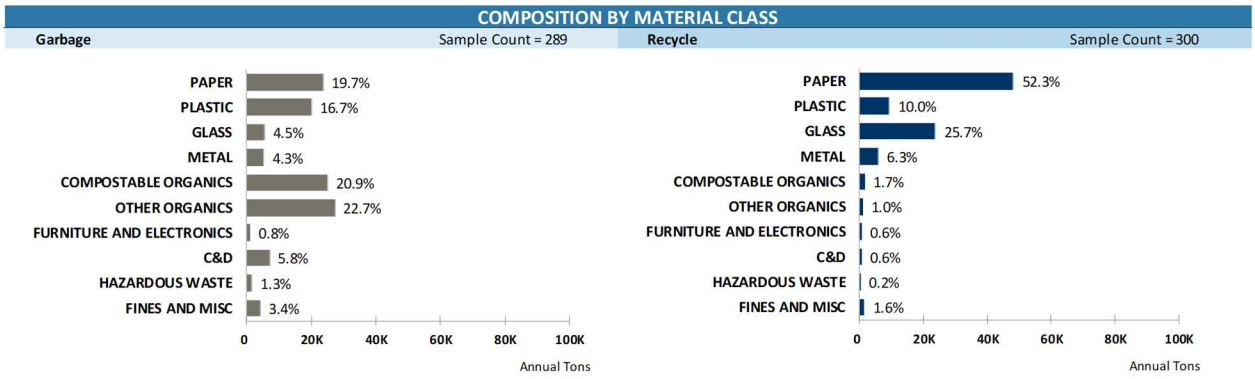
- The findings from 2020 study were compared with findings from earlier studies to identify changes in the composition of Seattle's garbage and recycling over time.
- Between 2014 and 2020 garbage studies, share of **Paper, Plastic, Glass**, **Metal**, **Hazardous** and **CDL wastes** increased, while **Organics** and **Other Materials** decreased.
- Between the 2015 and 2020 recycling studies, **Paper** and **Metal** percentages decreased, while percentages of **Plastic, Glass** and **Non-recyclables** increased.

- Cascadia calculated composition of Seattle's recycling stream for two demographic sub-sectors characteristics – median household income and average household size.
- Recycling composition of samples from smallest average household size, and samples from the largest average household size were nearly identical (91% of material collected for recycling was curbside recyclables) (**Error! Reference source not found.**).
- Recycling composition of samples from lowest average household income, and that from the highest average household income were similar (at least 89% of material collected for recycling was curbside recyclables) (**Error! Reference source not found.**).

Figure 1 summarizes the findings of the composition study for the overall residential garbage and recycling streams, showing tonnages, composition by material class, top-ten materials, composition by recoverability class, and capture rates for curbside recyclables.

Figure 1: Summary of Composition – Overall Residential Garbage and Recycling Combined





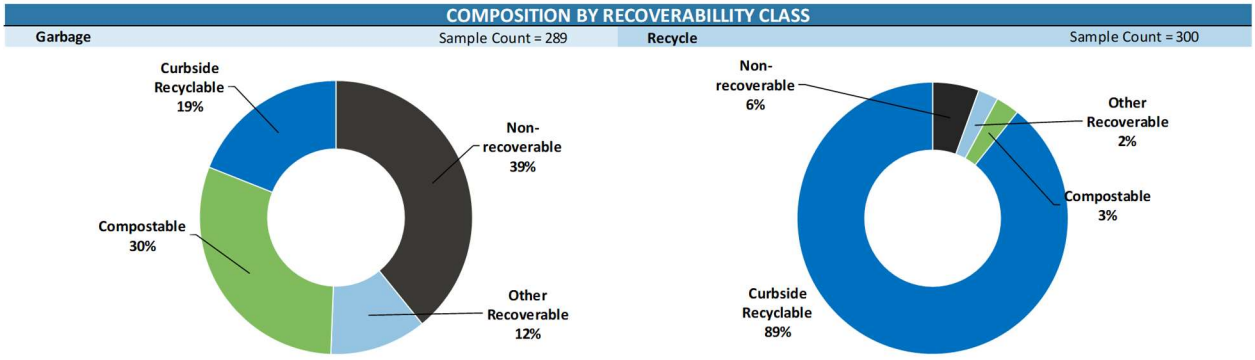
TOP 10 MATERIALS

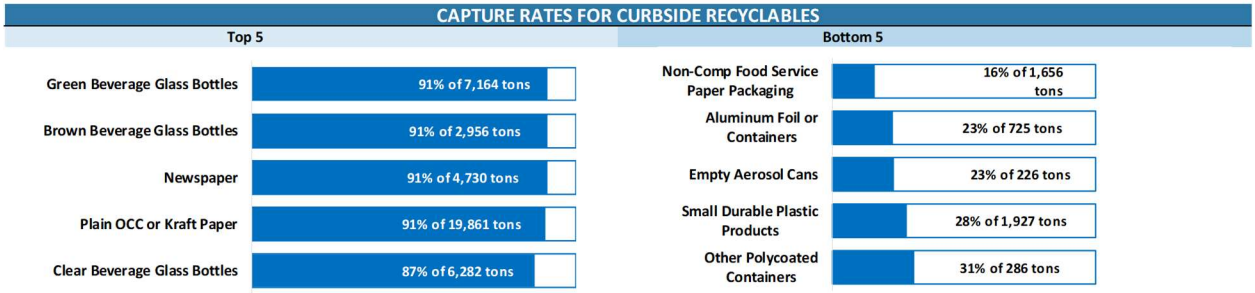
Garbage — Sample Count = 289

Material	Est.	Cum.	Est. Tons
Edible Food Scraps - Packaged	9.9%	9.9%	11,811
Animal By-products	9.2%	19.1%	11,073
Compostable or Soiled Paper Products	8.3%	27.4%	9,995
Disposable Diapers	7.3%	34.7%	8,734
Non-Edible Food Scraps	5.9%	40.6%	7,027
Other Plastic Film	5.3%	45.9%	6,391
Edible Food Scraps - Non-Packaged	4.0%	49.9%	4,758
Textiles	3.7%	53.6%	4,434
Paper Products	2.5%	56.1%	3,004
Plastic Garbage Bags	1.9%	58.0%	2,337
Total for Top Materials	**58.0%**		**69,564**

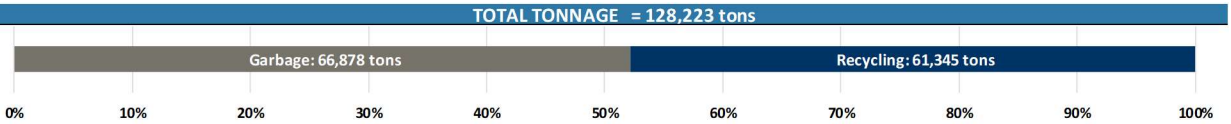
Recycle — Sample Count = 300

Material	Est.	Cum.	Est. Tons
Plain OCC or Kraft Paper	19.6%	19.6%	18,006
Paper Products	14.2%	33.8%	13,003
Green Beverage Glass Bottles	7.1%	41.0%	6,545
Paper Packaging	6.7%	47.7%	6,147
Clear Beverage Glass Bottles	6.0%	53.7%	5,486
Newspaper	4.7%	58.4%	4,315
Grocery or Shopping Bags	3.5%	61.9%	3,220
Brown Beverage Glass Bottles	2.9%	64.8%	2,697
PET Bottles	2.6%	67.4%	2,363
Aluminum Cans	2.5%	69.9%	2,264
Total for Top Materials	**69.9%**		**64,046**



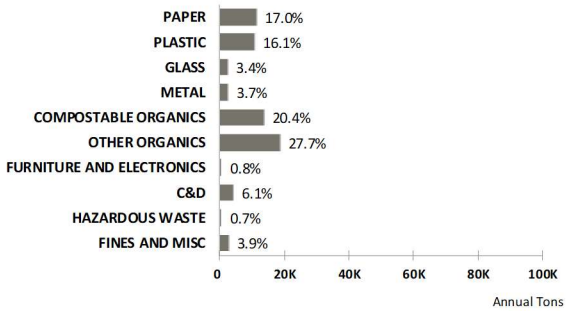


TOTAL TONNAGE = 128,223 tons

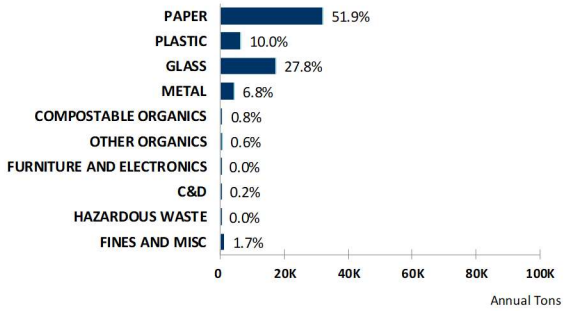


COMPOSITION BY MATERIAL CLASS

Garbage — Sample Count = 145



Recycle — Sample Count = 200



TOP 10 MATERIALS

Garbage — Sample Count = 145

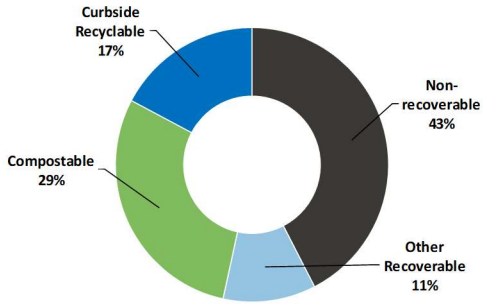
Material	Est.	Cum.	Est. Tons
Animal By-products	12.2%	12.2%	8,160
Edible Food Scraps - Packaged	10.8%	23.0%	7,254
Disposable Diapers	9.6%	32.6%	6,413
Compostable or Soiled Paper Products	7.9%	40.5%	5,291
Other Plastic Film	5.5%	46.0%	3,674
Non-Edible Food Scraps	5.3%	51.4%	3,564
Textiles	3.5%	54.9%	2,337
Edible Food Scraps - Non-Packaged	3.3%	58.2%	2,224
Paper Products	2.1%	60.3%	1,432
Mixed Textiles	1.8%	62.2%	1,219
Total for Top Materials	**62.2%**		**41,568**

Recycle — Sample Count = 200

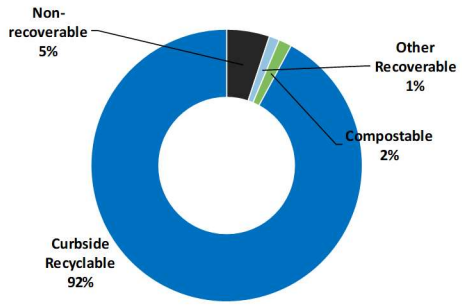
Material	Est.	Cum.	Est. Tons
Plain OCC or Kraft Paper	18.7%	18.7%	11,500
Paper Products	14.1%	32.8%	8,620
Green Beverage Glass Bottles	7.9%	40.6%	4,816
Paper Packaging	6.8%	47.5%	4,193
Clear Beverage Glass Bottles	6.0%	53.5%	3,710
Newspaper	5.3%	58.8%	3,232
Grocery or Shopping Bags	3.7%	62.5%	2,286
Brown Beverage Glass Bottles	2.8%	65.4%	1,744
Aluminum Cans	2.7%	68.1%	1,657
PET Bottles	2.5%	70.6%	1,538
Total for Top Materials	**70.6%**		**43,296**

COMPOSITION BY RECOVERABILLITY CLASS

Garbage — Sample Count = 145

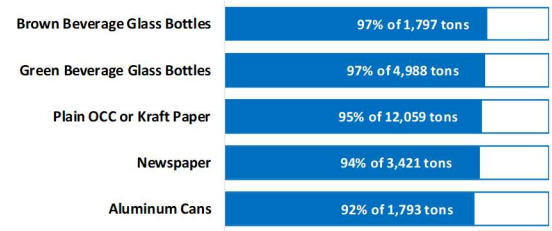


Recycle — Sample Count = 200

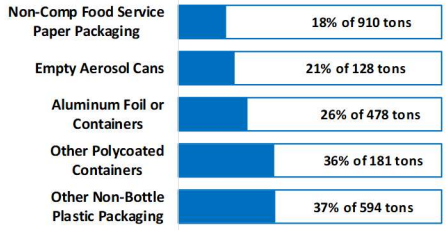


CAPTURE RATES FOR CURBSIDE RECYCLABLES

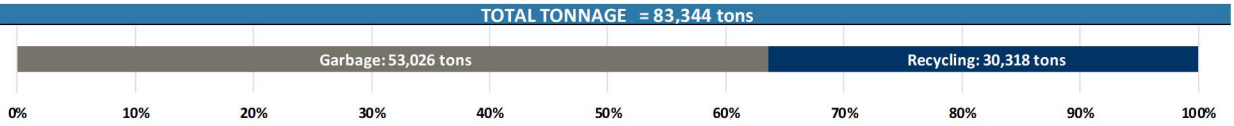
Top 5



Bottom 5

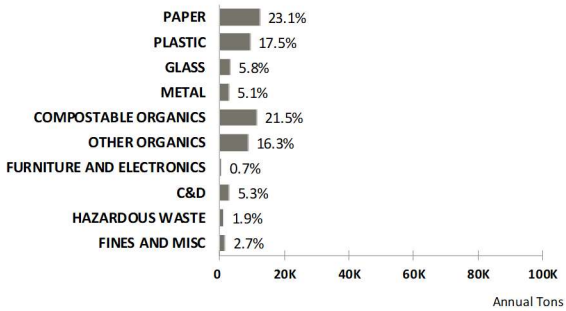


TOTAL TONNAGE = 83,344 tons

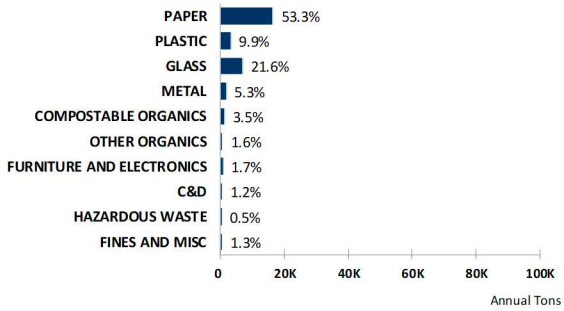


COMPOSITION BY MATERIAL CLASS

Garbage — Sample Count = 144



Recycle — Sample Count = 100



TOP 10 MATERIALS

Garbage — Sample Count = 144

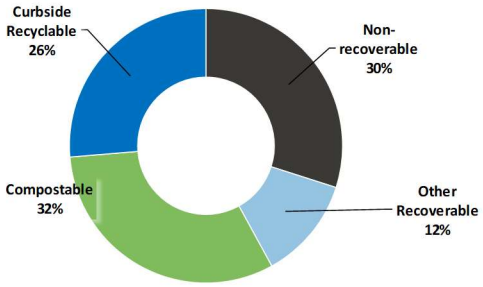
Material	Est.	Cum.	Est. Tons
Compostable or Soiled Paper Products	8.9%	8.9%	4,704
Edible Food Scraps - Packaged	8.6%	17.5%	4,557
Non-Edible Food Scraps	6.5%	24.0%	3,462
Animal By-products	5.5%	29.5%	2,914
Other Plastic Film	5.1%	34.6%	2,717
Edible Food Scraps - Non-Packaged	4.8%	39.4%	2,534
Disposable Diapers	4.4%	43.8%	2,321
Textiles	4.0%	47.7%	2,097
Paper Products	3.0%	50.7%	1,573
Plain OCC or Kraft Paper	2.4%	53.1%	1,295
Total for Top Materials	**53.1%**		**28,173**

Recycle — Sample Count = 100

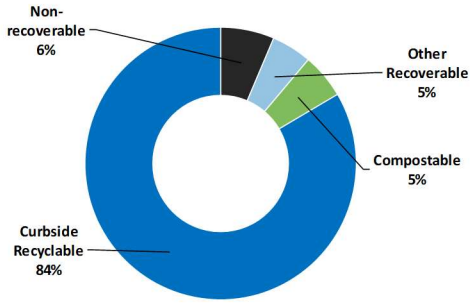
Material	Est.	Cum.	Est. Tons
Plain OCC or Kraft Paper	21.5%	21.5%	6,506
Paper Products	14.5%	35.9%	4,383
Paper Packaging	6.4%	42.4%	1,954
Clear Beverage Glass Bottles	5.9%	48.2%	1,776
Green Beverage Glass Bottles	5.7%	53.9%	1,730
Newspaper	3.6%	57.5%	1,082
Brown Beverage Glass Bottles	3.1%	60.6%	954
Grocery or Shopping Bags	3.1%	63.7%	934
PET Bottles	2.7%	66.4%	825
Aluminum Cans	2.0%	68.4%	607
Total for Top Materials	**68.4%**		**20,751**

COMPOSITION BY RECOVERABILLITY CLASS

Garbage — Sample Count = 144

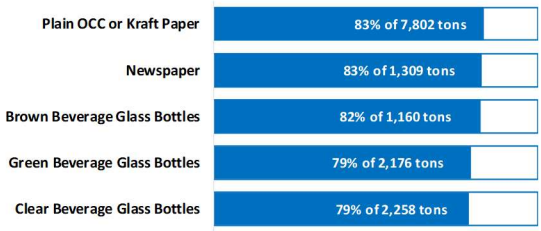
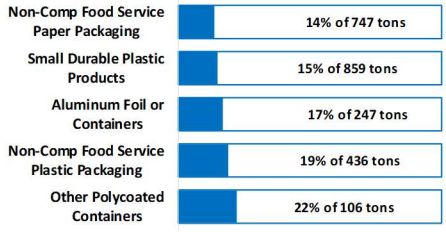


Recycle — Sample Count = 100



CAPTURE RATES FOR CURBSIDE RECYCLABLES

Top 5



Bottom 5