CITY OF CUPERTINO

MULTI-SECTOR WASTE CHARACTERIZATION STUDY

FINAL REPORT

APRIL 2020

PREPARED BY CASCADIA CONSULTING GROUP

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Executive Summary

OVERVIEW

The objective of the 2019 City of Cupertino (City) waste characterization study was to collect and analyze data on the composition and quantities of materials disposed of in Cupertino. The study focuses on disposed material from three sectors: multifamily, municipal, and commercial. For each sector, the field team collected and analyzed data for the following streams: garbage, recycle, and organics. This study builds on waste generation data collected in Cupertino during the 2018 Single-family Residential Characterization Study.

The primary objectives of this study are to enable the City to:

- Identify materials with potential diversion opportunities.
- Provide a baseline for evaluating the future success of diversion programs.
- Provide data useful in planning future programs to support the City's Zero Waste goals.

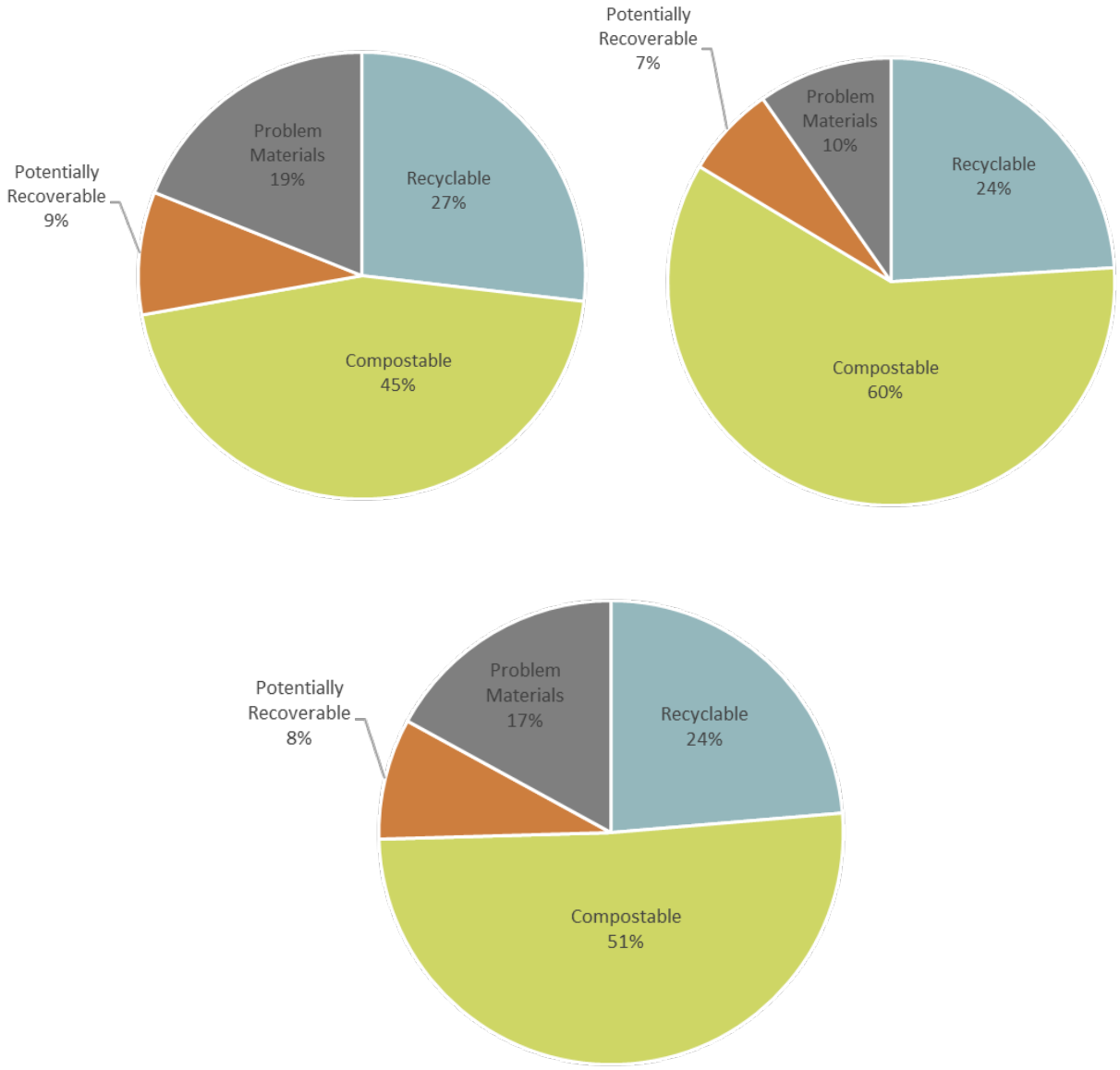
Cascadia Consulting Group (Cascadia) completed fieldwork for this study over a single week in October-November 2019. Cascadia characterized a total of 161 garbage, recycle, and organics samples across the three sectors, including 55 samples from multifamily properties, 26 samples from municipal properties, and 80 samples from the commercial sector.

KEY FINDINGS

Figure 1 shows the overall composition of each sector by **recoverability category**. Materials from the garbage, recycle, and organics streams are combined into a single figure for each sector.

In the multifamily sector (top left), nearly one half (45%) of the materials generated and placed for collection are **Compostable**, 27 percent are **Recyclable**, nine percent are **Potentially Recoverable**, and **Problem Materials** comprise the remaining 19 percent. In the municipal sector (top right), approximately 60 percent of the materials are **Compostable**, and 24 percent are **Recyclable**, seven percent are **Potentially Recoverable**, and the remaining 10 percent are **Problem Materials**. In the commercial sector (bottom), approximately half (51%) of all materials generated and placed for collection are **Compostable**, 24 percent are **Recyclable**, eight percent are **Potentially Recoverable**, and the remaining 17 percent are considered **Problem Materials**.

Figure 1. Overall Composition by Recoverability Category for Multifamily (Left), Municipal (Right), and Commercial (Bottom)



Other key findings from this study include the below:

- Organic materials are the most prevalent overall material class by weight. Organics comprise nearly half of overall generation from every sector: multifamily (48%), municipal (48%), and commercial (47%).
- There is significant opportunity to improve the capture rate of **Recyclable** and **Compostable** materials across all sectors.
  - Approximately 70 percent of material disposed in garbage carts from multifamily, municipal, and commercial sectors could have been recovered via the curbside recycling and organics programs if the material had been placed in the correct carts.

  - Five of the top ten most prevalent materials in the garbage stream for all sectors are **Compostable**. *Manure* is by far the most prevalent material in the municipal garbage stream.
- Contamination rates are highest in the multifamily recycling and commercial organics streams. In the multifamily sector, contaminants account for approximately 41 percent of the recycling stream and 15 percent of the organics stream. In the municipal sector, contaminants account for approximately 11 percent of the recycling stream and 13 percent of the organics stream. In the commercial sector, contaminants account for approximately 18 percent of the recycling stream and 34 percent of the organics stream.
- In the multifamily sector, approximately half the properties divert 60 percent or more of the recyclables that they generate, and 80 percent of properties have a recycling contamination rate of 15 percent or greater. A quarter of multifamily properties do not divert any organic material.
- Of the nine properties sampled from the municipal sector, two do not recycle, but four properties divert 80 percent or more of their recyclables. Three municipal properties compost at least 80 percent of their organic material, and only one does not compost at all.
- In the commercial sector, 47 percent of **Recyclable** and 64 percent of **Compostable** items are being captured in the correct bin, but a significant amount of non-compostable materials are contaminating the organics stream.

Introduction and Background

The City of Cupertino, with the assistance of Cascadia Consulting Group (Cascadia), completed a composition study of material (garbage, recycle, and organics) generated in Cupertino from three sectors: 1) multifamily, 2) commercial, and 3) municipal. This study builds on waste generation data collected in Cupertino during the 2018 Single-family Residential Characterization Study.

The composition and quantity data in this report are intended to:

- Identify materials with potential diversion opportunities.
- Provide a baseline for evaluating the future success of diversion programs.
- Provide data useful in planning future programs to support the City's Zero Waste goals.

The following section summarizes the main tasks of the study methodology: develop plan, select samples, collect data, and analyze data. The detailed study design and field protocols appear in Appendix A. Study Design.

SUMMARY OF METHODOLOGY

Develop Plan

Sampling Universe

The sampling universe for this study includes a total of nine waste streams: three streams for each of the three sectors. Each stream is determined by the generation, collection, or composition characteristics that make it a unique portion of the total waste stream. Below are definitions of each of the sectors and streams.

Waste Sectors

- **Multifamily:** Residential properties with five or more dwelling units. Typically, garbage, recycling, and organics bins are shared among many dwelling units.
- **Commercial:** Non-residential properties including businesses, industries (e.g. factories, farms), and institutions (e.g. correctional facilities, hospitals, churches).
- **Municipal:** Municipal properties including government buildings and facilities (e.g. City Hall). *Schools are excluded from this study as they are not part of the franchise.*

Waste Streams

- **Garbage:** Materials placed in a container that are normally hauled to a landfill with minimal or no processing.
- **Recycle:** Typical dry good materials placed in a container by the generator and collected by a certified or franchised hauler on a regular, contracted schedule. These are normally hauled to a facility that specializes in removing the recoverable fraction. These materials could be placed in a garbage container but are instead diverted from disposal and placed in a blue-bin recycling container.
- **Organics:** Organic materials placed in a container by the generator and collected by a certified or franchised hauler on a regular, contracted schedule. These are normally hauled to a facility that

specializes in recovering the organic fraction. These materials could be placed in a garbage container but are instead diverted from disposal and placed in a green-bin organics container.

Allocation of Samples and Sampling Calendar

Allocation of Samples

Cascadia collected and sorted samples over a single week (October 26-November 2, 2019). The study planned for a total of 185 samples allocated to the sectors and streams as shown in Table 1.

Table 1. Proposed vs Actual Sample Allocations

	Garbage		Recycle		Organics		Total	
	Proposed	Actual	Proposed	Actual	Proposed	Actual	Proposed	Actual
Multifamily	20	20	20	20	20	15	**60**	**55**
Commercial	40	40	20	20	20	20	**80**	**80**
Municipal	15	10	15	7	15	9	**45**	**26**
Total	**75**	**70**	**55**	**47**	**55**	**44**	**185**	**161**

See the Deviations from Plan section for a summary of the reasons why the actual number of samples is lower than the proposed number.

Sampling Calendar

Sampling began Saturday, October 26, 2019 and completed on Saturday, November 2, 2019. The field work schedule was based on regular collection and operating schedules for the City to minimize disruptions for the hauler and facilities. Commercial sector samples were evenly distributed across the days of the week. Multifamily and municipal sector samples were collected on a schedule that both maximized the amount of waste available to the sampling crew and was logistically feasible.

Deviations from Plan

The study planned for a total of 185 samples but collected 161 samples for the following reasons: 1) Nine municipal properties did not generate enough material for the field team to obtain multiple samples from a single property. 2) The field crew had restricted access and were not able to enter the property. 3) Despite planning around pickup schedules and visiting some sites multiple times, some containers were not set out, found to be serviced by the hauler, or were assumed to not be used by the occupants.

During the study season, the sample collected from City Hall was minimal and alone was not representative of the property's waste stream. In January 2020, Cascadia field crew returned to Cupertino to collect additional data from a second garbage sample. The composition of the make-up sample was included in the municipal data.

Finally, due to the high volumes of manure found in the municipal organics stream, *Manure* was added as a material definition to the predetermined material list after field work concluded to accurately represent its presence and recoverability. This increased the final count of material categories from 51 to 52.

Select Samples

Multifamily and Municipal

Cascadia obtained a list of multifamily properties and their service level information from the City. From that list, Cascadia identified properties that met sampling criteria and randomly selected 20 properties.

There are only nine municipal properties in Cupertino and the sampling plan included all nine properties. The field crew planned to collect multiple samples from some municipal properties to reach target sample goals.

Commercial

Cascadia worked with the City to pre-select commercial routes using a random selection method. For the garbage and organics streams, the City developed special routes that included the final 12 commercial accounts on the drivers' daily route. This method ensured "pure" loads to sample. For the recycle stream, special routes were not necessary. Field staff collected samples directly from loads on normal routes and special protocols were put in place to ensure that the sampled portion of recycle loads were primarily pure commercial material.

Collect Samples

Sampling collection varied by sector and stream. The entity responsible for collecting material is summarized in Table 2 and the sampling location is summarized in Table 3.

Table 2. Material Collection Roles

	Garbage	Recycle	Organics
Multifamily	Cascadia	Cascadia	Cascadia
Commercial	Recology	Recology	Recology
Municipal	Cascadia	Cascadia	Cascadia

Table 3. Sample Collection Locations

	Garbage	Recycle	Organics
Multifamily	At Property	At Property	At Property
Commercial	Recology Rogers Ave.	GreenWaste Charles St.	Recology Rogers Ave.
Municipal	At Property	At Property	At Property

Three separate Cascadia field crew teams were assigned to specific tasks during this project:

- **Field Crew One**: This team collected samples and set-out data directly from multifamily and municipal properties. The team consisted of a Field Crew One Lead and two additional crew members. Each day, from Monday through Saturday, Field Crew One drove to selected properties and collect garbage, recycle, and organics samples from each property. After sample collection, the team delivered garbage and

organics samples to the Rogers Avenue Transfer Station (Rogers Ave) and delivered recycle samples to GreenWaste Recovery at 625 Charles Street (GreenWaste) to be sorted. Some samples were sorted on-site depending on logistics that day.

- **Field Crew Two**: This team remained at the Rogers Ave transfer station Monday-Friday. The team consisted of a Field Crew Two Lead and four additional crew members. The team collected commercial garbage and organics samples from incoming loads as trucks arrived at the facility. The team also received multifamily and municipal garbage and organics samples delivered by Field Crew One. The team sorted all organics and garbage samples on-site.
- **Field Crew Three**: This team remained on-site at GreenWaste Monday-Friday. The team consisted of a Field Crew Three Lead and two additional crew members. The team collected commercial recycling samples from incoming loads as trucks entered the facility. The team also received multifamily and municipal recycling samples delivered by Field Crew One. The team sorted all recycling samples on-site at GreenWaste.

Multifamily and Municipal

Field Crew One collected multifamily and municipal samples directly from pre-selected properties. Each site visit included two components: documenting waste quantities and collecting samples. Compared to the traditional method of sampling from collections trucks at the transfer station, this sampling method and the additional set-out data allow for more detailed investigation of behavioral patterns among multifamily and municipal generators.

Documenting Waste Quantities

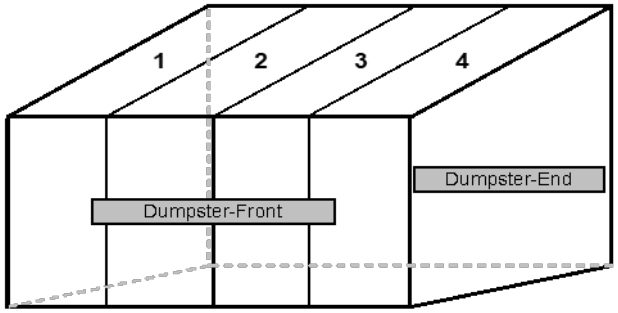
Field Crew One collected information about the amount of materials collected in all bins to calculate annual disposal and diversion quantities for each municipal and multifamily site. The procedure for measuring materials during the site visit is described in Appendix A. Study Design.

For sites with multiple containers serving each stream (multiple garbage containers, for example), Field Crew One measured each container separately, and then added the resulting measurements together to obtain a total annual volume of material.

Collecting Samples

Field Crew One collected a total of 55 multifamily samples and 24 municipal samples during the study period. The team obtained one sample of material from each stream from each property, with samples containing up to 150 pounds of garbage, up to 125 pounds of recycling, and up to 150 pounds of organics. In cases where all of the material in a stream set out was less than 150 pounds (or 125 pounds for recycling), all materials of that stream on-site were characterized as a sample. If a selected site did not use its recycling or organics container, Cascadia treated that site as a zero-weight sample. If a container contained more than the maximum sample weight (more than 150 pounds of garbage or organics or more than 125 pounds of recycling), Field Crew One randomly chose a vertical cross section, or “slice,” of the material for a sample. This slice included material from the top to the bottom of the container, as illustrated in Figure 2.

Figure 2. Example Container with Slices Illustrated

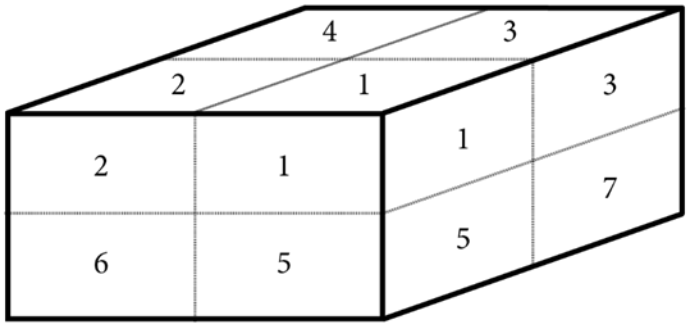


Once samples were collected, the Field Crew One either transported the materials to Rogers Ave or GreenWaste, or sorted the material on-site, depending on the collection team's logistics that day.

Commercial

Field Crew Two and Field Crew Three used the traditional method of sampling from collections trucks for garbage, recycle, and organics samples from the commercial sector. Field Crew Two, located at Rogers Ave, intercepted commercially hauled organics and garbage loads from the commercial sector and collected and hand-sorted samples on-site. Field Crew Three, stationed at GreenWaste, intercepted commercially hauled recycling loads from the commercial sector and the loads were tipped in an elongated pile. From each load, a sample was selected using an imaginary 8-cell grid (as shown in Figure 3) that was superimposed over the tipped material. The loader operator was provided with the randomly selected cell from which to capture the sample.

Figure 3. 8-cell Grid for Sampling



Sort Samples

The field crews sorted all samples by hand. After each sample was collected, it was placed on a tarp and the field crew lead photographed each sample. The field crew staff hand-sorted the sample into the 52 different material types presented in Appendix C. Material Definitions. The field crew stored separated materials in plastic laundry baskets. The field crew lead monitored the purity of each material as the field crew weighed each basket and recorded the weight on the *Tally Sheet*.

Analyze Data

During each day of fieldwork, the field crew lead entered weight data from the samples into a database customized for this study. In order to complete analysis, the City provided Cascadia with annual tonnage for each sector.

Cascadia calculated the mean composition as well as the 90 percent confidence intervals for each material type using industry-standard calculations. Cascadia used the annual tonnage to apportion tons by sector. The calculation method is described in Appendix D. Description of Calculations and Statistical Protocols.

Results

The data from the sorting process will be treated with a statistical procedure that provides two kinds of information for each of the *Material Types*:

- The percent-by-weight estimated composition
- The degree of precision of the composition estimates (All estimates of precision are calculated at the 90 percent confidence level)

The example below illustrates how the results can be interpreted. In this example, the best estimate of the amount of *Inedible Food Scraps* present in the universe of waste sampled is 22.7 percent. The figure of 2.6 percent reflects the precision of the estimate. When calculations are performed at the 9 percent confidence level, we are 90 percent certain that the true amount of *Inedible Food Scraps* is between 22.7 percent plus 2.6 percent and 22.7 percent minus 2.6 percent. In other words, we are 90 percent certain that the mean lies between 20.1 percent and 25.3 percent.

Material Type	Est. Pct.	+ / -
Inedible Food Scraps	22.7%	2.6%

Error Range (+/-)

The error range is a measure of the spread of values in a collection of data. For instance, if the quantity of *Inedible Food Scraps* was found to be nearly the same in each of the 113 samples analyzed for this study, the result would be a very narrow error range. By contrast, if some samples were composed of 75 percent *Inedible Food Scraps* and others were 0 percent *Inedible Food Scraps,* the results would show a much broader error range.

ROUNDING

To keep the composition tables and figures readable, estimated tonnages are rounded to the nearest ton and estimated percentages are rounded to the nearest tenth of a percent. Due to this rounding, the tonnages presented in the report, when added together, may not exactly match the subtotals and totals shown. Similarly, the percentages, when added together, may not exactly match the subtotals or totals shown. Percentages less than 0.05 percent are shown as 0.0 percent.

PRESENTATION OF DATA

The composition data will be presented in several ways for each sector:

- An overview of composition by **Recoverability Group** is presented as a pie chart.
- The overall composition by Material Class is summarized in a table.
- The ten most prevalent individual *Material Types*, by weight, are shown in a table.
- A detailed table lists the full composition and quantity results for the 52 *Material Types*.
- A summary of capture rates for key materials.
- Summaries of multifamily and municipal behavior patterns regarding bin usage and contamination.

MATERIAL TYPES

The project team worked with City staff to define the 52 material types used in the sorting procedure. The material list was largely modeled from the 2018 single-family study with an increased emphasis on defining organic materials. Defining the material types ahead of time assisted with consistent, accurate, and efficient sorting of each sample by the field crews. The material types are grouped into eight material classes: Paper, Plastic, Glass, Metal, Organic, Hazardous, Construction and Demolition Debris, and Other Materials. See Appendix C. Material Definitions for a list of the material types and detailed definitions.

To identify additional diversion opportunities, Cascadia also organized material types according to their recoverability using four recoverability groups:

- **Recyclable:** Materials accepted in the current curbside recycling program. These materials are highlighted in blue throughout the tables and figures.
- **Compostable:** Materials accepted in the current curbside organics program. These materials are highlighted in green throughout the tables and figures.
- **Potentially Recyclable:** Materials that are recoverable via consumer take-back or drop-off programs or which could be diverted in a curbside program if they customer was diligent about cleaning them. This includes the contaminated but otherwise recyclable items. These materials are highlighted in orange throughout the tables and figures.
- **Problem Materials:** Materials that are not currently readily recoverable due to a lack of markets, technologies, or programs. These materials are highlighted in grey throughout the tables and figures.

Each material type was assigned to one of these recoverability groups based on the definitions listed above. Material types are color coded in the results section to indicate where each material type will be allocated. Table 4 shows how material types are organized into recoverability groups.

Table 4. Recoverability Groups and Material Types, 2019 Characterization Study

Recyclable	Potentially Recyclable
Clean, Flattened, Uncoated Corrugated Cardboard	Contaminated Recyclable Paper
Clean, Unflattened, Uncoated Corrugated Cardboard	Paper Takeout Containers
Clean Recyclable Paper	Coated Paper Cups
Clean Coated Paper Products	Contaminated Recyclable Plastic
Gable Top Cartons Aseptics	Contaminated Recyclable Glass Bottles & Jars
Clean #1 PETE Plastic Packaging	Contaminated Recyclable Metal
Clean #2 HDPE Plastic Packaging	Electronics
Clean Other #3-7 Plastic Packaging	Batteries
Clean Recyclable Film Plastic	Natural Textiles
Plastic Takeout Containers	Construction & Demolition Debris
Durable Plastic Products	Carpet
Clean Glass Bottles & Jars	**Problem Materials**
Clean Aluminum Cans & Foil	Other Composite Paper
Clean Other Recyclable Metal	Expanded #6 Products and Packaging
	Flexible Plastic Pouches
	Other Composite Film Plastics
Compostable	Compostable Plastic
Paper Tissues & Towels	Other Plastic
Other Compostable Paper	Other Composite Glass
Pizza Boxes	Other Metal
Plant Trimmings	Diapers
Food-Potentially Dontable	Animal Feces & Litter
Food-Non Donatable	Other Organic
Inedible Food Scraps	Medicine
Other Compostable Organics	Other Hazardous Waste
Untreated Wood	Other Textiles
Pumpkins	Non-metal Appliances
Manure	Other Materials

COMPOSITION RESULTS BY SECTOR

Multifamily

Figure 4 shows the tons of materials by material class generated by multifamily properties. Materials from the garbage, recycling, and organics streams are combined into a single figure. Organic material (48%) is the largest material class, followed by Paper (26%), and Plastic (13%). Other Materials, Glass, Metal, and Hazardous Waste each account for less than five percent of the overall composition.

Figure 4. Tons by Material Class, Multifamily Generation (Recycling, Garbage, and Organics Combined)

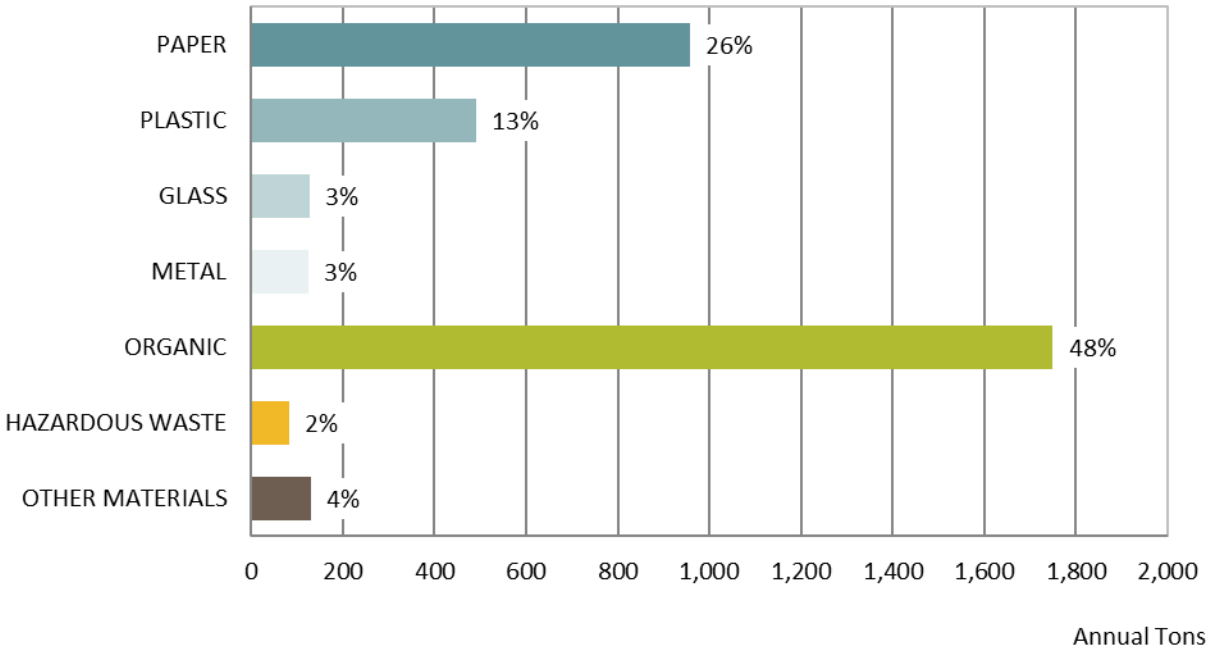
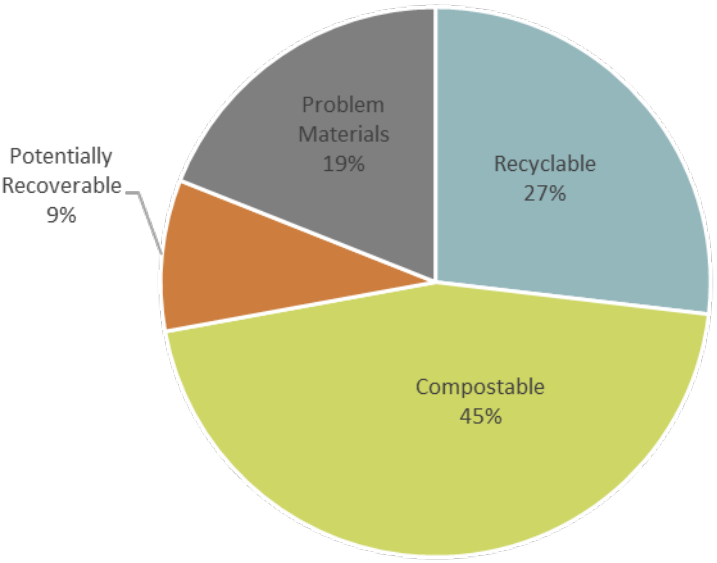


Figure 5 describes the overall generation for the multifamily sector by recoverability group. Materials from the garbage, recycling, and organics streams are combined into a single figure. Of all the materials that multifamily properties generate and place for collection in garbage, recycling, or organics carts, approximately 45 percent (1,660 tons) are **Compostable**, 27 percent (983 tons) are **Recyclable**, and nine percent are **Potentially Recoverable** (mostly recyclable items that are too contaminated to recycle). **Problem Materials** that are challenging or impossible to recycle make up the remaining 19 percent of the material generated.

Figure 5. Material Recoverability, Multifamily Generation (Recycling, Garbage, and Organics Combined)



The recoverability data in Figure 6 and Figure 7 are developed by multiplying the material compositions (based on the sorted material) by the annual tons (provided by the City). The height of each bar illustrates the annual tonnage of each stream (garbage, recycle, and organics) based on 2018-19 tonnage information provided by the City. Monthly tonnages from October 2018-September 2019 were the most recent data available at the time of the analysis.

As shown in Figure 6, 70 percent of materials that multifamily properties disposed of in garbage carts could have been recovered if the material had been placed in the correct carts. Fifty one percent of the materials in the garbage could have been recovered in the curbside organics bin, and 19 percent could have been recovered in the recycle bin. Contaminants comprise approximately 41 percent of the recycling stream and 15 percent of the organics stream.

Figure 6. Multifamily Recoverability and Annual Tonnage by Stream

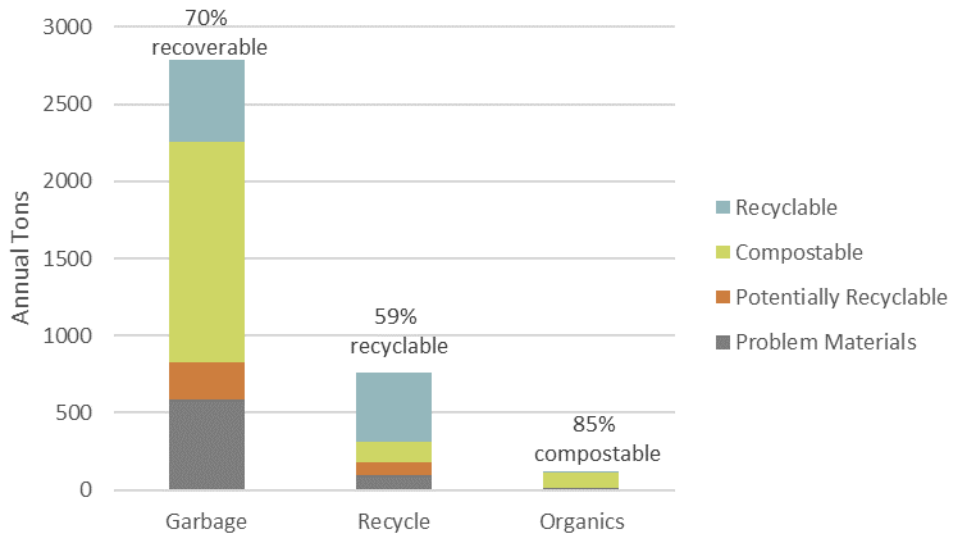
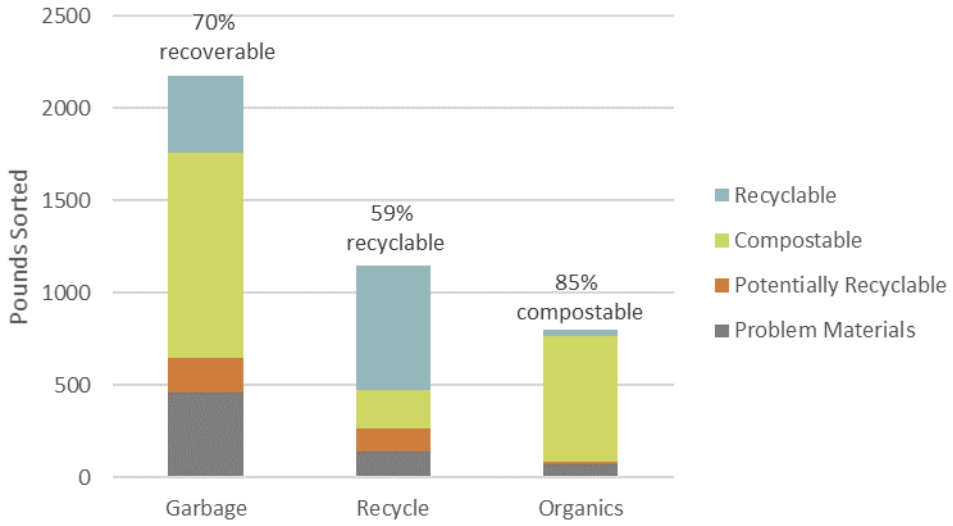


Figure 7 below illustrates the same recoverability information as the figure above, but instead of the height of the columns representing annual tons of multifamily material, the height of each column represents the pounds of material sorted.

Figure 7. Multifamily Recoverability and Pounds Sorted by Stream



Tables 5 - 7 show the ten most prevalent material types in each stream from the multifamily sector. Of the top ten materials in the multifamily garbage stream (Table 5), half are **Compostable**: *Food – Non Donatable* (24.5% and 682 tons), *Paper Tissue & Towels* (7.3% and 204 tons), *Food – Potentially Donatable* (6.2% and 174 tons), *Plant Trimmings* (6.0% and 168 tons), and *Untreated Wood* (2.9% and 81 tons). *Clean Recyclable Paper* (7.4% and 206 tons) is the second most prevalent material the multifamily garbage stream. **Problem Materials** include *Diapers, Other Plastic,* and *Animal Feces & Litter.*

Table 5. Ten Most Prevalent Materials, Multifamily Garbage

Material	Est. Percent	Est. Tons
Food - Non Donatable	24.5%	682
Clean Recyclable Paper	7.4%	206
Paper Tissue & Towels	7.3%	204
Food - Potentially Donatable	6.2%	174
Diapers	6.1%	169
Plant Trimmings	6.0%	168
Other Plastic	5.4%	149
Animal Feces & Litter	3.4%	94
Untreated Wood	2.9%	81
Natural Textiles	2.1%	58
Total for Top Materials	**71.3%**	**1,984**

Of the ten most prevalent material types in the multifamily recycling stream (Table 6), six are **Recyclable**: *Clean Recyclable Paper* (22.2% and 169 tons), *Clean Uncoated, Unflattened Corrugated Cardboard* (9.9% and 76 tons), *Clean Glass Bottles & Jars* (7.7% and 59 tons), *Clean Uncoated Corrugated Cardboard* (5.6% and 42 tons), *#1 PETE Plastic Packaging* (2.9% and 22 tons), and *#2 HDPE Plastic Packaging* (2.7% and 21 tons). *Inedible Food Scraps* (6.9% and 53 tons) and *Food – Non Donatable* (6.7% and 51 tons), if combined, would be the second most prevalent material and are a significant source of contamination.

Table 6. Ten Most Prevalent Materials, Multifamily Recycling

Material	Est. Percent	Est. Tons
Clean Recyclable Paper	22.2%	169
Clean Uncoated, Unflattened Corrugated Cardboard	9.9%	76
Clean Glass Bottles & Jars	7.7%	59
Inedible Food Scraps	6.9%	53
Food - Non Donatable	6.7%	51
Clean Uncoated Corrugated Cardboard	5.6%	42
Other Materials	4.3%	33
#1 PETE Plastic Packaging	2.9%	22
Other Plastic	2.9%	22
#2 HDPE Plastic Packaging	2.7%	21
Total for Top Materials	**71.8%**	**548**

Six of the seven most prevalent material types in the multifamily organics stream (Table 7) are **Compostable**. *Plant Trimmings* (33.8% and 39 tons), *Food – Not Donatable* (26.3% and 30 tons), and *Inedible Food Scraps* (15.6% and 18 tons) are the majority of the multifamily organics stream. *Food – Potentially Donatable* (5.4%

and 6 tons) is also a significant portion. The most prevalent non-compostable material is *Diapers* (5.2% and 6 tons). The ten most prevalent materials account for 94.4 percent of the organics stream.

Table 7. Five Most Prevalent Materials, Multifamily Organics

Material	Est. Percent	Est. Tons
Plant Trimmings	33.8%	39
Food - Non Donatable	26.3%	30
Inedible Food Scraps	15.6%	18
Food - Potentially Donatable	5.4%	6
Diapers	5.2%	6
Paper Tissue & Towels	2.1%	2
Pumpkins	1.8%	2
Other Plastic	1.6%	2
Clean Recyclable Paper	1.3%	2
Other Materials	1.1%	1
Total for Top Materials	**94.4%**	**108**

Municipal

Figure 8 shows the tons of materials by material class generated by municipal properties. Materials from the garbage, recycling, and organics streams are combined into a single figure. Organic material (48%) is the majority of the total material generated (consisting mostly of *Manure*), followed by Paper (34%), and Plastic (10%). Other Materials account for five percent of the overall composition, and Glass, Metal, and Hazardous Waste each account for two percent or less. It is important to note than the manure in the municipal garbage and organics streams was generated at a single property, the McClellan Ranch Preserve and associated 4H rogram.

Figure 8. Tons by Material Class, Municipal Generation (Recycling, Garbage, and Organics Combined

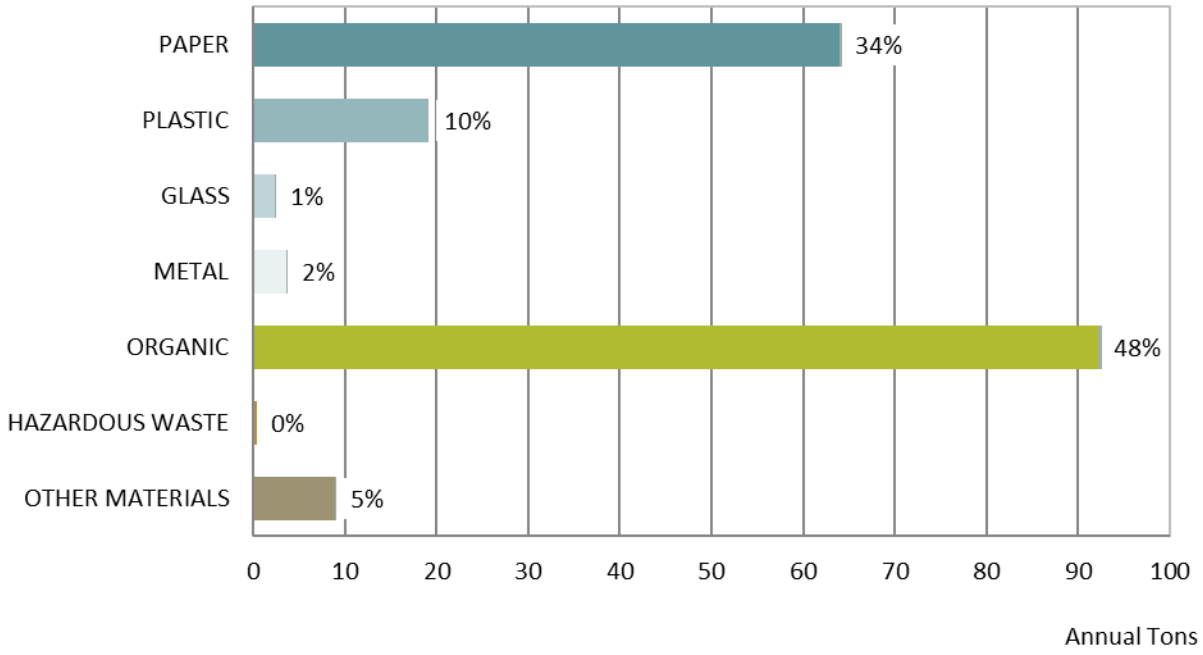
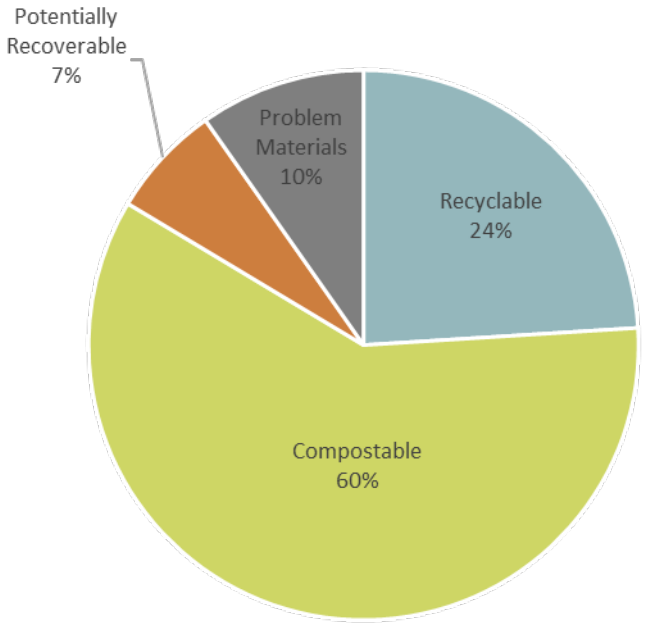


Figure 9 describes the overall generation for the municipal sector by recoverability group. Materials from the garbage, recycle, and organics streams are combined into a single figure. In the municipal sector, approximately 60 percent (113 tons) of the materials generated and placed for collection are **Compostable** and 24 percent (46 tons) are **Recyclable**. An additional seven percent are **Potentially Recoverable**, mostly recyclable items that are too contaminated to recycle. The remaining 10 percent are **Problem Materials** that are challenging or impossible to recycle.

Figure 9. Material Recoverability, Municipal Generation (Recycling, Garbage, and Organics Combined)



As shown in Figure 10, 71 percent of materials that municipal properties disposed in garbage carts are contaminants that could have been recovered if the material had been placed in the correct cart. Fifty percent of the materials in the garbage could have been recovered in the curbside organics bin and 21 percent could have been recovered in the recycle bin. Contaminants account for approximately 11 percent of the recycling stream. The municipal curbside organics carts contain approximately 13 percent contaminants.

Figure 10. Municipal Recoverability and Annual Tonnage by Stream

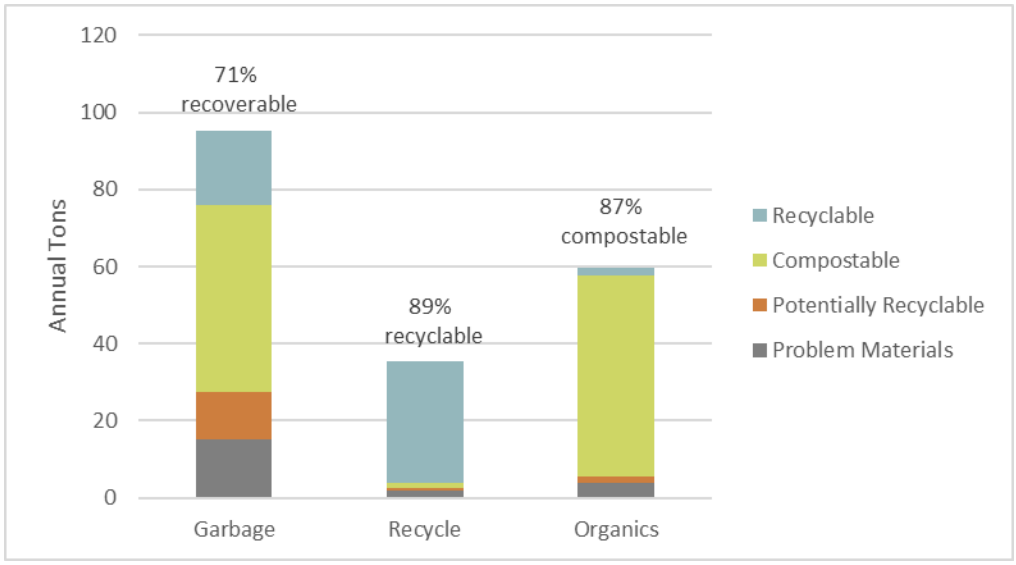
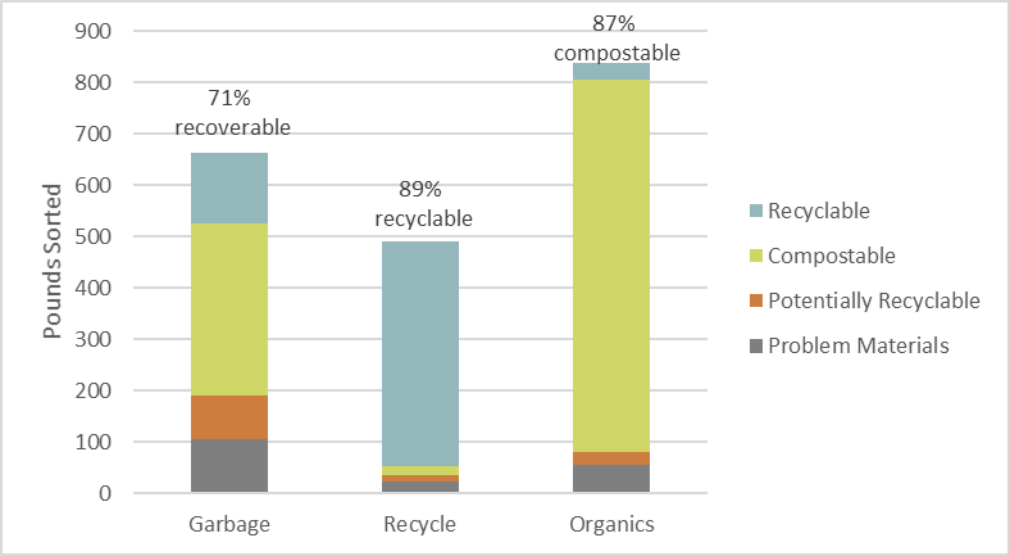


Figure 11 below illustrates the same recoverability information as the figure above, but instead of the height of the columns representing annual tons of municipal material, the height of each column represents the pounds of material sorted.

Figure 11. Municipal Recoverability and Pounds Sorted by Stream



Tables 8 - 10 show the ten most prevalent material types in each stream from the municipal sector. Of the top ten materials in the municipal garbage stream (Table 8), half are **Compostable**: *Manure* (25.8% and 25 tons), *Food – Non Donatable* (5.9% and 6 tons), *Paper Tissue & Towels* (4.6% and 4 tons), *Inedible Food Scraps* (4.2% and 4 tons), and *Other Compostable Paper* (3.6% and 3 tons). *Durable Plastic Products* (8.7% and 8 tons) and *Clean Recyclable Paper* (5.0% and 5 tons) are the most prevalent **Recyclable** materials in the municipal garbage stream. **Problem Materials** include *Other Plastic* and *Other Organic.*

Table 8. Ten Most Prevalent Materials, Municipal Garbage

Material	Est. Percent	Est. Tons
Manure	25.8%	25
Durable Plastic Products	8.7%	8
Contruction & Demolition Debris	6.3%	6
Food - Non Donatable	5.9%	6
Clean Recyclable Paper	5.0%	5
Other Plastic	4.7%	4
Paper Tissue & Towels	4.6%	4
Inedible Food Scraps	4.2%	4
Other Compostable Paper	3.6%	3
Other Organic	3.4%	3
Total for Top Materials	**72.3%**	**69**

Of the ten most prevalent material types in the municipal recycle stream (Table 9), eight are **Recyclable**. *Clean Recyclable Paper* (50.6% and 18 tons) alone makes up more than half of the entire stream. *Clean Uncoated Corrugated Cardboard* (17.7% and 6 tons), *Clean Uncoated, Unflattened Corrugated Cardboard* (6.6% and 2 tons), and *Clean Glass Bottles & Jars* (5.5% and 2 tons) make up most of the other half of material in multifamily recycling. The ten most prevalent materials account for 90.5 percent of the recycling stream.

Table 9. Ten Most Prevalent Materials, Municipal Recycling

Material	Est. Percent	Est. Tons
Clean Recyclable Paper	50.6%	18
Clean Uncoated Corrugated Cardboard	17.7%	6
Clean Uncoated, Unflattened Corrugated Cardboard	6.6%	2
Clean Glass Bottles & Jars	5.5%	2
#1 PETE Plastic Packaging	2.1%	1
Durable Plastic Products	1.8%	1
Other Textiles	1.7%	1
Other Plastic	1.7%	1
#2 HDPE Plastic Packaging	1.5%	1
Clean Recyclable Film Plastic	1.4%	0
Total for Top Materials	**90.5%**	**32**

The six most prevalent material types in the municipal organics stream (Table 10) are **Compostable**. *Plant Trimmings* (32.2% and 19 tons), *Paper Tissues & Towels* (22.3% and 13 tons), and *Manure* (17.9% and 11 tons) make up the majority of the of material in the multifamily organics stream. Top **Problem Materials** include *Animal Feces & Litter*, *Other Materials*, and *Diapers*. The ten most prevalent materials account for 91.2 percent of the organics stream.

Table 10. Ten Most Prevalent Materials, Municipal Organics

Material	Est. Percent	Est. Tons
Plant Trimmings	32.3%	19
Paper Tissue & Towels	22.3%	13
Manure	17.9%	11
Inedible Food Scraps	5.8%	3
Untreated Wood	4.8%	3
Food - Non Donatable	3.2%	2
Animal Feces & Litter	1.4%	1
Other Materials	1.3%	1
Clean Recyclable Paper	1.1%	1
Diapers	1.1%	1
Total for Top Materials	**91.2%**	**55**

Commercial

Figure 12 show the tons of materials by material class generated by municipal properties. Materials from the garbage, recycle, and organics streams are combined into a single figure. Organic material (47%) is the majority of the total material generated, followed by Paper (29%), and Plastic (14%). Other Materials, Glass, Metal, and Hazardous Waste each account for less than five percent of the overall composition.

Figure 12. Tons by Material Class, Commercial Generation (Recycling, Garbage, and Organics Combined)

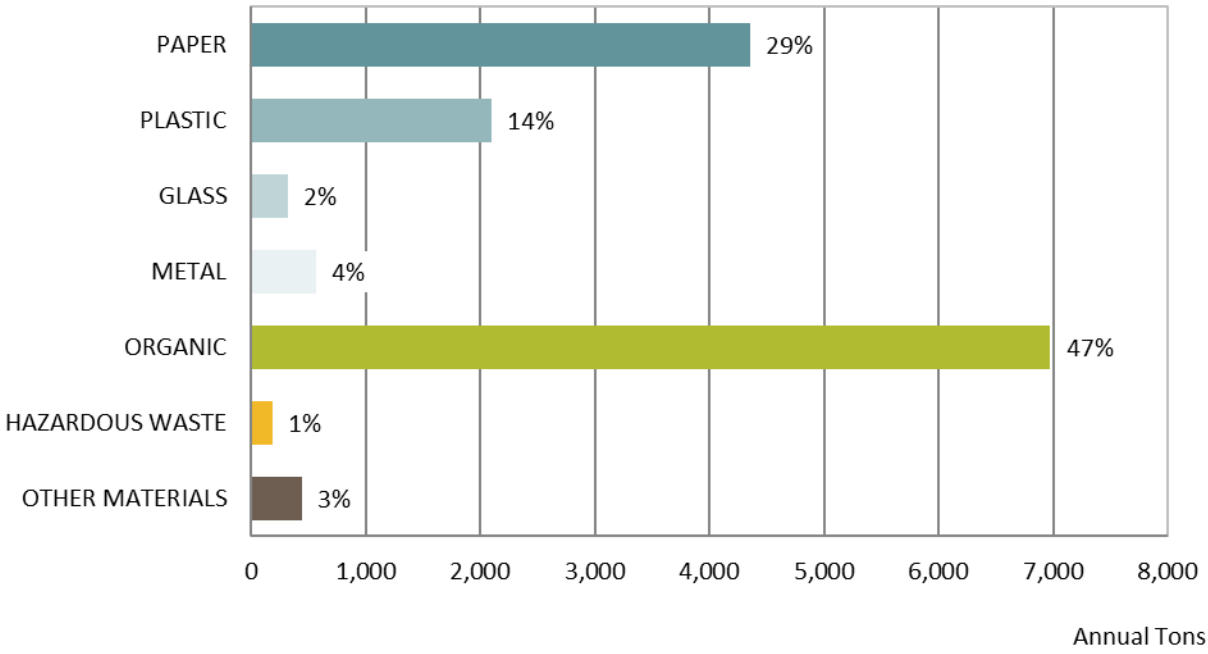
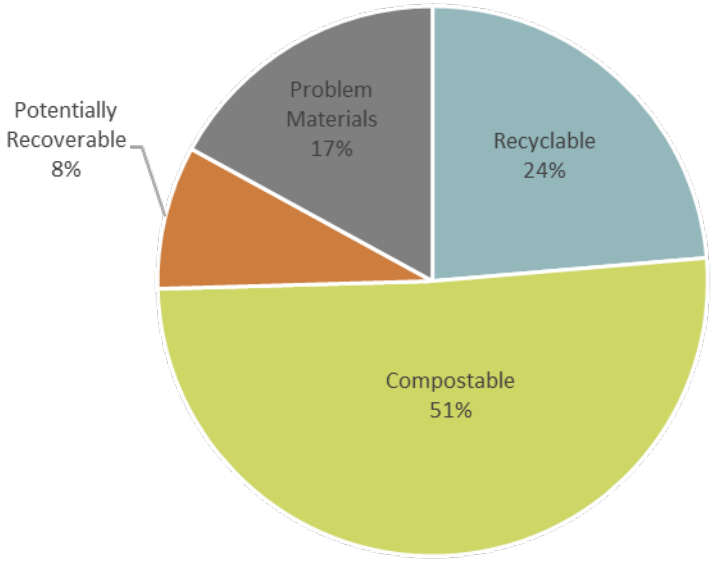


Figure 13 describes the overall generation for the commercial sector by recoverability group. Materials from the garbage, recycle, and organics streams are combined into a single figure. Of the material generated and placed for collection by commercial properties, approximately 51 percent (7,606 tons) of the materials generated and placed for collection are **Compostable**, and 24 percent (3,535 tons) are **Recyclable**. Eight percent are **Potentially Recoverable**, and the remaining 17 percent of generated materials are considered **Problem Materials**.

Figure 13. Material Recovery, Commercial Generation (Recycling, Garbage, and Organics Combined)



As shown in Figure 14, 69 percent of materials that commercial properties disposed in garbage carts are contaminants that could have been recovered if the material had been placed in the correct cart. Forty eight percent of the materials in the garbage could have been recovered in the curbside organics bin, and 21 percent could have been recovered in the recycle bin. Contaminants account for approximately 18 percent of the recycling stream. The commercial curbside organics carts contain approximately 34 percent contaminants.

Figure 14. Commercial Recoverability and Annual Tonnage by Stream

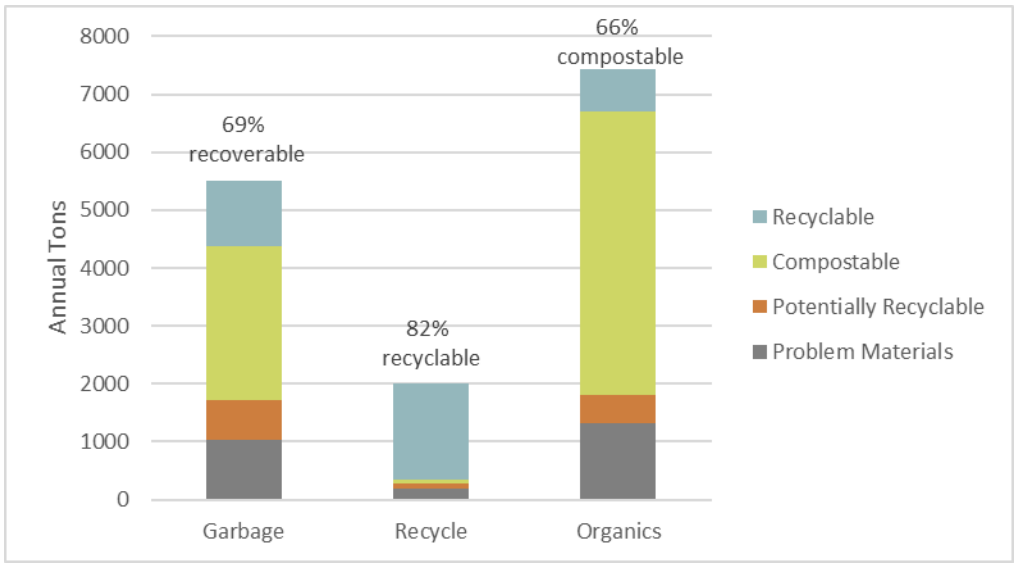
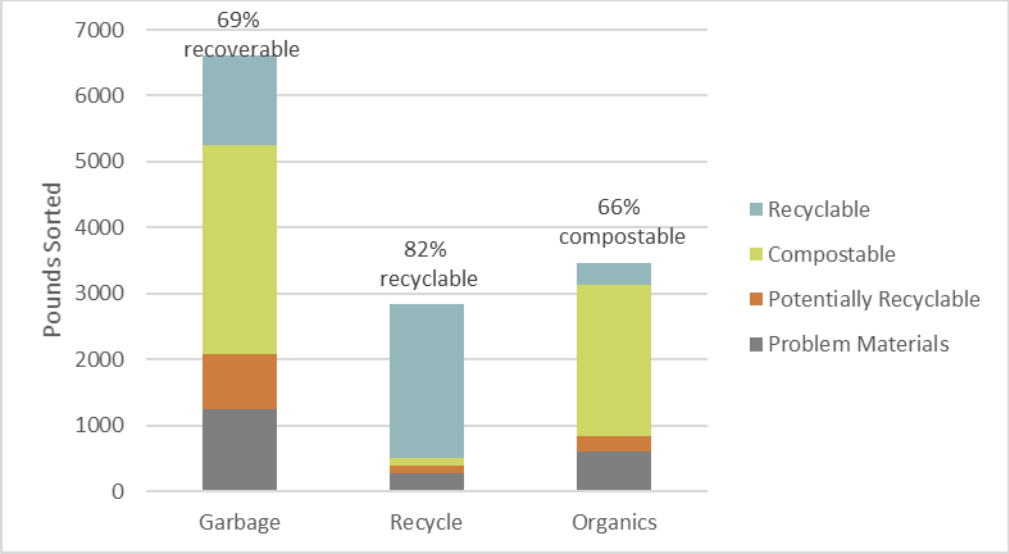


Figure 15 below illustrates the same recoverability information as the figure above, but instead of the height of the columns representing annual tons of commercial material, the height of each column represents the pounds of material sorted.

Figure 15. Commercial Recoverability and Pounds Sorted by Stream



Tables 11- 13 show the ten most prevalent material types in each stream from the multifamily sector. Of the top ten materials in the commercial garbage stream (Table 11), half of the materials are **Compostable**: *Untreated Wood* (16.4% and 900 tons), *Food – Non Donatable* (14.8% and 815 tons), *Paper Tissue & Towels* (7.2% and 394 tons), *Food – Potentially Donatable* (3.3% and 180 tons), and *Plant Trimmings* (3.2% and 175 tons). *Other Plastic* (9.2% and 508 tons) is the most prevalent **Problem Material**, and *Clean Recyclable Paper* (4.8% and 265 tons) is the most prevalent **Recyclable** material in the commercial garbage stream.

Table 11. Ten Most Prevalent Materials, Commercial Garbage

Material	Est. Percent	Est. Tons
Untreated Wood	16.4%	900
Food - Non Donatable	14.8%	815
Other Plastic	9.2%	508
Paper Tissue & Towels	7.2%	394
Clean Recyclable Paper	4.8%	265
Contruction & Demolition Debris	3.6%	196
Clean Other Recyclable Metal	3.3%	182
Food - Potentially Donatable	3.3%	180
Plant Trimmings	3.2%	175
Clean Uncoated Corrugated Cardboard	3.1%	168
Total for Top Materials	**68.8%**	**3,784**

Of the ten most prevalent materials in the commercial recycling stream (Table 12), seven of the materials are **Recyclable**. *Clean Uncoated Corrugated Cardboard* (48.6% and 981 tons) alone makes up nearly half of the entire stream. *Clean Uncoated, Unflattened Corrugated Cardboard* (13.1% and 263 tons) is the second most prevalent material. *Clean Glass Bottles & Jars* (7.0% and 141 tons) and *Clean Recyclable Paper* (4.4% and 88 tons) make up a significant portion of municipal recycling. Non-recyclable materials include *Other Composite Paper* (3.9% and 79 tons), *Other Plastic* (2.8%) and 57 tons), and *Paper Tissues & Towels* (1.8% and 36 tons).

Table 12. Ten Most Prevalent Materials, Commercial Recycling

Material	Est. Percent	Est. Tons
Clean Uncoated Corrugated Cardboard	48.8%	981
Clean Uncoated, Unflattened Corrugated Cardboard	13.1%	263
Clean Glass Bottles & Jars	7.0%	141
Clean Recyclable Paper	4.4%	88
Other Composite Paper	3.9%	79
Other Plastic	2.8%	57
Clean Other Recyclable Metal	1.9%	38
Paper Tissue & Towels	1.8%	36
#2 HDPE Plastic Packaging	1.6%	31
Clean Recyclable Film Plastic	1.5%	31
Total for Top Materials	**86.7%**	**1,745**

Six of the ten most prevalent materials in the commercial organics stream (Table 13) are **Compostable**. *Food – Non Donatable* accounts for nearly half of the entire stream (43.6% and 3,246 tons). *Inedible Food Scraps* (6.1% and 456 tons), *Food – Potentially Donatable* (5.6% and 417 tons), Paper Tissue & Towels (4.4% and 327 tons), Plant Trimmings (3.1% and 227 tons), and Untreated Wood (1.8% and 134 tons) are also among the top ten materials in the commercial organics stream. *Other Plastic* (8.9% and 663 tons) and *Other Composite* Paper (6.1% and 451 tons) are **Problem Materials** found in the top five most prevalent materials.

Table 13. Ten Most Prevalent Materials, Commercial Organics

Material	Est. Percent	Est. Tons
Food - Non Donatable	43.6%	3,246
Other Plastic	8.9%	663
Inedible Food Scraps	6.1%	456
Other Composite Paper	6.1%	451
Food - Potentially Donatable	5.6%	417
Paper Tissue & Towels	4.4%	327
Plant Trimmings	3.1%	227
Contaminated Recyclable Paper	2.6%	191
Clean Recyclable Paper	1.8%	136
Untreated Wood	1.8%	134
Total for Top Materials	**84.0%**	**6,248**

CAPTURE RATES BY SECTOR

This section shows the capture rates for aggregated key materials of interest. We have rolled many of the study's material types into more broad material categories to demonstrate where there are general opportunities for improving capture of materials. For example, *Clean Flattened, Uncoated Corrugated Cardboard* and *Clean Unflattened, Uncoated Corrugated Cardboard* are rolled into an aggregated material type called "Corrugated Cardboard".

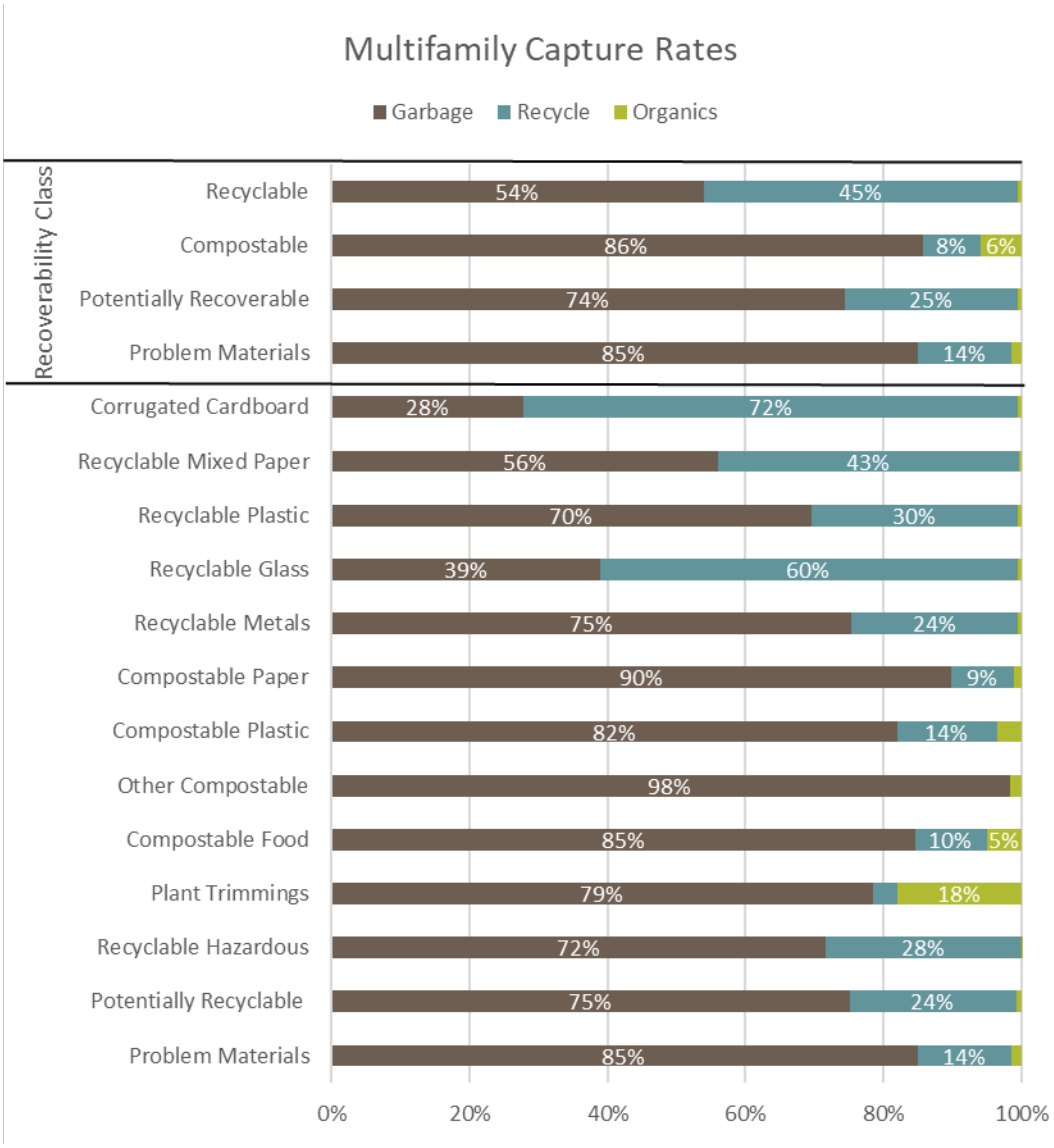
A capture rate indicates what proportion of each key material type customers are placing in the correct container. The capture rate is found by dividing the pounds of a single material type in one stream by the total pounds generated of that material. For example, the capture rate for *Recyclable Mixed Paper* is the pounds of *Recyclable Mixed Paper* in the recycling bin divided by the total pounds of *Recyclable Mixed Paper*. In addition to the material types, the capture rates for each recoverability class are included the figures below.

Multifamily

In the multifamily sector (as indicated in Figure 16), there is a significant opportunity to improve the capture rates of **Compostable** and **Recyclable** materials. The capture rate for *Compostable Food* in the organics bin is only 5 percent, while 85 percent is disposed as garbage and the remainder ends up as contamination in the recycling stream. *Plant Trimmings*, which had a 100 percent capture rate in the organics stream in the single-family sector in 2018, has a capture rate of only 18 percent among multifamily properties.

In the recycling stream, 45 percent of common recyclable materials are captured in the recycling bin. Only two recyclable material categories have a capture rate of more than 50 percent: *Corrugated Cardboard* (72%), and *Recyclable Glass* (60%). *Recyclable Plastic* has a capture rate of only 30 percent and that of *Recyclable Metals* is 24 percent.

Figure 16. Aggregate Multifamily Capture Rates by Stream

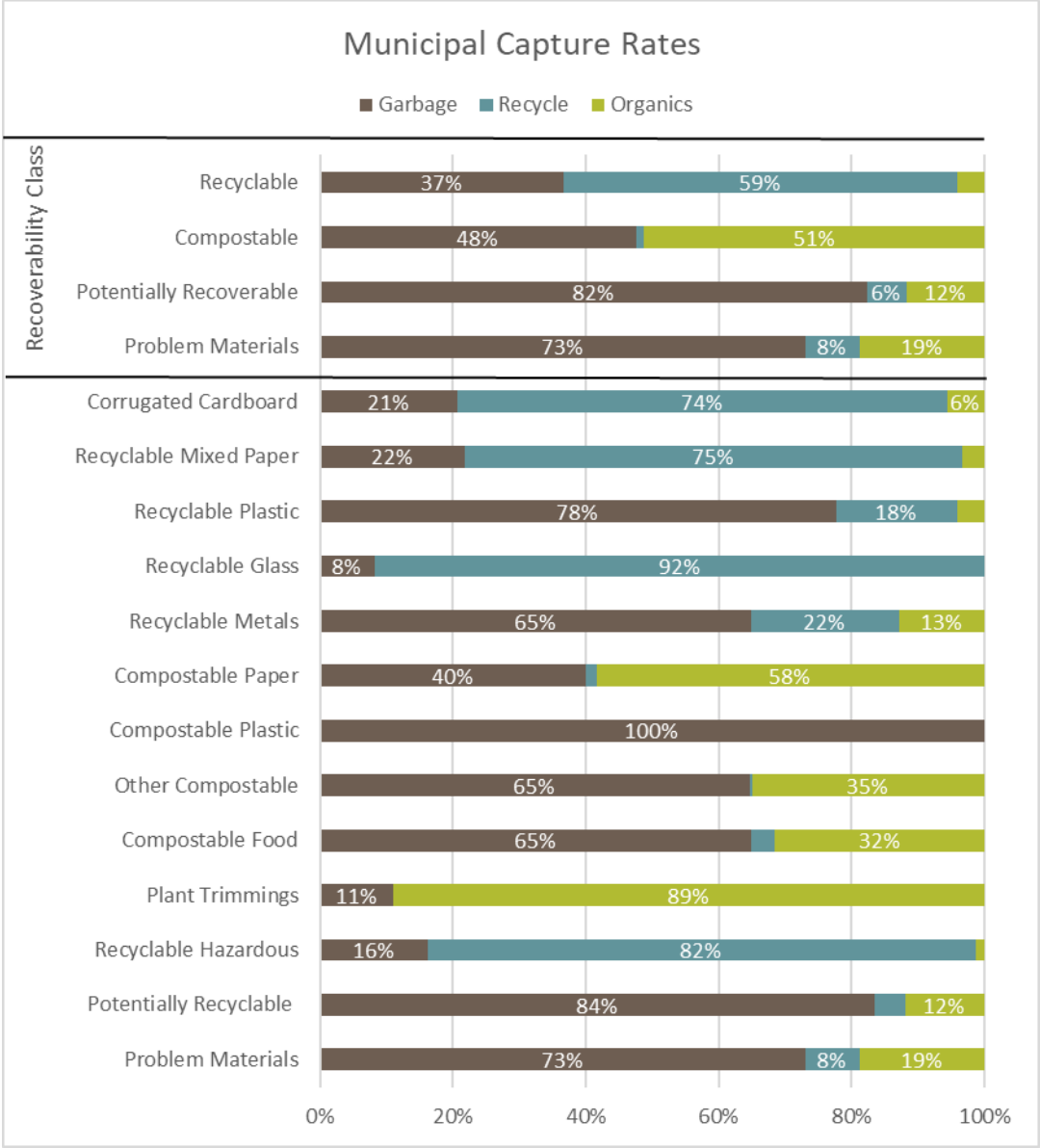


Municipal

In the municipal sector, approximately half of the **Compostable** and **Recyclable** materials are being captured in the correct bin (Figure 17). Fifty nine percent of **Recyclable** items are placed in the recycle bin and 51 percent of **Compostable** materials end up in the organics stream. *Corrugated Cardboard* and *Recyclable Paper* have capture rates around 75 percent and *Recyclable Glass* has a capture rate of 92 percent. However, *Recyclable Plastic* (18%) and *Recyclable Metal* (22%) have low capture rates.

Although the majority of *Plant Trimmings* (89%) are correctly placed in the organics bin, there is still opportunity to improve the capture rate of compostable materials. Only 32 percent of *Compostable Food* and 35 percent of *Other Compostable* were recovered in the organics bin. *Manure* comprises the largest portion of the *Other Organic* materials that end up in the garbage stream.

Figure 17. Aggregate Municipal Capture Rates by Stream

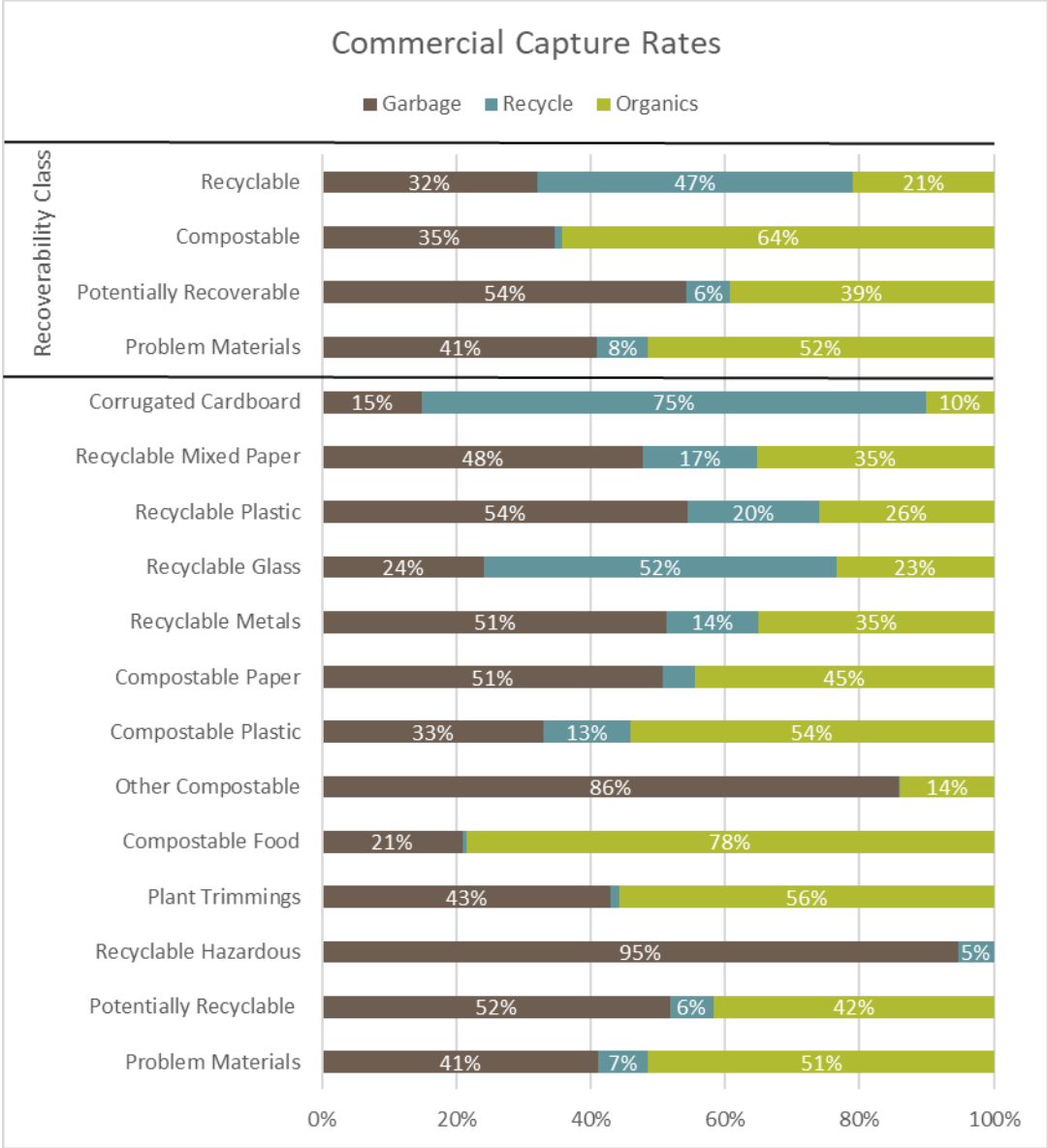


Commercial

In the commercial sector, 47 percent of **Recyclable** and 64 percent of **Compostable** items are being captured in the correct bin (Figure 18). However, nearly half of *Plant Trimmings* are disposed in the garbage bin. Additionally, a significant amount of non-compostable material is contaminating the organics stream. Twenty-six percent of *Recyclable Plastic*, 23 percent of *Recyclable Glass*, and 35 percent of *Recyclable Metal* items (and 21% of **Recyclable** items overall) are ending up in the compost bin as contamination. Over half of **Problem Materials** are disposed of in the organics stream as well.

On a positive note, 75 percent of *Corrugated Cardboard* is correctly placed in the recycle bin and 78 percent of *Compostable Food* is disposed of in the organic stream. A minimal percentage of **Compostable** materials are placed in the recycle bin.

Figure 18. Aggregate Commercial Capture Rates by Stream



BEHAVIOR PATTERNS FOR MUNICIPAL AND MULTIFAMILY SECTORS

Each day, the field team collected samples on-site from pre-selected multifamily and municipal properties. This provided us with the opportunity to track recycling diversion patterns by property. We were not able to organize the commercial data in this way because all samples were taken back-of-truck from haulers as they arrived at the transfer station; there was no way to distinguish materials from specific businesses.

Multifamily

Figure 19 below indicates that 55 percent of multifamily properties divert 60 percent or more of the recyclables that they generate. Conversely, 10 percent of properties divert less than 20 percent of the recyclables that they generate.

Figure 19. Multifamily Recycling Diversion Efficiency Behavior Patterns

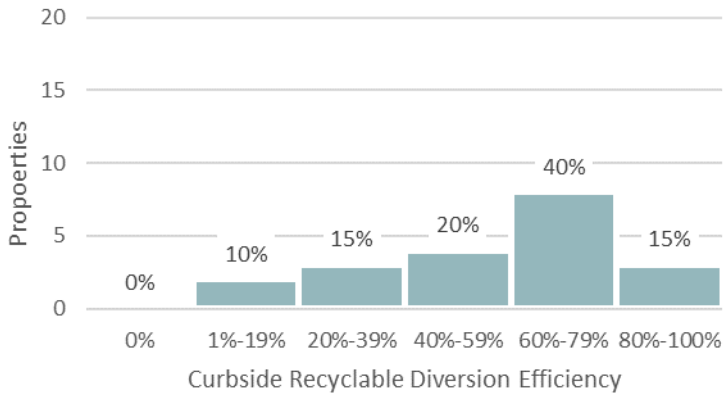


Figure 20 presents the efficiency patterns for compost diversion from municipal properties. As shown, only five percent of properties divert 60 percent or more of the organic material they generate, and 25 percent of properties do not divert any organic material.

Figure 20. Multifamily Compost Diversion Efficiency Behavior Patterns

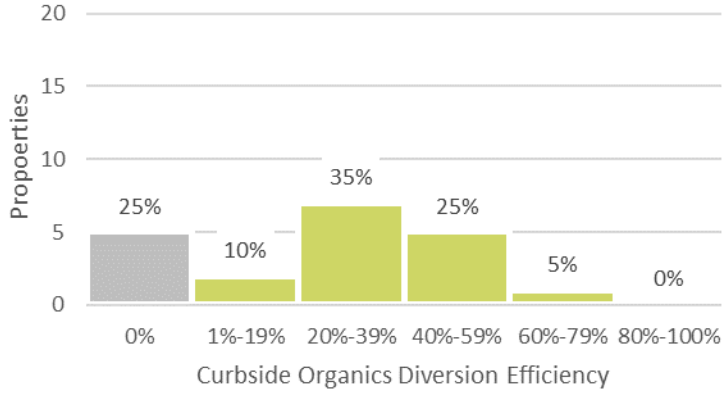
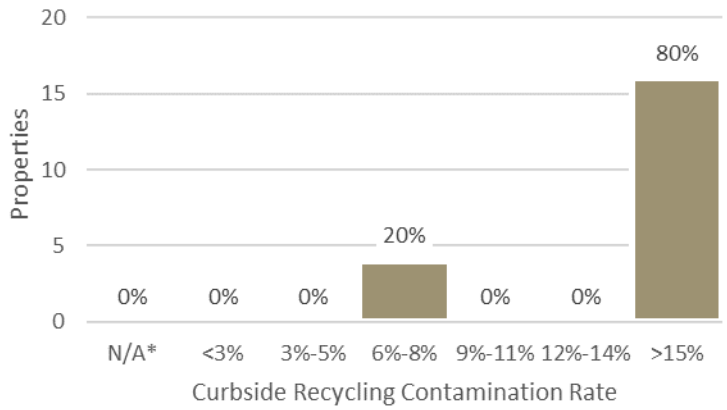


Figure 21 below shows the contamination rates in the multifamily recycling stream. Eighty percent of properties have a contamination rate of 15 percent or greater. All other properties had recycling contamination rates between six and eight percent.

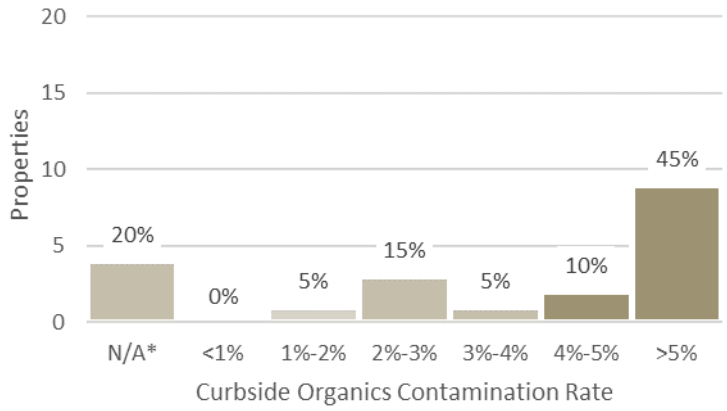
Figure 21. Multifamily Recycling Contamination Rates Behavior Patterns



*This includes the locations that either didn't have or didn't use a recycling bin.

Figure 22 shows the organics contamination rates from multifamily properties. Nearly half of the properties had contamination rates greater than five percent.

Figure 22. Multifamily Organics Contamination Rates Behavior Patterns



*This includes the locations that either didn't have or didn't use an organics bin.

Municipal

Figure 23 indicates that nearly one quarter of municipal properties do not recycle[1], but 44 percent of properties divert 80 percent or more of their recyclables.

Figure 23. Municipal Recycling Diversion Efficiency Behavior Patterns

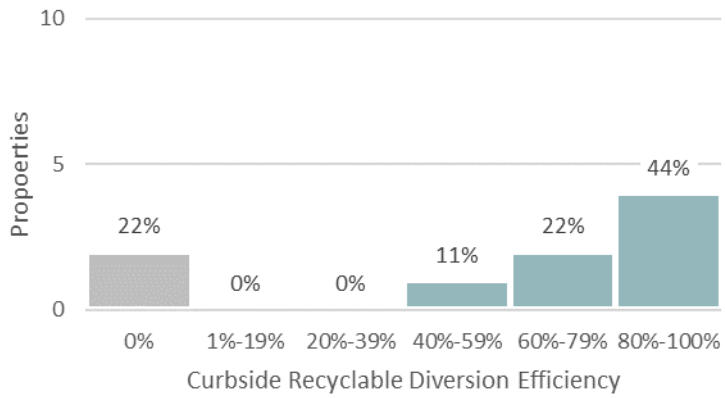


Figure 24 shows that 11 percent of municipal properties do not compost[2], but the remaining properties properly divert at least 40 percent of their organic material. One third of municipal properties divert at least 80 percent of their organic material.

[1] Some municipal sites were visited for sample collection multiple times. McClellan Ranch Preserve had recycling bins during the first visit but not during the second visit. The Corporation Yard at Franco Court did not have recycling collection bins during any visit nor did the service data indicate this site ever had these services.

[2] The Corporation Yard at Franco Court did not have composting collection bins during any visit nor did the service data indicate this site ever had these services.

Figure 24. Municipal Compost Diversion Efficiency Behavior Patterns

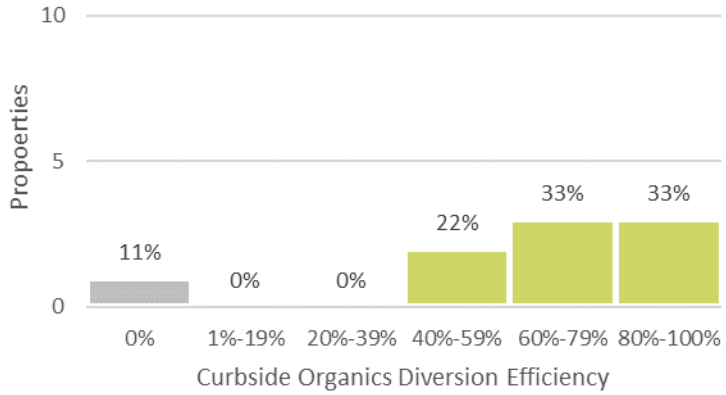
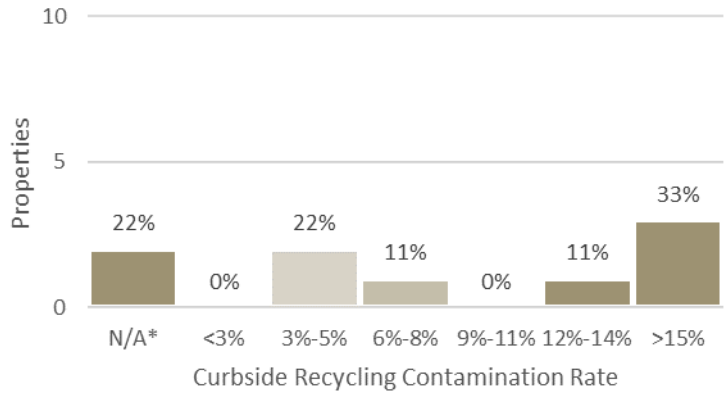


Figure 25 below presents the recycling contamination rates for municipal properties. Nearly a quarter (22%) have a contamination rate of 5 percent or less. One third (33%) of municipal properties have contamination rates greater than 15 percent.

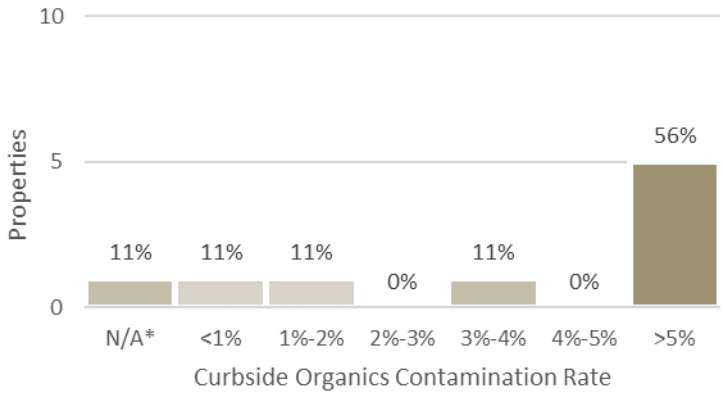
Figure 25. Municipal Recycling Contamination Rates Behavior Patterns



*This includes the locations that either didn't have or didn't use a recycling bin.

Figure 26 shows that over half (56%) of municipal properties have a contamination rate of more than five percent.

Figure 26. Municipal Organics Contamination Rates Behavior Patterns



*This includes the locations that either didn't have or didn't use an organics bin.

DETAILED COMPOSITION RESULTS

Detailed composition results for each sector are presented in this section.

Table 14. Detailed Composition, Multifamily Garbage, Recycle, Organics, and Overall Generation

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
PAPER	**21.1%**	**3.7%**	**586**	**47.8%**	**7.3%**	**365**	**5.7%**	**1.9%**	**6**	**26.1%**	**3.2%**	**957**		
Clean Uncoated Corrugated Cardboard	0.6%	0.3%	15	5.6%	2.9%	42	0.2%	0.2%	0	1.6%	0.6%	58	73%	0%
Clean Uncoated, Unflattened Corrugated Cardboard	1.1%	0.4%	31	9.9%	4.0%	76	0.5%	0.4%	1	2.9%	0.9%	107	71%	1%
Clean Recyclable Paper	7.4%	3.2%	206	22.2%	7.5%	169	1.3%	1.0%	2	10.3%	2.9%	376	45%	0%
Clean Coated Paper Products	0.7%	0.3%	21	1.1%	0.4%	8	0.2%	0.4%	0	0.8%	0.2%	29	29%	1%
Gable Top Cartons & Aseptics	0.4%	0.1%	12	0.9%	0.3%	7	0.1%	0.1%	0	0.5%	0.1%	20	36%	0%
Contaminated Recyclable Paper	1.1%	0.3%	29	2.6%	1.1%	20	0.4%	0.3%	0	1.3%	0.3%	49	40%	1%
Paper Tissue & Towels	7.3%	1.8%	204	1.9%	1.0%	15	2.1%	1.1%	2	6.0%	1.4%	221	7%	1%
Other Compostable Paper	0.5%	0.2%	14	0.2%	0.1%	2	0.2%	0.1%	0	0.4%	0.2%	16	11%	1%
Paper Takeout Containers	0.7%	0.2%	21	0.7%	0.6%	5	0.2%	0.1%	0	0.7%	0.2%	26	21%	1%
Coated Paper Cups	0.5%	0.2%	14	1.0%	0.7%	7	0.1%	0.1%	0	0.6%	0.2%	22	33%	1%
Pizza Boxes	0.2%	0.2%	5	0.8%	0.4%	6	0.1%	0.1%	0	0.3%	0.1%	11	54%	1%
Other Composite Paper	0.5%	0.2%	14	0.9%	0.3%	7	0.3%	0.3%	0	0.6%	0.1%	21	31%	2%
PLASTIC	**13.3%**	**2.7%**	**371**	**15.0%**	**2.4%**	**115**	**3.2%**	**1.6%**	**4**	**13.4%**	**2.1%**	**490**		
#1 PETE Plastic Packaging	1.3%	0.3%	37	2.9%	0.6%	22	0.2%	0.1%	0	1.6%	0.2%	59	38%	0%
#2 HDPE Plastic Packaging	0.7%	0.2%	20	2.7%	0.9%	21	0.1%	0.2%	0	1.1%	0.2%	41	51%	0%
Other #3-7 Plastic Packaging	0.6%	0.1%	16	1.5%	0.5%	11	0.4%	0.4%	1	0.8%	0.1%	28	41%	2%
Clean Recyclable Film Plastic	0.6%	0.1%	16	1.6%	0.6%	12	0.2%	0.1%	0	0.8%	0.2%	28	44%	1%
Plastic Takeout Containers	0.9%	0.3%	26	0.2%	0.1%	2	0.1%	0.1%	0	0.8%	0.2%	28	6%	0%
Durable Plastic Products	1.9%	2.1%	52	0.4%	0.3%	3	0.0%	0.0%	0	1.5%	1.6%	55	6%	0%
Contaminated Recyclable Plastic	1.0%	0.3%	27	1.9%	1.4%	15	0.2%	0.1%	0	1.1%	0.4%	42	35%	0%
Expanded #6 Polystyrene Products and Packaging	0.4%	0.1%	10	0.3%	0.1%	2	0.1%	0.1%	0	0.4%	0.1%	13	18%	1%
Compostable Plastic	0.1%	0.1%	2	0.1%	0.0%	0	0.1%	0.1%	0	0.1%	0.0%	3	14%	4%
Flexible Plastic Pouches	0.1%	0.1%	4	0.2%	0.1%	2	0.0%	0.0%	0	0.2%	0.1%	6	28%	0%
Other Composite Film Plastics	0.4%	0.1%	11	0.3%	0.1%	2	0.2%	0.2%	0	0.4%	0.1%	14	15%	2%
Other Plastic	5.4%	0.9%	149	2.9%	1.5%	22	1.6%	0.7%	2	4.7%	0.7%	173	13%	1%
GLASS	**2.2%**	**0.7%**	**62**	**8.4%**	**2.5%**	**64**	**0.6%**	**0.5%**	**1**	**3.5%**	**0.7%**	**127**		
Clean Glass Bottles & Jars	1.4%	0.5%	38	7.7%	2.3%	59	0.5%	0.5%	1	2.6%	0.6%	97	60%	1%
Contaminated Recyclable Glass Bottles & Jars	0.2%	0.3%	6	0.7%	0.5%	6	0.2%	0.2%	0	0.3%	0.2%	12	47%	1%
Other Composite Glass	0.6%	0.4%	18	0.0%	0.0%	0	0.0%	0.0%	0	0.5%	0.3%	18	0%	0%
METAL	**3.5%**	**1.9%**	**98**	**3.6%**	**2.0%**	**28**	**0.4%**	**0.3%**	**0**	**3.4%**	**1.5%**	**126**		
Clean Aluminum Cans & Foil	0.9%	0.5%	25	0.7%	0.3%	5	0.3%	0.3%	0	0.8%	0.4%	31	18%	1%
Clean Other Recyclable Metal	0.6%	0.3%	17	1.0%	0.6%	8	0.0%	0.0%	0	0.7%	0.2%	25	32%	0%
Contaminated Recyclable Metal	1.0%	1.0%	28	0.2%	0.3%	2	0.1%	0.1%	0	0.8%	0.8%	30	6%	0%
Other Metal	1.0%	1.5%	27	1.6%	1.9%	13	0.0%	0.0%	0	1.1%	1.2%	40	31%	0%

Table 15. Detailed Composition, Multifamily Garbage, Recycle, Organics, and Overall Generation (Continued)

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
ORGANIC	**54.8%**	**5.1%**	**1524**	**16.2%**	**7.5%**	**124**	**88.5%**	**5.8%**	**101**	**47.8%**	**4.2%**	**1749**		
Plant Trimmings	6.0%	4.6%	168	1.0%	0.6%	7	33.8%	22.4%	39	5.8%	3.5%	214	3%	18%
Untreated Wood	2.9%	2.9%	81	0.0%	0.0%	0	0.0%	0.0%	0	2.2%	2.2%	81	0%	0%
Food - Potentially Donatable	6.2%	2.2%	174	0.8%	0.4%	6	5.4%	2.8%	6	5.1%	1.6%	187	3%	3%
Food - Non Donatable	24.5%	4.3%	682	6.7%	2.2%	51	26.3%	9.3%	30	20.8%	3.3%	763	7%	4%
Inedible Food Scraps	1.8%	0.5%	50	6.9%	5.3%	53	15.6%	7.5%	18	3.3%	1.2%	121	44%	15%
Other Compostable Organics	0.1%	0.1%	4	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.1%	4	3%	1%
Diapers	6.1%	2.2%	169	0.5%	0.5%	4	5.2%	4.5%	6	4.9%	1.7%	179	2%	3%
Natural Textiles	2.1%	1.2%	58	0.3%	0.4%	2	0.3%	0.4%	0	1.7%	0.9%	61	3%	1%
Animal Feces & Litter	3.4%	3.3%	94	0.0%	0.0%	0	0.0%	0.0%	0	2.6%	2.5%	94	0%	0%
Manure	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Pumpkins	1.5%	1.3%	42	0.0%	0.0%	0	1.8%	2.0%	2	1.2%	1.0%	44	0%	5%
Other Organic	0.1%	0.2%	4	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.2%	4	1%	0%
HAZARDOUS WASTE	**2.2%**	**2.5%**	**61**	**2.7%**	**2.8%**	**21**	**0.1%**	**0.1%**	**0**	**2.2%**	**2.0%**	**82**		
Electronics	1.8%	2.3%	49	2.5%	2.7%	19	0.1%	0.1%	0	1.9%	1.8%	68	28%	0%
Batteries	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	34%	0%
Medicine	0.1%	0.2%	3	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.1%	3	4%	0%
Other Hazardous Waste	0.3%	0.2%	9	0.2%	0.2%	1	0.0%	0.0%	0	0.3%	0.1%	11	13%	0%
OTHER MATERIALS	**2.9%**	**1.6%**	**81**	**6.2%**	**2.0%**	**47**	**1.5%**	**1.2%**	**2**	**3.5%**	**1.3%**	**130**		
Other Textiles	0.6%	0.3%	18	1.2%	0.8%	9	0.0%	0.0%	0	0.7%	0.3%	27	33%	0%
Carpet	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Non-Metal Appliances	0.8%	1.2%	22	0.0%	0.0%	0	0.0%	0.0%	0	0.6%	0.9%	22	0%	0%
Contruction & Demolition Debris	0.3%	0.3%	9	0.7%	0.9%	5	0.4%	0.6%	0	0.4%	0.3%	15	36%	3%
Other Materials	1.2%	0.3%	32	4.3%	1.4%	33	1.1%	0.7%	1	1.8%	0.4%	66	50%	2%
Totals	**100.0%**		**2784**	**100.0%**		**764**	**100.0%**		**114**	**100.0%**		**3661**		
Sample Count			**20**			**20**			**15**			**55**		
Recyclable	**19.1%**	**4.6%**	**531**	**58.5%**	**11.7%**	**447**	**4.1%**	**2.5%**	**5**	**26.8%**	**4.3%**	**983**	45%	0%
Compostable	**51.1%**	**5.7%**	**1422**	**18.4%**	**7.9%**	**140**	**85.4%**	**9.6%**	**97**	**45.3%**	**4.7%**	**1660**	8%	6%
Potentially Recoverable	**8.7%**	**2.4%**	**242**	**10.6%**	**3.8%**	**81**	**1.9%**	**1.3%**	**2**	**8.9%**	**2.0%**	**326**	25%	1%
Problem Materials	**21.1%**	**4.1%**	**588**	**12.4%**	**3.2%**	**95**	**8.6%**	**5.6%**	**10**	**18.9%**	**3.2%**	**693**	14%	1%
Totals	**100.0%**		**2784**	**100.0%**		**764**	**100.0%**		**114**	**100.0%**		**3661**		

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

Table 16. Detailed Composition, Municipal Garbage, Recycle, Organics, and Overall Generation

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
PAPER	**22.6%**	**7.4%**	**22**	**77.9%**	**13.8%**	**27**	**26.8%**	**16.4%**	**16**	**33.6%**	**8.3%**	**64**		
Clean Uncoated Corrugated Cardboard	0.8%	0.7%	1	17.7%	6.9%	6	0.4%	0.4%	0	3.8%	1.3%	7	87%	3%
Clean Uncoated, Unflattened Corrugated Cardboard	1.8%	1.0%	2	6.6%	2.2%	2	0.7%	0.8%	0	2.3%	0.7%	4	53%	10%
Clean Recyclable Paper	5.0%	3.6%	5	50.6%	18.5%	18	1.1%	0.8%	1	12.2%	3.9%	23	77%	3%
Clean Coated Paper Products	0.3%	0.3%	0	0.8%	0.4%	0	0.2%	0.3%	0	0.4%	0.2%	1	39%	20%
Gable Top Cartons & Aseptics	0.2%	0.1%	0	0.1%	0.1%	0	0.0%	0.0%	0	0.1%	0.1%	0	9%	8%
Contaminated Recyclable Paper	0.5%	0.2%	0	0.5%	0.4%	0	0.9%	0.8%	1	0.6%	0.3%	1	16%	47%
Paper Tissue & Towels	4.6%	3.4%	4	0.7%	0.5%	0	22.3%	11.1%	13	9.4%	3.9%	18	1%	74%
Other Compostable Paper	3.6%	4.1%	3	0.1%	0.1%	0	0.2%	0.2%	0	1.9%	2.0%	4	1%	3%
Paper Takeout Containers	0.5%	0.4%	1	0.1%	0.1%	0	0.1%	0.2%	0	0.3%	0.2%	1	6%	14%
Coated Paper Cups	2.1%	1.6%	2	0.3%	0.3%	0	0.4%	0.3%	0	1.2%	0.8%	2	5%	11%
Pizza Boxes	1.5%	2.6%	1	0.2%	0.3%	0	0.1%	0.1%	0	0.8%	1.3%	2	5%	2%
Other Composite Paper	1.7%	1.6%	2	0.2%	0.1%	0	0.3%	0.4%	0	1.0%	0.8%	2	4%	8%
PLASTIC	**19.0%**	**7.6%**	**18**	**10.0%**	**4.2%**	**4**	**2.6%**	**1.5%**	**2**	**10.0%**	**3.0%**	**19**		
#1 PETE Plastic Packaging	1.0%	0.6%	1	2.1%	1.7%	1	0.4%	0.4%	0	1.0%	0.4%	2	38%	11%
#2 HDPE Plastic Packaging	0.1%	0.2%	0	1.5%	1.7%	1	0.0%	0.1%	0	0.3%	0.3%	1	79%	3%
Other #3-7 Plastic Packaging	0.3%	0.2%	0	0.4%	0.2%	0	0.1%	0.1%	0	0.3%	0.1%	0	26%	10%
Clean Recyclable Film Plastic	0.4%	0.2%	0	1.4%	0.5%	0	0.5%	0.5%	0	0.6%	0.2%	1	42%	23%
Plastic Takeout Containers	0.7%	0.4%	1	0.1%	0.1%	0	0.0%	0.0%	0	0.3%	0.2%	1	3%	1%
Durable Plastic Products	8.7%	6.8%	8	1.8%	1.1%	1	0.0%	0.0%	0	4.7%	3.4%	9	7%	0%
Contaminated Recyclable Plastic	1.1%	1.5%	1	0.9%	1.4%	0	0.6%	0.4%	0	0.9%	0.8%	2	19%	20%
Expanded #6 Polystyrene Products and Packaging	0.1%	0.2%	0	0.1%	0.1%	0	0.0%	0.0%	0	0.1%	0.1%	0	25%	2%
Compostable Plastic	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0%	0%
Flexible Plastic Pouches	1.5%	2.1%	1	0.0%	0.0%	0	0.0%	0.0%	0	0.7%	1.0%	1	1%	1%
Other Composite Film Plastics	0.3%	0.1%	0	0.1%	0.1%	0	0.3%	0.3%	0	0.3%	0.1%	1	9%	33%
Other Plastic	4.7%	2.3%	4	1.7%	0.9%	1	0.8%	0.7%	0	2.9%	1.2%	6	11%	9%
GLASS	**0.4%**	**0.4%**	**0**	**5.5%**	**4.8%**	**2**	**0.4%**	**0.3%**	**0**	**1.2%**	**0.8%**	**2**		
Clean Glass Bottles & Jars	0.2%	0.2%	0	5.5%	4.8%	2	0.0%	0.0%	0	1.1%	0.9%	2	92%	0%
Contaminated Recyclable Glass Bottles & Jars	0.2%	0.3%	0	0.0%	0.0%	0	0.3%	0.2%	0	0.2%	0.2%	0	0%	50%
Other Composite Glass	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.2%	0	0.0%	0.1%	0	9%	91%
METAL	**3.1%**	**2.9%**	**3**	**1.2%**	**0.8%**	**0**	**1.2%**	**1.2%**	**1**	**1.9%**	**1.2%**	**4**		
Clean Aluminum Cans & Foil	0.6%	0.3%	1	0.5%	0.6%	0	0.1%	0.1%	0	0.4%	0.2%	1	21%	9%
Clean Other Recyclable Metal	0.3%	0.2%	0	0.4%	0.3%	0	0.2%	0.2%	0	0.3%	0.1%	1	25%	20%
Contaminated Recyclable Metal	2.2%	2.9%	2	0.1%	0.1%	0	0.2%	0.3%	0	1.2%	1.4%	2	1%	5%
Other Metal	0.0%	0.0%	0	0.3%	0.4%	0	0.7%	1.2%	0	0.3%	0.4%	1	17%	82%

Table 17. Detailed Composition, Municipal Garbage, Recycle, Organics, and Overall Generation (Continued)

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
ORGANIC	**45.7%**	**20.4%**	**44**	**2.5%**	**2.2%**	**1**	**67.0%**	**23.0%**	**40**	**48.4%**	**13.1%**	**92**		
Plant Trimmings	2.5%	3.1%	2	0.1%	0.1%	0	32.3%	18.2%	19	11.4%	5.9%	22	0%	89%
Untreated Wood	0.1%	0.1%	0	0.5%	0.4%	0	4.8%	6.7%	3	1.6%	2.1%	3	6%	91%
Food - Potentially Donatable	1.9%	1.6%	2	0.1%	0.2%	0	0.3%	0.2%	0	1.1%	0.8%	2	2%	9%
Food - Non Donatable	5.9%	4.2%	6	1.3%	1.0%	0	3.2%	2.4%	2	4.2%	2.2%	8	6%	24%
Inedible Food Scraps	4.2%	5.3%	4	0.4%	0.4%	0	5.8%	5.2%	3	4.0%	3.1%	8	2%	46%
Other Compostable Organics	0.5%	0.6%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.3%	0.3%	0	1%	0%
Diapers	0.9%	1.0%	1	0.1%	0.1%	0	1.1%	1.2%	1	0.8%	0.6%	2	2%	41%
Natural Textiles	0.1%	0.1%	0	0.0%	0.0%	0	0.2%	0.1%	0	0.1%	0.1%	0	0%	48%
Animal Feces & Litter	0.3%	0.5%	0	0.0%	0.1%	0	1.4%	2.1%	1	0.6%	0.7%	1	1%	73%
Manure	25.8%	21.9%	25	0.0%	0.0%	0	17.9%	15.8%	11	18.5%	12.0%	35	0%	30%
Pumpkins	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Other Organic	3.4%	5.0%	3	0.0%	0.0%	0	0.0%	0.0%	0	1.7%	2.5%	3	0%	0%
HAZARDOUS WASTE	**0.1%**	**0.1%**	**0**	**0.8%**	**0.6%**	**0**	**0.0%**	**0.0%**	**0**	**0.2%**	**0.1%**	**0**		
Electronics	0.0%	0.0%	0	0.6%	0.6%	0	0.0%	0.0%	0	0.1%	0.1%	0	100%	0%
Batteries	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0%	8%
Medicine	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0%	100%
Other Hazardous Waste	0.0%	0.0%	0	0.1%	0.2%	0	0.0%	0.0%	0	0.0%	0.0%	0	76%	0%
OTHER MATERIALS	**9.1%**	**9.2%**	**9**	**2.2%**	**2.6%**	**1**	**2.0%**	**1.4%**	**1**	**4.7%**	**3.6%**	**9**		
Other Textiles	1.7%	1.8%	2	1.7%	2.2%	1	0.4%	0.7%	0	1.3%	1.0%	3	24%	10%
Carpet	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Non-Metal Appliances	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Contruction & Demolition Debris	6.3%	9.4%	6	0.0%	0.0%	0	0.2%	0.4%	0	3.2%	4.7%	6	0%	2%
Other Materials	1.1%	0.7%	1	0.4%	0.4%	0	1.3%	1.1%	1	1.0%	0.5%	2	8%	39%
Totals	**100.0%**		**95**	**100.0%**		**35**	**100.0%**		**60**	**100.0%**		**190**		
Sample Count			**10**			**7**			**9**			**26**		
Recyclable	**20.5%**	**10.1%**	**20**	**89.2%**	**7.0%**	**31**	**3.7%**	**1.7%**	**2**	**24.0%**	**4.0%**	**46**	69%	5%
Compostable	**50.7%**	**18.8%**	**48**	**3.4%**	**2.4%**	**1**	**86.9%**	**8.8%**	**52**	**59.6%**	**8.2%**	**113**	1%	46%
Potentially Recoverable	**13.0%**	**8.4%**	**12**	**2.5%**	**1.8%**	**1**	**2.9%**	**1.6%**	**2**	**6.6%**	**3.2%**	**13**	7%	14%
Problem Materials	**15.9%**	**8.3%**	**15**	**4.8%**	**3.8%**	**2**	**6.5%**	**4.7%**	**4**	**9.8%**	**3.8%**	**19**	9%	21%
Totals	**100.0%**		**95**	**100.0%**		**35**	**100.0%**		**60**	**100.0%**		**190**		

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

Table 18. Detailed Composition, Commercial Garbage, Recycle, Organics, and Overall Generation

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
PAPER	**23.8%**	**3.3%**	**1310**	**75.5%**	**4.0%**	**1518**	**20.5%**	**3.5%**	**1527**	**29.2%**	**2.2%**	**4357**		
Clean Uncoated Corrugated Cardboard	3.1%	1.3%	168	48.8%	5.7%	981	1.4%	1.4%	107	8.4%	1.1%	1255	78%	9%
Clean Uncoated, Unflattened Corrugated Cardboard	1.4%	0.6%	79	13.1%	2.9%	263	0.8%	0.4%	61	2.7%	0.5%	403	65%	15%
Clean Recyclable Paper	4.8%	1.2%	265	4.4%	1.4%	88	1.8%	0.9%	136	3.3%	0.7%	488	18%	28%
Clean Coated Paper Products	0.5%	0.1%	25	0.5%	0.5%	11	1.0%	0.6%	74	0.7%	0.3%	110	10%	68%
Gable Top Cartons & Aseptics	0.2%	0.1%	12	0.4%	0.2%	9	0.2%	0.1%	13	0.2%	0.1%	34	26%	38%
Contaminated Recyclable Paper	1.2%	0.4%	68	1.3%	0.7%	26	2.6%	0.6%	191	1.9%	0.3%	284	9%	67%
Paper Tissue & Towels	7.2%	1.5%	394	1.8%	0.6%	36	4.4%	1.4%	327	5.1%	0.9%	757	5%	43%
Other Compostable Paper	0.9%	0.4%	50	0.2%	0.1%	4	0.8%	0.3%	56	0.7%	0.2%	111	4%	51%
Paper Takeout Containers	0.6%	0.2%	31	0.3%	0.4%	7	0.8%	0.3%	59	0.7%	0.2%	97	7%	61%
Coated Paper Cups	1.0%	0.3%	57	0.6%	0.2%	13	0.5%	0.1%	39	0.7%	0.1%	109	12%	36%
Pizza Boxes	0.1%	0.1%	6	0.1%	0.1%	3	0.2%	0.1%	12	0.1%	0.1%	20	14%	58%
Other Composite Paper	2.8%	1.0%	156	3.9%	2.0%	79	6.1%	2.4%	451	4.6%	1.3%	686	11%	66%
PLASTIC	**16.4%**	**2.7%**	**900**	**10.1%**	**2.5%**	**204**	**13.3%**	**2.9%**	**989**	**14.0%**	**1.8%**	**2094**		
#1 PETE Plastic Packaging	0.6%	0.1%	33	0.9%	0.3%	17	0.4%	0.2%	30	0.5%	0.1%	80	22%	38%
#2 HDPE Plastic Packaging	0.6%	0.2%	31	1.6%	0.6%	31	0.3%	0.1%	19	0.5%	0.1%	81	39%	23%
Other #3-7 Plastic Packaging	0.5%	0.1%	27	0.3%	0.1%	6	0.4%	0.1%	32	0.4%	0.1%	65	10%	49%
Clean Recyclable Film Plastic	1.0%	0.4%	55	1.5%	0.4%	31	0.5%	0.2%	37	0.8%	0.2%	122	25%	30%
Plastic Takeout Containers	0.4%	0.1%	23	0.2%	0.2%	4	0.1%	0.1%	11	0.3%	0.1%	38	10%	29%
Durable Plastic Products	2.6%	1.1%	141	1.1%	0.7%	21	0.3%	0.1%	20	1.2%	0.4%	182	12%	11%
Contaminated Recyclable Plastic	0.6%	0.2%	35	0.9%	0.5%	18	1.1%	0.5%	85	0.9%	0.3%	137	13%	62%
Expanded #6 Polystyrene Products and Packaging	0.3%	0.1%	14	0.5%	0.2%	9	0.1%	0.1%	9	0.2%	0.1%	32	28%	27%
Compostable Plastic	0.3%	0.1%	15	0.3%	0.1%	6	0.3%	0.2%	24	0.3%	0.1%	44	13%	54%
Flexible Plastic Pouches	0.0%	0.0%	2	0.1%	0.0%	1	0.1%	0.1%	10	0.1%	0.1%	13	10%	77%
Other Composite Film Plastics	0.3%	0.1%	17	0.1%	0.0%	2	0.7%	0.6%	51	0.5%	0.3%	70	2%	73%
Other Plastic	9.2%	2.3%	508	2.8%	1.2%	57	8.9%	1.8%	663	8.2%	1.3%	1228	5%	54%
GLASS	**1.6%**	**0.5%**	**90**	**7.1%**	**2.7%**	**144**	**1.2%**	**0.4%**	**88**	**2.2%**	**0.4%**	**322**		
Clean Glass Bottles & Jars	1.2%	0.4%	65	7.0%	2.7%	141	0.8%	0.3%	63	1.8%	0.4%	269	52%	23%
Contaminated Recyclable Glass Bottles & Jars	0.3%	0.2%	17	0.1%	0.1%	3	0.2%	0.2%	18	0.2%	0.1%	37	7%	48%
Other Composite Glass	0.2%	0.1%	8	0.0%	0.0%	0	0.1%	0.1%	7	0.1%	0.1%	16	0%	46%
METAL	**6.2%**	**2.3%**	**341**	**3.2%**	**2.1%**	**65**	**2.1%**	**0.9%**	**155**	**3.8%**	**1.0%**	**563**		
Clean Aluminum Cans & Foil	0.4%	0.1%	24	0.9%	0.4%	17	0.2%	0.1%	15	0.4%	0.1%	57	31%	27%
Clean Other Recyclable Metal	3.3%	1.7%	182	1.9%	2.1%	38	1.7%	0.9%	125	2.3%	0.8%	346	11%	36%
Contaminated Recyclable Metal	2.1%	1.1%	117	0.3%	0.2%	5	0.2%	0.1%	12	0.9%	0.4%	134	4%	9%
Other Metal	0.3%	0.5%	18	0.2%	0.2%	4	0.0%	0.1%	2	0.2%	0.2%	25	18%	9%

Table 19. Detailed Composition, Commercial Garbage, Recycle, Organics, and Overall Generation (Continued)

	Garbage			Recycle			Organics			Generation			Capture Rates	
Material	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Estimated Percent	+/-	Estimated Tons	Recycling Bin	Compost Bin
ORGANIC	**42.5%**	**4.8%**	**2334**	**2.1%**	**0.6%**	**43**	**61.9%**	**4.4%**	**4604**	**46.7%**	**2.8%**	**6974**		
Plant Trimmings	3.2%	2.4%	175	0.3%	0.4%	5	3.1%	3.3%	227	2.7%	1.8%	408	1%	56%
Untreated Wood	16.4%	4.9%	900	0.1%	0.1%	1	1.8%	1.2%	134	6.9%	1.9%	1035	0%	13%
Food - Potentially Donatable	3.3%	1.3%	180	0.3%	0.2%	6	5.6%	2.1%	417	4.0%	1.1%	603	1%	69%
Food - Non Donatable	14.8%	3.8%	815	0.6%	0.2%	12	43.6%	5.8%	3246	27.3%	3.2%	4073	0%	80%
Inedible Food Scraps	1.9%	1.1%	102	0.6%	0.3%	13	6.1%	2.3%	456	3.8%	1.2%	571	2%	80%
Other Compostable Organics	0.2%	0.1%	9	0.1%	0.0%	1	0.2%	0.1%	15	0.2%	0.0%	25	5%	59%
Diapers	0.9%	0.6%	51	0.2%	0.2%	4	0.4%	0.4%	31	0.6%	0.3%	85	4%	36%
Natural Textiles	1.6%	1.0%	91	0.0%	0.0%	0	1.1%	1.0%	79	1.1%	0.6%	170	0%	47%
Animal Feces & Litter	0.0%	0.0%	2	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	0%	0%
Manure	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
Pumpkins	0.2%	0.2%	9	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.1%	9	0%	0%
Other Organic	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0		
HAZARDOUS WASTE	**3.2%**	**2.1%**	**176**	**0.5%**	**0.4%**	**9**	**0.0%**	**0.0%**	**1**	**1.3%**	**0.8%**	**188**		
Electronics	1.3%	1.1%	70	0.2%	0.2%	4	0.0%	0.0%	0	0.5%	0.4%	74	5%	0%
Batteries	0.0%	0.0%	1	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	1	3%	0%
Medicine	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0%	0%
Other Hazardous Waste	1.9%	1.9%	105	0.3%	0.4%	6	0.0%	0.0%	1	0.8%	0.7%	112	5%	1%
OTHER MATERIALS	**6.3%**	**2.1%**	**345**	**1.4%**	**0.7%**	**28**	**1.0%**	**0.5%**	72	**3.0%**	**0.8%**	**446**		
Other Textiles	1.0%	0.5%	53	0.2%	0.2%	4	0.3%	0.4%	26	0.6%	0.3%	82	4%	31%
Carpet	0.0%	0.1%	2	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	0%	0%
Non-Metal Appliances	0.2%	0.2%	9	0.0%	0.0%	0	0.0%	0.0%	0	0.1%	0.1%	9	0%	0%
Contruction & Demolition Debris	3.6%	1.8%	196	0.3%	0.3%	5	0.2%	0.3%	12	1.4%	0.7%	213	2%	6%
Other Materials	1.5%	0.6%	85	1.0%	0.4%	20	0.5%	0.2%	34	0.9%	0.2%	139	14%	25%
Totals	**100.0%**		**5496**	**100.0%**		**2012**	**100.0%**		**7437**	**100.0%**		**14944**		
Sample Count			40			**20**			**20**			**80**		
Recyclable	**20.5%**	**3.0%**	**1129**	**82.4%**	**3.2%**	**1658**	**10.0%**	**1.9%**	**742**	**23.7%**	**1.5%**	**3535**	47%	21%
Compostable	**48.0%**	**4.5%**	**2641**	**4.1%**	**0.9%**	**82**	**65.8%**	**3.7%**	**4890**	**50.9%**	**2.5%**	**7606**	1%	64%
Potentially Recoverable	**12.4%**	**2.6%**	**683**	**4.0%**	**1.3%**	**81**	**6.7%**	**1.7%**	**495**	**8.4%**	**1.3%**	**1260**	6%	39%
Problem Materials	**19.0%**	**3.0%**	**1043**	**9.5%**	**2.4%**	**191**	**17.6%**	**2.6%**	**1310**	**17.0%**	**1.7%**	**2543**	8%	51%
Totals	**100.0%**		**5496**	**100.0%**		**2012**	**100.0%**		**7437**	**100.0%**		**14944**		

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

Appendix A. Study Design

SAMPLING UNIVERSE

The first step in planning a waste characterization study is to identify and carefully define the waste streams, the "universe" of waste to be studied. Each stream is determined by the generation, collection, or composition characteristics that make it a unique portion of the total waste stream. The sampling universe for this study includes a total of nine waste streams – three streams for each of the three sectors.

Waste sectors

- **Multifamily-** A residential property with five or more dwelling units. Typically waste and diversion bins are shared among many dwelling units.
- **Commercial-** A non-residential property including businesses, industries (e.g. factories, farms), and institutions (e.g. correctional facilities, hospitals, churches).
- **Municipal**- A municipal property including government buildings (e.g. offices, parks). *Schools are excluded from this study as they are not part of the franchise.*

Waste Streams

- **Garbage -** Materials placed in a container that are normally hauled to a landfill with minimal or no processing.
- **Recycle -** Typical dry good materials placed in a container by the generator and collected by a certified or franchised hauler on a regular, contracted schedule that is normally hauled to a facility that specializes in removing the recoverable fraction. These materials could be placed in a disposal container but are instead diverted from disposal and placed in a blue-bin recycling container.
- **Organics -** Organics materials placed in a container by the generator and collected by a certified or franchised hauler on a regular, contracted schedule that is normally hauled to a facility that specializes in recovering the organic fraction. These materials could be placed in a disposal container but are instead diverted from disposal and placed in a green-bin organics container.

SAMPLE ALLOCATION AND SAMPLING CALENDAR

Allocation of Samples

Cascadia will collect and sort samples over five consecutive days in a single week (October 28 – November 1, 2019). During the study week, a total of 185 samples will be characterized. The proposed sample counts by sector and stream are summarized in Table 17 .

Table 20. Proposed Sample Allocations

	Garbage	Recycle	Organics	Total
Multifamily	20	20	20	**60**
Commercial	40	20	20	**80**
Municipal	15	15	15	**45**
Total	**75**	**55**	**55**	**185**

Sampling Calendar

Sampling will begin Saturday, October 26, 2019 and complete on Friday, November 1, 2019. The field work schedule is based on regular collection and operating schedules for the City to minimize disruptions for the hauler and facilities.

Commercial sector samples will be evenly distributed across the days of the week. Multifamily and municipal sector samples will be collected on a schedule that maximizes the amount of waste available to the sampling crew and is logistically feasible. Table 18 below summarizes the tentative sample counts for each day. The actual daily sample counts may vary depending on the availability of multifamily and municipal samples.

Table 21. Tentative Sample Schedule

		Monday	Tuesday	Wednesday	Thursday	Friday	TOTALS
Municipal	Garbage	3	3	3	3	3	**15**
	Recycle	3	3	3	3	3	**15**
	Organics	3	3	3	3	3	**15**
Multifamily	Garbage	4	4	4	4	4	**20**
	Recycle	4	4	4	4	4	**20**
	Organics	4	4	4	4	4	**20**
Commercial	Garbage	8	8	8	8	8	**40**
	Recycle	4	4	4	4	4	**20**
	Organics	4	4	4	4	4	**20**
TOTAL		**37**	**37**	**37**	**37**	**37**	**185**

SITE LOGISTICS AND HAULER/FACILITY COORDINATION

Cascadia coordinates with all involved parties, including the hauler, the site(s) selected for sorting, and City staff, to ensure smooth execution of the study. Prior to creating this study design, Cascadia received route data from Recology to determine which routes would be selected for sampling. Cascadia received a list of multifamily and municipal accounts from the City in order to randomly select properties to sample.

Cascadia scheduled planning meetings over the phone with each facility to walk through specific site needs and logistics. Discussion with the facility managers included the collection process of samples from incoming vehicles, the protocol for sorting samples, the disposal of sorted material, and health and safety.

Cascadia will coordinate with Recology to determine schedules of incoming loads and establish lines of communication between the dispatcher and the field crew leads to notify the field crew of incoming loads.

Cascadia will confirm a point of contact at Recology who is available to review each day's sampling requirements during the field portion of the study.

SELECTING AND COLLECTING SAMPLES

The sampling methodology varies by sector and stream. The entity responsible for collecting materials is summarized in Table 19 and the sampling location is summarized in Table 20. Detailed descriptions of the sampling methodology for each sector and stream are included in this section.

Table 22. Material Collection Roles

	Garbage	Recycle	Organics
Multifamily	Cascadia	Cascadia	Cascadia
Commercial	Recology	Recology	Recology
Municipal	Cascadia	Cascadia	Cascadia

Table 23. Sample Collection Locations

	Garbage	Recycle	Organics
Multifamily	At Property	At Property	At Property
Commercial	Recology Rogers Ave.	GreenWaste Charles St.	Recology Rogers Ave.
Municipal	At Property	At Property	At Property

Three separate Cascadia field crew teams will be assigned to specific tasks during this project:

- **Field Crew One**: This team will collect samples from multifamily and municipal properties. The team consists of a Field Crew One Lead and two additional crew members. Each day, Monday – Friday, Field Crew One will drive to selected properties and collect garbage, recycle, and organics samples from each property. After sample collection, they will deliver garbage and organics samples to Rogers Ave and deliver recycling samples to GreenWaste to be sorted. Some samples may be sorted on-site depending on logistics that day.
- **Field Crew Two**: This team will remain at the Rogers Ave transfer station Monday – Friday. The team will consist of a Field Crew Two Lead and 2-4 additional crew members. They will collect commercial garbage and organics samples from incoming loads as trucks arrive at the facility. They will also receive multifamily and municipal garbage and organics samples delivered by Field Crew One. They will sort all organics and garbage samples on-site.
- **Field Crew Three**: This team will remain on-site at GreenWaste Monday – Friday. The team will consist of a Field Crew Three Lead and two additional crew members. They will collect commercial recycling samples from incoming loads as trucks enter the facility. They will also receive multifamily and municipal recycling samples delivered by Field Crew One. They will sort all recycling samples on-site at GreenWaste.

Multifamily and Municipal

Selecting Samples

Field Crew One will collect samples directly from the waste containers at multifamily and municipal properties. The proposed approach is the same for all three streams. For multifamily, Cascadia obtained a list of properties and their service level information from the City. From that list, Cascadia will identify properties that meet sampling criteria and randomly select 20 multifamily properties. To achieve this, Cascadia will assign each property a random number and organize the properties by ideal sampling day. Ideal sampling days consider pickup schedules and ensure that enough material will on-site to obtain a sample from each stream. Within the ideal sampling days, Cascadia will organize the list by increasing random numbers and select the first four properties within each day for sampling.

There are only nine municipal properties in the Cupertino and all properties are anticipated to be sampled. Some municipal properties will be sampled twice to reach target sample goals.

Obtaining Samples

Field Crew One will collect multifamily and municipal samples. The team will visit the selected properties the day before their normal collection day to maximize the quantity of material available to sample. Recology or the City will provide means for the field crew to access containers that may be locked or in locked enclosures. Each site visit includes two components: documenting waste quantities and collecting samples.

Documenting waste quantities

Field Crew One will collect information about the amount of materials collected in all bins. We will use this information along with the City and hauler provided service level information to calculate annual disposal and diversion quantities for each municipal and multifamily site. The procedure for measuring materials during the site visit is described below:

- Document the Number and Capacity of Containers and confirm collection frequency identified during the site selection process.
- Volume Measurements: Field Crew One will record the volume of materials placed in bins, dumpsters, or other containers at each site. The volume of the material at each site will be the sum in cubic inches of all volumes for each container (if there is more than one container on-site).
- Material Accumulation Time: While on-site, Field Crew One will contact the property manager to verify critical information collected during site selection process: the time the containers were last collected by the hauler (or regular collection schedule), and when material is regularly taken to outside containers.

For sites with multiple containers serving each stream (multiple garbage containers, for example), we will measure each container separately, and then add the resulting measurements together to obtain a total annual volume of material.

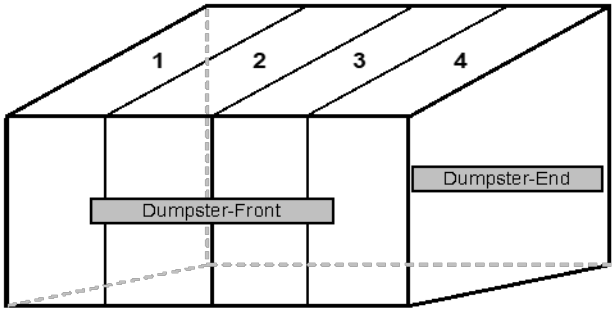
Collecting samples

To characterize materials from multifamily and municipal sites, Field Crew One will obtain one sample of material from each stream. The team will collect material from the containers and sort all material set out for

collection up to 150 pounds of garbage, up to 125 pounds of recycling, and up to 150 pounds of organics. In cases where all the material set out is less than 150 pounds (or 125 pounds for recycling), all materials on-site will be characterized as a sample. The following list provides the procedure for selecting the samples based on different container configurations:

- If a site has one container from a stream, Field Crew One will sort a randomly selected sample from the container.
- If a site has multiple containers from a stream, Field Crew One will randomly select a single container to represent the site.
- If a site has multiple containers each with a distinct portion of a stream (e.g. cardboard is in a separate container from bottles and cans; food waste and yard trimmings are in separate containers), Field Crew One will randomly select partial samples from each container where the partial samples together total 150 pounds for organics or 125 pounds for recycling.
- If a container contains more than the maximum sample weight (more than 150 pounds of garbage or organics, more than 125 pounds of recycling), Field Crew One will randomly choose a vertical cross section, or "slice," of the material for a sample. This slice will include material from the top to the bottom of the container as illustrated in Figure 27.

Figure 27. Example Container with Slices Illustrated



- If material is inaccessible, unique arrangements will be required for the sample collection. For example, if the site uses a compactor, Cascadia will ask that recyclables and/or organics be collected temporarily in a rolling cart or other alternate container. Field Crew One will acquire the sample from the container and return any materials not part of the sample to the compactor.

Once samples are collected, the Field Crew One will either transport the materials to Rogers Ave., GreenWaste, or sort the material on-site depending on the collection team's logistics that day. All samples will be hand-sorted as described below in the sorting protocol. If a selected site does not use their recycling or organics container, we will treat that site as a zero-weight sample.

After completing the site visit, Field Crew One will ensure the area around the waste containers is as clean as when they arrived. The Field Crew One Lead will track actual samples collected and sorted against targets and will consistently check the data sheets for errors or missing data that can be corrected in the field.

Commercial

Cascadia will sample Cupertino's commercial garbage, recycle, and organics. Special routes will be developed for the garbage and organics streams. Recology typically collects multifamily material on the same route as

they collect commercial material, so commercial and multifamily sector materials are normally mixed. The multifamily material is a small fraction of the material on the commercial routes. Because the City is interested in assessing the composition of multifamily and commercial material separately, Recology will provide trucks to collect special loads of "pure" commercial sector garbage and organics. The recycling will be collected from mixed loads; special protocols will be in place to ensure that the sampled portion of recycling loads is primarily pure commercial material.

Selecting Routes

Cascadia will work with the City to pre-select commercial routes using a random selection method. Cascadia will obtain lists of front-end loader and rear-end loader routes from the City, sorted by day of service. Cascadia will then randomly select routes for each vehicle type using Microsoft Excel's random number generator until daily quotas are filled. Cascadia will also prepare *Daily Commercial Sample Collection Forms* listing selected routes for each sampling day. Prior to sampling, Cascadia will provide these sheets to Recology staff, along with brightly-colored *Sample Placards* to identify loads designated for sampling. The *Placards* will display the route number, sector (commercial), truck type (if relevant), date, number of samples to be captured from the load, and the random cell from which to select a sample. Copies of both the *Sample Placards* and *Daily Commercial Sample Collection Forms* can be found in Appendix B. Sample Field Forms.

Select Accounts for Sampling

Samples from the commercial garbage and organics streams will be taken from the final 12 commercial accounts on the drivers' daily route. Samples from the commercial recycling stream will be taken directly from loads from the normal route.

Obtaining Samples

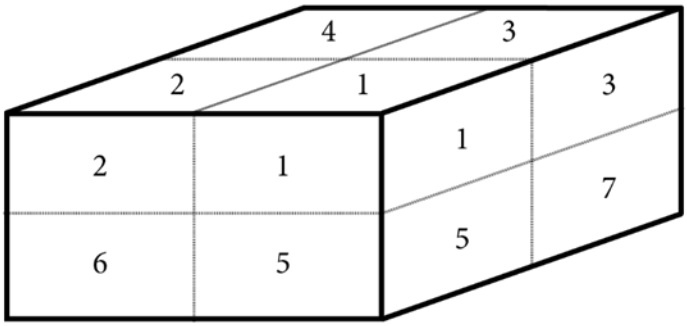
Recology will be collecting materials for all commercial samples and delivering that material to a transfer station where Field Crew Two and Field Crew Three will sample and sort the material. The detailed approach for each commercial stream is outlined below:

- **Garbage:** Recology operates three commercial front end loader (FEL) routes each day. Each FEL route typically requires the driver to make at least two trips to transfer station (the entire route is too large to fit in a single truckload). Each day a FEL route driver will finish the majority of their route as normal. After clearing their truck, they will return to their route and collect the final 12 commercial (non-multifamily, non-municipal) accounts on their route. The FEL driver will tip this material at the Rogers Ave transfer station. This process is repeated for each of the three, daily FEL routes.
- **Recycle:** Recology operates two commercial front end loader (FEL) routes each day. Each day a FEL route driver will run their route and tip at the GreenWaste MRF as normal. When the load is tipped at GreenWaste, Field Crew Three will work with the GreenWaste facility staff to select samples from pure commercial portions of the load.
- **Organics:** Recology operates one commercial front end loader (FEL) routes each day. Each day the FEL route driver will finish the majority of their route as normal. After clearing their truck, they will return to their route and collect the final 12 commercial (non-multifamily, non-municipal) accounts on their route. The FEL driver will tip this material at the Rogers Ave. transfer station.

The sample trucks will place the brightly-colored placard given to them prior to sample collection on their dashboard to be easily identified as they enter the facility. Recology dispatchers will be asked to notify the appropriate field crew when the truck is approaching the facility. To ensure sample collection, the scalehouse staff will be instructed to inform the field crew as trucks with the placard comes through the scalehouse. The field crews will identify the truck as it comes in and facility staff will direct the loads to the designated area of the tipping floor. The facility staff will ask the driver how many sample placards they have to determine whether a single, double, or triple sample will be taken from the load. The facility staff will also confirm with the driver that the materials in their truck match what is listed on the placard.

Selected loads will be tipped in an elongated pile. From each load, a sample will be selected using an imaginary 8-cell grid (as shown in Figure 28) that will be superimposed over the tipped material. The loader operator (Operator) will be provided with the randomly-selected cell from which to capture the sample.

Figure 28. 8-Cell Grid for Sampling



Samples sizes will be based on the weights from Table 21:

Table 24. Sample Size Per Stream

Sector	Stream	Sample Size
Municipal	Garbage	up to 150 lbs
	Recycle	up to 125 lbs
	Organics	up to 150 lbs
Multifamily	Garbage	up to 150 lbs
	Recycle	up to 125 lbs
	Organics	up to 150 lbs
Commercial	Garbage	150 lbs
	Recycle	125 lbs
	Organics	150 lbs

The Operator will scoop the specified amount of material from the selected cell and transport the sample(s) from the tip floor to the sort location. Samples will be collected before facility staff divert any materials from the load. Once finished dumping their load and handing off the *Sample Placard(s)*, drivers will make their way back to the scalehouse to weigh out.

The Operator will work with the field crew lead to confirm the load and sample information so that the field crew lead can ensure sample quotas are being met each day. The Operator and field crew lead will work together to place each sample on a clean tarp with the *Sample Placard*, which will identify and provide key

information (e.g. route number, vehicle type, etc.). The field crew lead will then photograph each sample, with the *Sample Placard* included in the image.

SORTING SAMPLES

Each day, after Field Crew One has finished collecting samples, they will transport any samples not sorted onsite to the appropriate facility for hand sorting. The anticipated sort locations for samples from each sector and stream are summarized in Table 22.

Table 25. Proposed Sorting Locations

	Garbage	Recycle	Organics
Multifamily	Recology Rogers Ave.	GreenWaste Charles St.	At Property
Commercial	Recology Rogers Ave.	GreenWaste Charles St.	Recology Rogers Ave.
Municipal	Recology Rogers Ave.	GreenWaste Charles St.	At Property

Crew leads from Field Crew Two and Field Crew Three will be on-site during all commercial sampling and sorting activities to ensure that the field crews follow approved protocols and maintain consistency across samples and sampling events. The crew leads will also brief personnel on any facility-specific health and safety requirements, personal protective equipment (PPE) requirements, and contingency protocols. Each sample is sorted and weighed separately. The sorting procedure included the following four steps. The material definitions are included in Appendix C. Material Definitions.

- **Step 1: Review methodology and sorting categories with the crew.** To provide consistent sorting, Cascadia uses highly trained crew members throughout the project. Before the sorting begins, all crew members will review the procedures, forms, and material definitions in detail.
- **Step 2: Photograph the Sample.** A member of the field crew will take photographs of the sample using a digital camera. The *Sample Placard* identifying the sample will be positioned to be visible in each photo.
- **Step 3: Sort Sample.** Once the sample is placed on the sorting table, the field crews will sort material by hand into the prescribed material categories into plastic baskets. Individual members of the field crew typically specialize in groups of materials, such as papers or plastics. The crew leads monitor the accuracy of sorting, rejecting materials that are improperly classified.
- **Step 3: Weigh the Sample.** The crew leads verify the purity of each material as it is weighed using a pre-tared scale and records the data on the sample tally sheet or into a cloud-based database on handheld iPads.
- **Step 4: Review Data.** At the conclusion of each sorting day, the crew leads will conduct a quality control review of the data recorded.

Below are photo examples of the sample selection, collection, and sorting process.

Figure 29. Example of Sample Collection for Multifamily and Municipal Sectors

Figure 30. Example of Sample Collection for Commercial Sector

DATA ENTRY AND ANALYSIS

The Cascadia team will analyze the data collected using rigorous QA/QC protocols and the standard statistical procedures used for previous studies. Detailed description of calculations and statistical protocols are in Appendix D. Description of Calculations and Statistical Protocols.

Conduct Data Quality Control and Assurance

Cascadia understands the importance of accurate information and protects data integrity during each step—collection, review, entry, calculation, and analysis. Easy-to-use forms and rigorous data-entry protocols virtually eliminate errors.

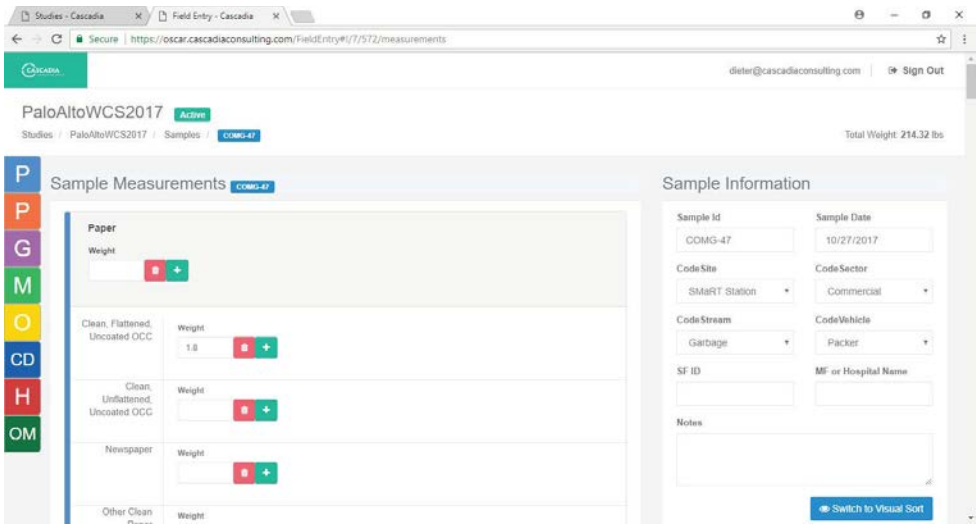
Cascadia's quality assurance/quality control process includes:

- Assigning a unique sample number to each sample, maintaining a chain of custody for sample data as it moves from vehicle selection through data entry.
- Verifying that the Cascadia field crew completes data forms for each sample and reviews them every evening during the study for accuracy.
- Summing sample weights in real time so the Field Manager can confirm achievement of weight targets for every sample.
- The tablet automatically syncs to a cloud storage preventing data loss and reducing transcription errors.
- Encoding the composition analysis formulae so that statistical protocols are consistently applied to different data sets.
- Extensive data entry checks and random proofing to ensure error-free results.

Cascadia will enter data into our customized characterization database and will provide the City with a final accounting of all samples sorted at the conclusion of each sampling event.

A typical data entry screen for our hand-sort characterization data is shown below.

Figure 31. Data Entry Screen for Hand-Sort Characterization



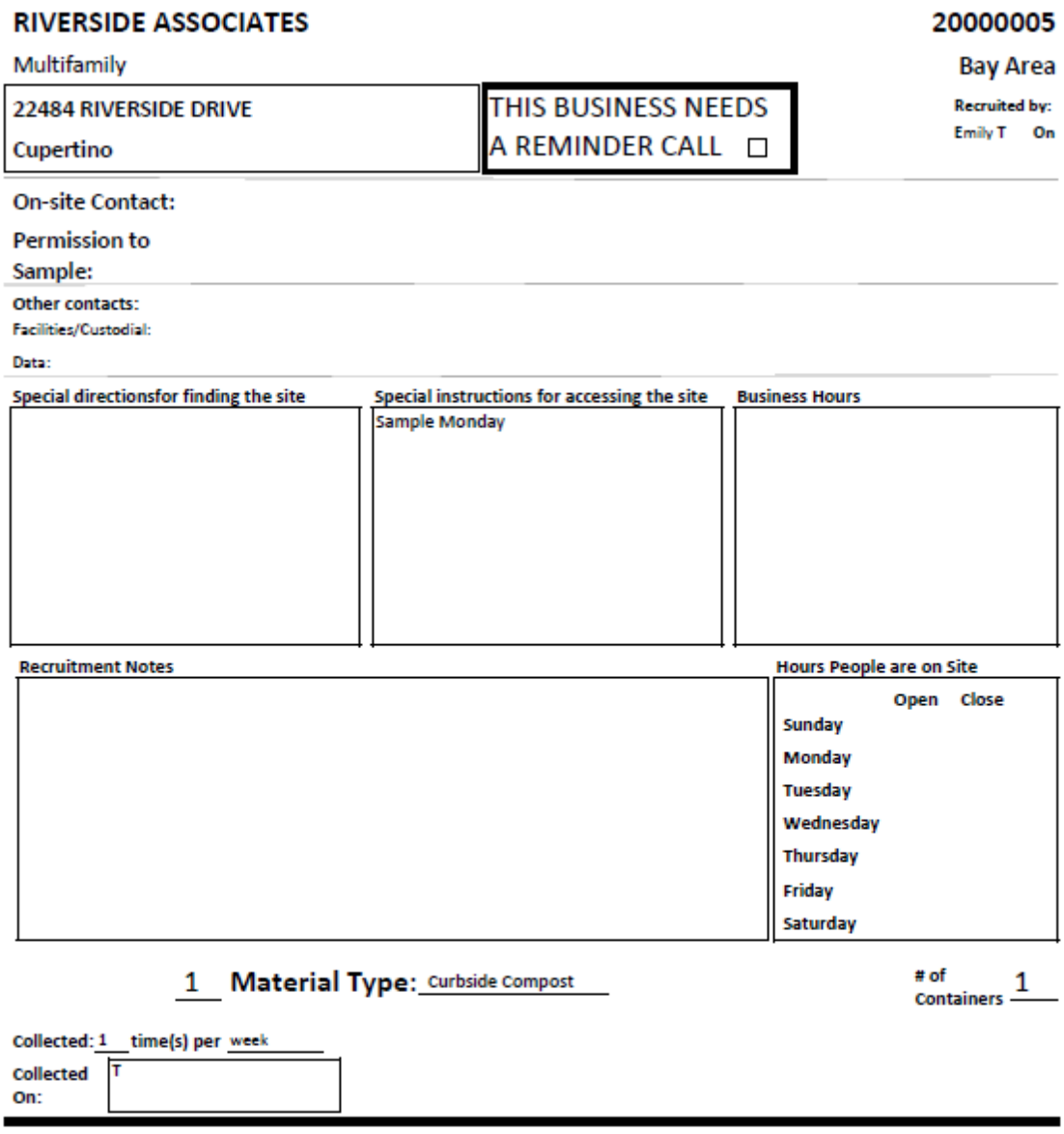
Method for Obtaining Tonnage Data

A complete analysis requires determining the amount of waste from each sector and stream. Cascadia will rely on the City to provide annual and/or monthly tonnage estimates for each sector and stream in the study.

Appendix B. Sample Field Forms

Multifamily and Municipal Sample Collection Forms include property specific service level and contact information for each selected property to support efficient sample collection.

Figure 32. Multifamily and Municipal Sample Collection Forms, Front Page



RIVERSIDE ASSOCIATES **20000005**

Multifamily Bay Area

22484 RIVERSIDE DRIVE
Cupertino

THIS BUSINESS NEEDS A REMINDER CALL ☐

Recruited by: Emily T On

On-site Contact:

Permission to Sample:

Other contacts:
Facilities/Custodial:
Data:

Special directionsfor finding the site	Special instructions for accessing the site	Business Hours
	Sample Monday	

Recruitment Notes

Hours People are on Site

	Open	Close
Sunday		
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		

1 **Material Type:** Curbside Compost # of Containers 1

Collected: 1 time(s) per week

Collected On: T

Figure 33. Multifamily and Municipal Sample Collection Forms, Back Page

Substream # 1 Material Type: Curbside Garbage **Desc. if Other** _____ **# of Containers** 8

Container # 1 Type: cans

Where is the container: _____ Locked? ☐

Special instructions to access the container: _____

Collection is regular

Collected: 1 time(s) per week

Collected On: T

Trash is taken out: _____

If regular, goes out at _____

	Width	Length	Height
Container Volume (inches):			inches
Material volume before sampling (inches):			inches
Material volume after sampling (inches):			inches

Date and time of measurements: _____ Date and time of last pick-up: _____

Container # 2 Type: cans

Where is the container: _____ Locked? ☐

Special instructions to access the container: _____

Collection is regular

Collected: 1 time(s) per week

Collected On: T

Trash is taken out: _____

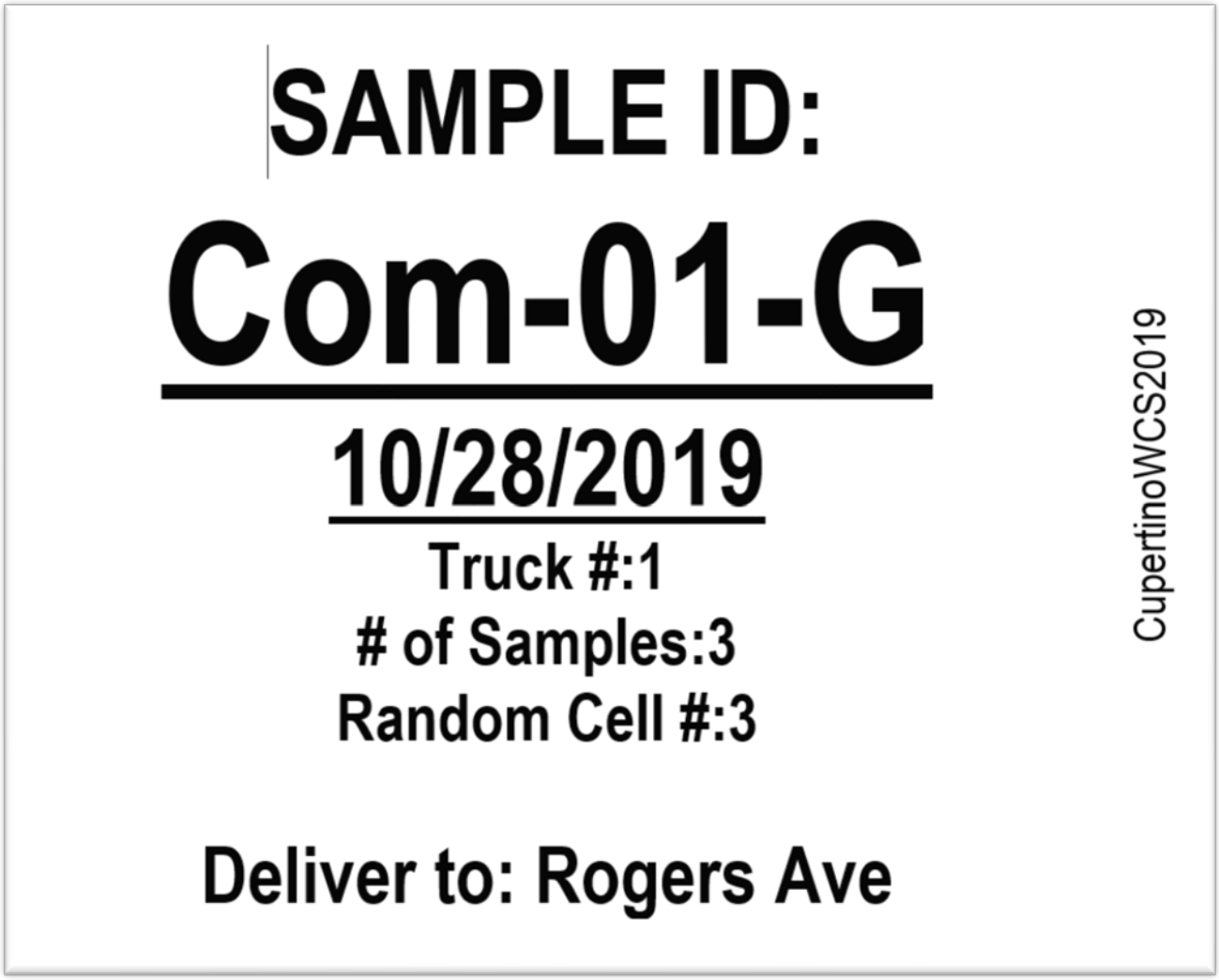
If regular, goes out at _____

	Width	Length	Height
Container Volume (inches):			inches
Material volume before sampling (inches):			inches
Material volume after sampling (inches):			inches

Date and time of measurements: _____ Date and time of last pick-up: _____

Sample Label Placards are brightly colored paper signs with a pre-printed, unique sample number on the front. The field crews placed the placards in every sample so that the crew leads could easily identify and maintain custody over individual samples.

Figure 34. Sample Label Placard



Sample Tally Sheets were used to record the individual material weights after each sample was sorted.

Figure 35. Tally Sheet

2019 City of Cupertino WCS

Facility:	SAMPLE ID:	
Region: City of Cupertino	Date:	Photo ☐

PAPER	Clean Uncoated Corrugated Cardboard				
	Clean Uncoated, Unflattened Corrugated Cardboard				
	Clean Recyclable Paper				
	Clean Coated Paper Products				
	Gable Top Cartons & Aseptics				
	Contaminated Recyclable Paper				
	Paper Tissue & Towels				
	Other Compostable Paper				
	Paper Takeout Containers				
	Coated Paper Cups				
	Pizza Boxes				
	Other Compostable Paper				
METAL	Clean Aluminum Cans & Foil				
	Clean Other Recyclable Metal				
	Contaminated Recyclable Metal				
	Other Metal				
GLASS	Clean Glass Bottles & Jars				
	Contaminated Recyclable Glass Bottles & Jars				
	Other Composite Glass				
OTHER MATERIALS	Other Textiles				
	Carpet				
	Non-Metal Appliances				
	Contruction & Demolition Debris				
	Other Materials				

PLASTIC	#1 PETE Plastic Packaging			
	#2 HDPE Plastic Packaging			
	Other #3-7 Plastic Packaging			
	Clean Recyclable Film Plastic			
	Plastic Takeout Containers			
	Durable Plastic Products			
	Contaminated Recyclable Plastic			
	Expanded #6 Polystyrene Products and Packaging			
	Compostable Plastic			
	Flexible Plastic Pouches			
	Other Compostable Film Plastics			
	Other Plastic			
ORGANICS	Plant Trimmings			
	Untreated Wood			
	Food - Potentially Donatable			
	Food - Non Donatable			
	Inedible Food Scraps			
	Other Compostable Organics			
	Diapers			
	Natural Textiles			
	Animal Feces & Litter			
	Pumpkins			
	Other Organic			
HHW	Electronics			
	Batteries			
	Medicine			
	Other Hazardous Waste			

Appendix C. Material Definitions

PAPER

1. **CLEAN, FLATTENED, UNCOATED CORRUGATED CARDBOARD**: Uncoated boxes, packaging, sheets, and other pieces with a corrugated layer sandwiched between two outer layers that has been flattened to reduce the volume. Examples include shipping boxes and some shoe boxes.
2. **CLEAN, UNFLATTENED, UNCOATED CORRUGATED CARDBOARD**: Uncoated boxes, packaging, sheets, and other pieces with a corrugated layer sandwiched between two outer layers that has **NOT** been flattened to reduce the volume. Examples include shipping boxes and some shoe boxes.
3. **CLEAN RECYCLABLE PAPER**: Paper and paper products recycled curbside, except corrugated cardboard. Includes newspaper, high grade white or colored ledger, paper bags, bond, rag, stationary, office, copy or printing paper, low grade mixed junk mail, envelopes (plastic windows ok), magazines, clay coated glossy catalogs, brochures and pamphlets, hardback and paperback books, spiral notebooks, manila folders, index cards, self-adhesive notes, phonebooks, bagged shredded paper, construction paper, kraft or bleached sheets, toilet paper tubes, non-corrugated box/liner/chip/paper board (e.g., cereal and tissue boxes, six pack holders), egg cartons, tissue wrapping paper, blueprints, and carbonless forms. Minor amounts of glue or other binding are okay.
4. **CLEAN COATED PAPER PRODUCTS**: Paper and paper products that are coated with polyethylene or other non-compostable layers inside and/or outside. Includes fast food wrappers, pizza box liners, butcher paper, and ice cream and other frozen/refrigerated food packaging. This does not include coated corrugated cardboard, items with a gable top, prepared food takeout containers, or paper cups.
5. **GABLE TOP CARTONS & ASEPTICS**: Containers that are poly or wax (not clay) coated inside and/or outside with a gable top such as milk and juice cartons (including those with plastic spouts). Does not include aseptic packaging. Multilayer composite cartons of bleached paper, poly film and foil, such as juice, milk, soup and tofu boxes.
6. **CONTAMINATED RECYCLABLE PAPER**: paper items normally accepted in the curbside recycling program that are too contaminated to be marketed. Examples include ledger paper soaked in coffee, cardboard covered in paint, excessively wet boxboard packaging, etc. Includes loose shredded paper.
7. **PAPER TISSUE & TOWELS**: Paper towels, napkins, tissues, toilet paper, and other short fiber, potentially soiled, paper that is not recyclable, but is compostable. Includes cotton balls, pads, and non-plastic swabs and wipes.
8. **OTHER COMPOSTABLE PAPER**: Uncoated paper not generally accepted in the recycling program that is not tissue & towels, and that can be composted. This includes some paper products with a compostable plastic liner. Examples include: some food-soiled paper plates, french fry containers, and coffee filters. Recyclable paper that was likely soiled in the collection cart should be included in the contaminated recyclable paper category.

9. **PAPER TAKEOUT CONTAINERS:** Rigid paper containers used for serving or transporting single-use, ready to eat, prepared foods from a food service point-of-sale. This material type includes containers that could have been avoided had a customer brought a re-usable food container to the point-of-sale. Example include boxes and clamshells for items from the "hot food" bar or salad bar at a grocery store or deli, "Chinese food" take out cartons, etc. This does not include paper cups or paper wraps (like for a hamburger, deli sandwich, or burrito). This does not include items in paper retail packaging like frozen foods, cereals.
10. **COATED PAPER CUPS**: Cups that are poly, compostable plastic, or wax coated inside and/or outside such as for coffee and other hot drinks or soda and other cold drinks.
11. **PIZZA BOXES:** Boxes used for take-out or delivery of prepared pizza. Includes both clean and soiled boxes.
12. **OTHER COMPOSITE PAPER**: Items predominantly paper, not elsewhere defined, but with one or more other material rendering them hard to recycle or compost, such as orange juice concentrate cans, carbon copy paper, foil laminated paper boxes and gum wrappers, packaging with large plastic windows (blister packs) or integrated foam, cylindrical coffee containers made of paperboard and metal with a plastic lid, and heavily plastic laminated or painted paper.

PLASTIC

13. **CLEAN #1 PETE PLASTIC PACKAGING**: Polyethylene terephthalate (PET) bottles, jars, frozen food trays, retail packaging and other rigid items such as food and beverage containers. This includes clamshells that are not otherwise included in the plastic takeout containers material type, like berry clamshells and four pack muffin clamshells.
14. **CLEAN #2 HDPE PLASTIC PACKAGING**: High-density polyethylene (HDPE) bottles, jars, tubs, lids, and other rigid items such as distilled water, milk, juice, vinegar, yogurt, detergent and empty motor oil or antifreeze containers.
15. **CLEAN OTHER #3-7 PLASTIC PACKAGING**: Polyvinyl chloride (PVC), low-density polyethylene (LDPE), polypropylene (PP), non-expanded styrene (PS), other (#7, various resins) and unlabeled, unidentifiable bottles, jars, tubs, lids, and other rigid items such as some salad dressing, syrup and prescription bottles, CD cases, and auto parts. Items are typically constructed of a single plastic resin and smaller than a basketball.
16. **CLEAN RECYCLABLE FILM PLASTIC**: Single layer clear or colored film without an inner foil or metallic layer accepted in the Cupertino recycling carts. Includes, dry cleaner, newspaper, Ziploc, bread, cracker, tortilla chip, stretch, shrink and bubble wrap, plastic sheeting, frozen food, and clear or colored grocery, department store and other retail and food establishment merchandise and to go bags.
17. **PLASTIC TAKEOUT CONTAINERS:** Rigid plastic containers used for serving or transporting single-use, ready to eat, prepared foods from a food service point-of-sale. This material type includes containers that could have been avoided had a customer brought a re-usable food container to the point-of-sale. Example include boxes and clamshells for items from the "hot food" bar or salad bar at a grocery store or deli, "Chinese food" take out cartons, plastic tubs and bowls from fast food restaurants, etc. This does include plastic to-go cups. This does not include items in plastic retail packaging like frozen foods, microwavable soups, etc.

18. **DURABLE PLASTIC PRODUCTS:** Large, rigid items made predominately from plastic (usually a single resin) and intended for multiple uses. Examples include clothes hangers, buckets, lawn furniture, plastic pipe, and some toys.
19. **CONTAMINATED RECYCLABLE PLASTIC**: plastic items normally accepted in the curbside recycling program that are too contaminated to be marketed. Examples include yogurt tubs containing yogurt residue or milk jugs containing milk.
20. **EXPANDED #6 PRODUCTS AND PACKAGING**: Styrofoam and other expanded polystyrene cups, plates, bowls, clamshells, packaging blocks and peanuts (except compostable ones), insulation, non-corrugated foamcore (Include sandwiched between two layers of paper or plastic) and other rigid items. Does not include food service items that would otherwise be included in the plastic takeout containers material type.
21. **COMPOSTABLE PLASTIC**: Polylactic acid (PLA) and other bags, cups, lids, plates, bowls, clamshells, trays, utensils, and other items labeled "compostable."
22. **FLEXIBLE PLASTIC POUCHES**: means plastic pouches made of thicker, multi-layer flexible material. May have a flat bottom so that package would stand up on its own, but not always. Material is thicker than potato chip bags and frozen vegetable bags. Includes plastic coffee bags like Starbucks and Peet's; Capri Sun pouches; baby food pouches – may have plastic screw top; soup pouches; salad dressing pouches; wine pouches; backpacking meals in pouches; soap refill pouches; laundry detergent pouches; and other similar items.

INCLUDED – THICKER, MULTI-LAYER PACKAGING	EXCLUDED – THINNER, SINGLE-LAYER PACKAGING
Plastic coffee bags (Starbucks and Peet's)	Potato chip bags and similar
Juice pouches (Capri Sun)	Candy wrappers
Baby food pouches – may have plastic screw top	Tortilla bags
Soup pouches	Frozen food bags (vegetables, berries)
Salad dressing pouches	Nut/snack bags
Wine pouches	Shrink plastic wrappers (Slim Jim and string cheese wrappers)
Backpacking meals in pouches	Ziplock bags intended for home use
Soap refill pouches	Thin produce bags as used in grocery stores
Laundry detergent pouches	Newspaper bags
Other similar items	Bread bags
	Small (2 inch) pouches for condiments (mustard, relish, etc.)
	Yogurt tubes (Gogurt)

	Mailing pouches, usually colored or white (not clear) (LL Bean, medication pouches) 100% Plastic mailing pouches with bubble wrap Other similar items

23. **OTHER COMPOSITE FILM PLASTICS:** Items made of multi-layer, multi-material films, typically with a metallic or foil layer. Examples include potato chip bags, candy bar wrappers, energy bar wrappers, and anti-static electronics wrappers.

24. **OTHER PLASTIC**: Items that are predominantly rigid plastic but have more than one type of plastic and/or other materials like metal or film plastics not described elsewhere. Includes toothbrushes, disposable razors, pens, some toys, lighters, vinyl binders, hoses, foil and plastic blister packs (such as for medications), and fiberglass products except insulation. Does not

include appliances or electronics. Includes non-recyclable film like trash bags, condiment pouches, mailing pouches, shower curtain, woven polyethylene (e.g., grain bags, wipes, dryer sheets), and mylar balloons**.**

GLASS

25. **CLEAN GLASS BOTTLES & JARS**: Any container grade glass bottles and jars for water, soda, juice, wine, beer, liquor, vinegar, condiments, pickles, body care, and other products.
26. **CONTAMINATED RECYCLABLE GLASS BOTTLES & JARS**: Glass items normally accepted in the curbside recycling program that are too contaminated to be marketed.
27. **OTHER COMPOSITE GLASS**: Items that are predominantly glass but have other materials like wire mesh or plastic lamination (curved auto windshields, bus shelter and other safety glass), silvering (mirrors), or other components (incandescent and halogen bulbs). Does not include mercury lamps, which go in the *mercury lamps* hazardous category. Items made only of clear or tinted glass that is not container glass. Includes drinking glasses, crystal, and laboratory ware, table tops, or blown glass. Includes tempered or toughened glass (such as flat side or rear window auto glass).

METAL

28. **CLEAN ALUMINUM CANS & FOIL**: Aluminum cans and bi-metal cans made mostly of aluminum (for beverages, pet food, etc.), empty aluminum aerosol cans for hazardous products, all (empty or full) aluminum aerosol cans with non-toxic contents, and aluminum food containers, trays, pie tins and foil.
29. **CLEAN OTHER RECYCLABLE METAL**: Non-ferrous, ferrous, composite, etc. Any other metal not described above.
30. **CONTAMINATED RECYCLABLE METAL**: Metal items normally accepted in the curbside recycling program that are too contaminated to be marketed.
31. **OTHER METAL**: Other items predominately made of metal that are not accepted in the curbside recycling program. Examples include major appliances, window blinds, and car parts.

ORGANIC

32. **PLANT TRIMMINGS**: Prunings and cuttings from bushes, shrubs and trees, and non-woody plant materials including grass clippings, sod, leaves, dead flowers, weeds, loose or rolled tobacco (without filters but including any rolling paper), cork, hemp rope and other plant material. Includes all plant types, and branches, trunks and stumps of any size.
33. **UNTREATED WOOD**: Wood not treated with paint, stain, or other chemical finish. Includes scrap from production of prefabricated wood projects such as wood furniture or cabinets that have not been treated, untreated and unpainted fencing, recyclable demolition wood and untreated or unpainted wood roofing and siding as long as the wood material is not contaminated with another material (i.e. tar). May contain nails or other trace contaminants.
34. **FOOD - POTENTIALLY DONATABLE:** Food products that are in a whole state (i.e. not partially consumed), are unmixed with other food types, and in the original unopened package.

Potentially donatable food includes cooked and uncooked fresh vegetables, fruit, fungi, eggs, dairy, dairy alternatives, uncooked or cooked meat (beef, poultry, pork, lamb), fish, and cooked/baked, prepared perishable items. Examples include mixed fruit salad, whole apple, sliced fruits, sliced vegetables, head of lettuce, unopened package of mushrooms, milk, cheese, eggs, yogurt, soy milk, tofu, whole rotisserie chicken or raw meat in original unopened package, jerky, canned meat or fish, whole tray of lasagna, whole frozen pizza in original unopened package, whole loaves of bread, and whole pastries. Also includes unopened perishable beverages such as fresh fruit or vegetable juice.

35. **FOOD – NON DONATABLE:** Any food not in a whole state (i.e. partially consumed), or not in its original unopened package. Examples include a partially consumed rotisserie chicken, a hamburger, meat trimmings, fruit and vegetable peels, skins, and ends (e.g. banana peels, potato skins, cucumber end), partially consumed lasagna, or a half-eaten burrito. This category also includes any indistinguishable food.

36. **INEDIBLE FOOD SCRAPS:** Items typically not consumed by people in the United States (e.g. bones, pits, shells, coffee grounds, etc.). Note that small amounts of edible material associated with the inedible material are permitted to be included as "inedible." Excludes fruit and vegetable peels, skins, trimmings, and ends.

37. **OTHER COMPOSTABLE ORGANICS**: Includes bagasse foodware and disposable wood utensils, wood stirrers, toothpicks, wood popsicle sticks, candles, compostable packaging peanuts, hair, finger nails, etc.

38. **DIAPERS***:* Diapers made from a combination of fibers, synthetic and/or natural, primarily for single use. Includes disposable baby diapers, adult protective undergarments, feminine hygiene products. Includes diaper and any contents, including human feces not in diapers, etc.

39. **NATURAL TEXTILES:** Items made of thread, yarn, fabric, or cloth from natural materials such as cotton, wool, or silk. Includes clothes, fabric trimmings, curtains, drapes, and linens.

40. **ANIMAL FECES & LITTER**: Any non-human animal feces and litter such as cat feces and kitty litter, dog poop, bird droppings, and horse manure and soiled bedding. Includes soiled paper and other litter materials. Also includes animal carcasses not resulting from food storage or preparation.

41. **MANURE**: Manure and soiled bedding materials from domestic, farm, or ranch animals. Examples include manure and soiled bedding from animal production operations, race tracks, riding stables, animal hospitals, and other sources.

42. **PUMPKINS:** Whole or carved pumpkins and pumpkin stems.

43. **OTHER ORGANIC**: Predominantly organic items that are mixed with non-organic materials and cannot easily be separated for composting.

HAZARDOUS WASTE

44. **ELECTRONICS**: All types of products which include one or more integrated circuits, circuit boards, or "chips" and/or have a visual display greater than (or equal to) four inches on the diagonal. Generally includes anything that can be programmed. Includes televisions, computer monitors, CPUs and computer peripherals, fax machines, stereo equipment, VCRs, some games and toys. Does NOT include items powered by electricity ("plug or battery") if electronic circuitry or a

video display are not present, for example non-robotic vacuum cleaners. Note that there may be products intended for the same use of which some will be electronic waste and some will not – for example, coffeemakers (some just plug in and are switched on manually and some contain chips/boards because they have on/off/grind etc. features which can be programmed).

45. **BATTERIES:** All chemistries, including alkaline batteries, Ni-Cd, Ni-MH, Lithium, Lithium-ion, and small sealed lead acid (SSLA) batteries often used in battery backup units.

46. **MEDICINE**: All medicine intended for human or veterinary use, including prescription and non-prescription (over-the-counter) drugs as well as vitamins and nutritional products.

47. **OTHER HAZARDOUS WASTE:** Paint, mercury lamps, pesticides, cleaning products, motor oil, oil & fuel filters, medical waste, cold packs, and items and materials not fitting into any of the other hazardous categories but which meet California's hazardous waste characteristic descriptions for ignitability, corrosivity, reactivity, or toxicity. Includes lab chemicals, solvents (paint thinner, nail polish & nail polish remover), mercury thermometers & thermostats, adhesives, glues, fuel, non-empty and pressurized gas canisters and cylinders, antifreeze, asbestos containing material, ammunition, writing and printing ink, hair dye. Does NOT typically include cosmetics or personal care products. Includes empty containers which previously contained a hazardous material.

OTHER MATERIALS

48. **OTHER TEXTILES:** Other items made of thread, yard, fabric, or cloth from synthetic materials such as rayon or polyester. Also includes items made of natural or synthetic leather such as shoes, handbags, and belts.

49. **CARPET**: Flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. This type does not include carpet padding or woven rugs with no backing.

50. **NON-METAL APPLIANCES**: Multi-material electric analog (not digital, no chips) appliances, primarily plastic, such as old toasters, power tools, curling irons, light fixtures, clocks and dial telephones

51. **CONSTRUCTION AND DEMOLITION DEBRIS:** Includes painted and treated wood; inerts; gypsum; roofing; C&D glass, and other construction & demolitions related items.

52. **OTHER MATERIALS**: All remaining, generally multi-material composite or indistinct items not elsewhere defined. Examples include items less than 2" in diameter on any side, whole filtered cigarettes and cigarette butts, dryer lint, tires, rubber, and personal care products (shampoo, cosmetics, soaps, toothpaste, etc.).

Appendix D. Description of Calculations and Statistical Protocols

Using the statistical methods that we helped to develop and have used in material characterization studies nationwide, Cascadia calculated detailed estimates of composition and quantities. All estimates are presented along with statistical error and confidence intervals at the industry standard 90% confidence level. The waste composition formulae that Cascadia used appears below.

Waste Composition Calculations

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

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

where:

r = ratio of components' weight to the total sample weight
c = weight of particular component
w = sum of all component weights
for i 1 to n, where n = number of selected samples
for j 1 to m, where m = number of components

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

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

where:

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

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

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

where:

t = the value of the t-statistic (1.645) corresponding to a 90% confidence level (or 1.960 at a 95% confidence level).

Appendix E. List of City Facilities

		Garbage		Recycle*		Organics**	
Site	Address	Service/Bins Available?	Bins Used?	Service/Bins Available?	Bins Used?	Service/Bins Available?	Bins Used?
Blackberry Farm	21975 San Fernando Avenue	Y	Y	Y	Y	Y	Y
City Hall	10300 Torree Avenue	Y	Y	Y	Y	Y	Y
Corporation Yard - Franco Court	10981 Franco Court	Y	Y	N	N	N	N
Corporation Yard - Mary Avenue	10555 Mary Avenue	Y	Y	Y	Y	Y	Y
McClellan Ranch Preserve	22221 McClellan Road	Y	Y	Y	Y/N	Y	Y
Quinlan Community Center	10185 Stelling Road North	Y	Y	Y	Y	Y	Y
Senior Center	21251 Stevens Creek Boulevard	Y	Y	Y	Y	Y	Y
Sports Center	21111 Stevens Creek Boulevard	Y	Y	Y	Y	Y	Y

*Some municipal sites were visited for sample collection multiple times. McClellan Ranch Preserve had recycling bins during the first visit but not during the second visit. The Corporation Yard on Franco Court did not have recycle collection bins during any visit nor did the service data indicate this site ever had these services.

**The Corporation Yard on Franco Court did not have organics collection bins during any visit nor did the service data indicate this site ever had these services.