



CITY OF PHOENIX RESIDENTIAL WASTE CHARACTERIZATION STUDY 2017-2018 FINAL REPORT



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1. Executive Summary

INTRODUCTION AND OBJECTIVE

Increasing waste diversion is a high priority for the City of Phoenix: in 2013, Mayor Stanton announced his goal to achieve a 40 percent landfill diversion rate by 2020. Since then, the City has undertaken many important initiatives to support progress toward this goal, including:

- Establishing the “Save as You Reduce and Recycle” program, a volume-based pricing structure for garbage service.
- Establishing the Green Organics curbside collection program, now available to almost 40 percent of households in the city.
- Launching the “Reimagine Phoenix” residential education and outreach campaign, including the introduction of the Recyclebank program in 2017.

In 2014-2015, the City of Phoenix also took an important step on the path to increasing waste diversion by performing a comprehensive analysis of the composition of Phoenix’s residential waste stream. The results from that study were used to inform the development of many of the new programs and initiatives implemented since then.

This 2017-2018 Residential Waste Characterization Study is an update to that study. The methodology, analysis, and reporting of this study mirrors the 2014-15 study.

The results from this study can be used to help the City understand how the residential waste stream has changed since completion of the previous study and support further development and implementation of diversion policies, programs, and technology moving forward.

PROJECT OVERVIEW

This study mirrors the 2014-15 study design and includes characterization of the following two substreams:

- **City Collected Residential Garbage** – Garbage generated by single family residences located within the City of Phoenix. City collection vehicles collect these materials at the curb or in the alley.
- **City Collected Residential Recycling** – Recycling generated by single family residences located within the City of Phoenix. City collection vehicles collect these materials at the curb or in the alley.

These two substreams do not represent the full universe of residential waste generated by single-family residences located within the City of Phoenix. Specifically, two additional substreams collected by Phoenix Public Works—Bulk Trash and Green Organics—are not included in this study.

Prior to beginning fieldwork, Cascadia staff met with City staff, transfer station staff, and hauler representatives to plan and coordinate study logistics such as space at the transfer stations, vehicle selection strategies, and assistance from facility staff. The field crew sorted the disposed and recycled samples into 84 unique material types, divided among nine material classes. The material types and classes mirror those used in the 2014-15 study.

Cascadia pre-selected random residential garbage and recycling routes for sampling using route data provided by the City. Field crew staff photographed each sample, hand sorted the material into 84 different material types, and recorded the weight for each sorted material type. The average garbage sample weight was 225 pounds and the average recycling sample weight was 132 pounds. In the 2014-15 study, the average garbage sample weighed 217 pounds, and the average recycling sample weight was 136 pounds. The samples goals and actual samples sorted are summarized in Table 1. As shown, the citywide garbage and recycling targets were met.

Table 1. Sampling Goals and Actual Sample Counts

		Season 1		Season 2		Total	
Substream	Bid Area	Goal	Actual	Goal	Actual	Goal	Actual
Garbage	A	13	13	13	13	26	26
Garbage	B	13	13	13	13	26	26
Garbage	C	13	13	13	13	26	26
Garbage	D	13	13	13	13	26	26
Garbage	E	13	13	13	13	26	26
Garbage	F	13	13	13	13	26	26
Garbage	G	13	13	13	13	26	26
Garbage	H	13	13	13	13	26	26
Garbage	I	13	13	13	13	26	26
Garbage	J	13	13	13	13	26	26
Garbage Subtotal		130	130	130	130	260	260
Recycle	A	10	10	10	10	20	20
Recycle	B	10	10	10	10	20	20
Recycle	C	10	10	10	10	20	20
Recycle	D	10	10	10	10	20	20
Recycle	E	10	10	10	10	20	20
Recycle	F	10	10	10	10	20	20
Recycle	G	10	10	10	10	20	20
Recycle	H	10	10	10	10	20	20
Recycle	I	10	10	10	10	20	20
Recycle	J	10	10	10	10	20	20
Recycle Subtotal		100	100	100	100	200	200
Total		230	230	230	230	460	460

SUMMARY OF FINDINGS

Cascadia analyzed the data from both seasons of field work to estimate the composition of residential garbage and recycling for each bid area and citywide. To quantify diversion opportunities, the project team grouped material types according to their recoverability, using four recoverability groups:

- **Curbside Recycle**—Materials for which recycling technologies, programs, and markets are well developed and readily available. These materials are **accepted in the current curbside program**.

- **All Compostables**—Organic materials typically accepted for use in commercial compost systems in other areas, even if not currently accepted in the City of Phoenix Green Organics program. Examples include *compostable yard waste* and *food waste*.
- **Other Recoverable**—Materials for which recycling technologies, programs, and markets exist, but are not well developed and are **not part of the curbside recycle program**. Third parties frequently recycle these materials through drop-off recycling programs. Examples include *grocery/merchandise bags*, and *batteries*.
- **Non-recoverable**—**Trash and garbage** materials that are not readily recyclable or face other market-related barriers to diversion. Examples include *garbage bags*, *disposable diapers*, and *treated wood*.

Each material type was assigned to one of the recoverability groups based on the definitions listed above. Appendix A: Material Type Definitions shows how material types were categorized into each recoverability group. Detailed composition tables for each substream, bid area, and citywide are presented in Appendix D: Detailed Composition Results by Bid Area.

When interpreting the results presented in the tables and figures in this report, it is important to consider the effect of rounding. Estimated tonnages are rounded to the nearest tenth of ton, and estimated percentages are rounded to the nearest hundredth of a percent. Tonnage subtotals and totals are rounded to the nearest ton. Percentage subtotals are rounded to the nearest tenth of a percent and totals to the nearest 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.

CITYWIDE GARBAGE FINDINGS

The composition of residential garbage at the citywide level is summarized in Figure 1 and Table 2. This composition data is based on 260 hand sorted samples. Tables in this section aggregate the 84 material types included in field sorting into 25 condensed material categories designed to showcase the curbside recyclables and compostable materials remaining in the garbage and to make the tables more readable when comparing the results between bid areas. See the *Garbage Summary Material List* in Appendix A: Material Type Definitions.

Many, but not all, materials in the construction and demolition (C&D) category are included in the Other Recoverable group (the purple slice of the pie in Figure 1). However, the Other Recoverable slice of the pie is greater than the sum of the purple rows in Table 2 because the C&D materials are not listed individually. Due to rounding in the tables, sums may not exactly match subtotals and totals shown.

Key findings for the citywide garbage substream include:

- ▶ Approximately 60% of the residential garbage consists of material that could be diverted through curbside recycling and composting programs (if all compostables, including food waste, were accepted).
- ▶ More than 77,400 tons of material that could be recycled through the existing curbside recycling collection program is being disposed annually. This is approximately 18% of disposed residential garbage.
- ▶ Leaves and grass (17.08%), purchased food (11.24%), and compostable/food-soiled paper (6.05%) are the three most prevalent disposed materials by weight. Combined, they account for over one-third (34.38%) of disposed residential garbage (see Table 7. Ten Most Prevalent Material Types, Citywide Garbage in the full report for details).

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- ▶ More than half of residential disposed garbage could be diverted through curbside recycling and composting programs (if all compostables, including food waste, were included) in every bid area and citywide (see Figure 2). Across bid areas, between 14% and 26% of residential garbage is recyclable and between 34% and 52% is compostable.

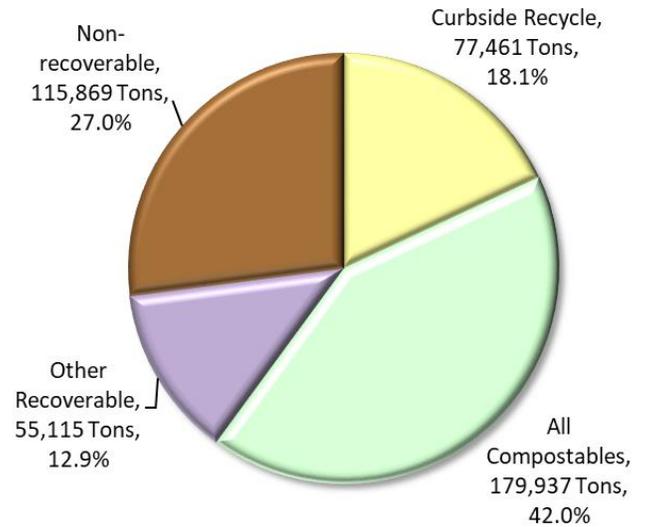
Table 2. Citywide Garbage Summary Composition

Material	Citywide	
	%	Est. Tons
Paper	16.0%	68,440
Newspaper	0.77%	3,316.3
Unwaxed OCC / Kraft paper	2.38%	10,209.3
Other recyclable paper	5.35%	22,930.9
Compostable paper	6.07%	26,013.0
Other paper	1.39%	5,971.0
Plastic	11.4%	48,900
PET (#1) plastic	1.21%	5,188.0
HDPE (#2) plastic	0.86%	3,696.7
Other recyclable plastic	3.63%	15,531.6
Compostable plastic	0.01%	44.9
Clean plastic film (grocery sacks)	0.79%	3,374.4
Other plastic film	3.47%	14,853.7
Expanded polystyrene	0.64%	2,734.8
Other plastic	0.81%	3,475.7
Glass	1.8%	7,773
Recyclable glass	1.60%	6,843.2
Other glass	0.22%	930.0
Metal	3.8%	16,134
Aluminum cans	0.24%	1,008.6
Tin/steel food cans	0.54%	2,297.0
Other recyclable metals	1.50%	6,439.7
Other metals	1.49%	6,389.0
Organic	38.7%	165,683
Compostable yard waste	22.03%	94,362.4
Food waste	13.89%	59,516.6
Non-compostable organic	2.76%	11,803.8
Construction and demolition waste	6.8%	28,982
Household hazardous waste	0.6%	2,628
Other materials	21.0%	89,842
Subtotal Curbside Recycle	18.1%	77,461
Subtotal Compostable	42.0%	179,937
Total	100.0%	428,382

Key: Curbside Recycle Compostable
 Other Recoverable Non-recoverable

Due to rounding in the tables, sums may not exactly match subtotals and totals shown.

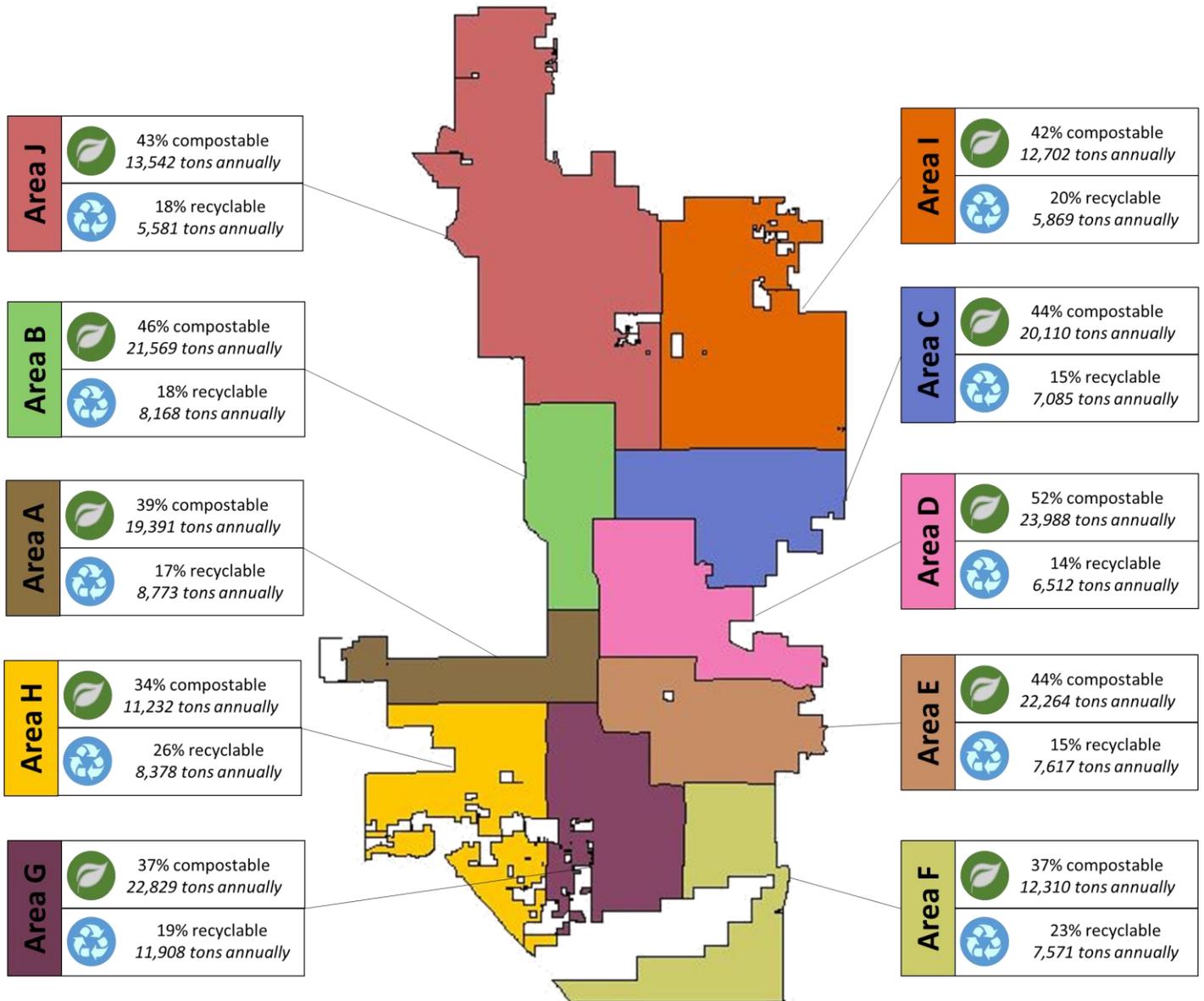
Figure 1. Citywide Garbage Recoverability



Due to rounding in this figure, sums may not exactly match subtotals and totals shown

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Figure 2. Summary of Recoverability by Bid Area, Citywide Garbage



CITYWIDE RECYCLING FINDINGS

The recycling composition data is based on 200 hand sorted samples. Tables in this section aggregate the 84 material types using during field sorting into 21 condensed material categories designed to showcase the acceptable and contaminant materials in the recycling substream and to make the tables more readable when comparing the results between bid areas. See the *Recycling Summary Material List* in Appendix A: Material Type Definitions.

Many, but not all, materials in the construction and demolition (C&D) category are included in the Other Recoverable group (the purple slice of the pie in Figure 3). However, the Other Recoverable slice of the pie is greater than the sum of the purple rows in Table 3 because the C&D materials are not listed individually. Due to rounding in the tables, sums may not exactly match subtotals and totals shown.

The composition of residential recycling at the citywide level is summarized by recoverability group in Figure 3. The three most prevalent materials by weight are *mixed low-grade paper* (19.32%), *plain OCC/kraft paper* (14.81%), and *glass beverage containers* (9.55%). Combined, they account for nearly half (43.68%) of the material collected for recycling.

Approximately 30.5% of the recycling substream is contaminant materials. Citywide, the five most prevalent contaminant material types by weight are:

- ▶ *Non-distinct fines* (8.95%, 10,650 tons). This is material smaller than 2" in diameter including dirt, broken glass, bottle caps, loose shredded paper, and small pieces of food.
- ▶ *Purchased food*, (2.84%, 3,380 tons). This includes most home food waste such as peels, bones, and unconsumed edible food.
- ▶ *Compostable/Food-soiled paper* (2.15%, 2,556 tons). This includes paper towels, paper plates, waxed paper, tissues, and other paper products without a plastic coating. The items may be food soiled.
- ▶ *Textiles* (2.05%, 2,436 tons). This includes items mostly made of natural or synthetic fabrics such as pants, shirts, bed sheets, curtains, and towels. This does not include leather items.
- ▶ *Paper/Other materials* (1.48%, 1,764 tons). This includes items made predominantly of paper but with other materials attached (e.g. orange juice cans and spiral notebooks) and other hard-to-recycle paper items such as carbon copy paper, hardcover books, and photographs.

The citywide recycling composition is summarized in Table 3. Due to rounding in the tables, sums may not exactly match subtotals and totals shown.

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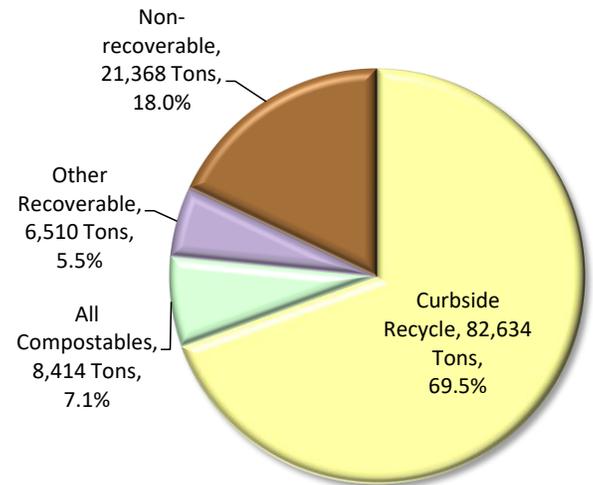
Table 3. Citywide Recycling Summary Composition

Material	Citywide	
	%	Est. Tons
Paper	48.4%	57,533
Newspaper	7.81%	9,291.9
Unwaxed OCC / Kraft paper	14.81%	17,614.4
Other recyclable paper	22.10%	26,278.3
Other paper	3.66%	4,348.1
Plastic	14.6%	17,310
PET (#1) plastic	4.59%	5,462.0
HDPE (#2) plastic	2.61%	3,105.9
Other recyclable plastic	3.76%	4,466.8
Clean plastic film (grocery sacks)	0.60%	715.3
Other plastic film	1.83%	2,179.1
Expanded polystyrene	0.42%	504.9
Other plastic	0.74%	875.5
Glass	9.9%	11,814
Recyclable glass	9.55%	11,355.4
Other glass	0.39%	458.4
Metal	5.2%	6,243
Aluminum cans	1.15%	1,372.6
Tin/steel food cans	1.37%	1,631.1
Other recyclable metals	1.73%	2,055.7
Other metals	1.00%	1,183.8
Organic	5.0%	5,934
Construction and demolition waste	1.7%	2,007
Household hazardous waste	0.4%	484
Other materials	14.8%	17,602
Subtotal Curbside Recycle	69.5%	82,634
Subtotal Contaminants	30.5%	36,292
Total	100.0%	118,926

Key: Curbside Recycle Compostable
 Other Recoverable Non-recoverable

Due to rounding in the tables, sums may not exactly match subtotals and totals shown. Many, but not all, materials in the C&D category are included in the other recoverable group

Figure 3. Citywide Recycling Recoverability



Due to rounding in this figure, sums may not exactly match subtotals and totals shown

Contaminants in the Recycling

Citywide, the recycling contamination rate is approximately 30.5% (rounded to 31% in Table 4). Across bid areas, the recycling contamination rate ranges from a low of 21% in Area I to a high of 43% in Area H. Table 4 also notes the five most prevalent contaminant material types by weight in each bid area and citywide. *Non-distinct fines* and *purchased food* are in the top five in every bid area; Citywide, they are the two most prevalent contaminants. *Compostable/food soiled paper* and *textiles* are top contaminants in seven of the ten bid areas and citywide. *Paper/other materials* and *other plastic film* are top contaminants in four bid areas, and *demo gypsum scrap* is a top contaminant in two bid areas. *Leaves and grass*, *beverages and food liquids*, *plastic/other materials*, *carpet upholstery*, *disposal diapers*, and *contaminated wood* are each top contaminants in one bid area (Areas G, E, J, I, H, and F, respectively). The top five contaminants represent between 12% and 29% of the recycling stream in each bid area. The contamination rate in each bid area is further summarized in Figure 4. Due to rounding in the table, sums may not exactly match subtotals and totals shown.

Table 4. Acceptable and Contaminant Materials by Bid Area, Citywide Recycling

	Bid Area Composition										Citywide
	A	B	C	D	E	F	G	H	I	J	Composition
Recyclable	59%	77%	73%	76%	66%	73%	59%	57%	79%	74%	69%
Recyclable papers	33.4%	52.3%	48.4%	48.0%	40.3%	49.1%	35.0%	35.1%	52.6%	50.6%	44.7%
Recyclable plastics	12.9%	12.4%	9.9%	9.9%	9.8%	10.8%	10.3%	11.7%	10.9%	10.9%	11.0%
Recyclable glass	7.5%	8.3%	10.8%	14.4%	12.9%	8.7%	8.5%	7.0%	10.3%	6.7%	9.5%
Recyclable metals	5.5%	3.5%	4.0%	3.9%	3.1%	4.5%	4.9%	3.4%	4.7%	5.3%	4.3%
Common Contaminants											
Non-distinct Fines	11%	6%	8%	5%	13%	9%	11%	12%	8%	6%	9%
Purchased Food	6%	2%	2%	3%	3%	2%	4%	4%	1%	2%	3%
Compostable/Food Soiled Paper	3%		2%	2%	2%		3%	4%	1%		2%
Textiles	3%	2%			3%	2%	3%	4%		2%	2%
Paper/other materials		2%		1%		2%			1%		1%
Other Plastic Film	2%	1%	1%	1%							
Demo Gypsum Scrap			2%								2%
Leaves and grass							3%				
Beverages and Food Liquids					1%						
Plastic/other materials											2%
Carpet/upholstery									1%		
Disposable diapers								4%			
Contaminated wood						2%					
Sum of Top Five Contaminants	25%	13%	16%	12%	23%	16%	25%	29%	13%	14%	17%
All Other Contaminants	16%	11%	11%	12%	11%	11%	16%	14%	8%	13%	13%
Total Contaminants	41%	23%	27%	24%	34%	27%	41%	43%	21%	26%	31%
Total Composition	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Key: ■ Curbside Recycle ■ Compostable ■ Other Recoverable ■ Non-recoverable

Due to rounding in the tables, sums may not exactly match subtotals and totals shown.

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Figure 4. Summary of Contamination Rate by Bid Area, Citywide Recycling

