



DRAFT
Waste Generation
Report







1.0 Introduction and Summary

1.1 Introduction

The Waste Quantities and Projections Report forecasts waste generation over a twenty-two-year period (2019 – 2040) and was prepared as part of the City of Houston’s (City) overall Integrated Resource Recovery & Management Plan (Plan). As a starting point, the Project Team utilized the methodology developed for the Houston-Galveston Area Council’s (H-GAC) solid waste generation and diversion forecast, completed in November 2017, by NewGen Strategies & Solutions (“A Municipal Solid Waste Generation and Diversion Forecast for the H-GAC Planning Region”), which is referred to as the 2017 H-GAC Study in this report. The data sources utilized in this analysis, however, were updated using data provided by H-GAC, which is consistent with the data sources used by the City of Houston’s Planning and Development Department. The analysis by the Project Team also relies upon tonnage data provided by the City’s Solid Waste Management Department.

1.2 Purpose

The purpose of this analysis is to forecast waste generation quantities for the following residential and commercial waste streams:

- Municipal Solid Waste
- Organics
- Recyclables
- Construction & Demolition (C&D) Waste

The waste generation methodology includes taking the existing waste generation rates, and then projecting the future amounts of each commodity to be generated annually. The projections are based on current and future trends analyzed from H-GAC’s comprehensive data sets, which include forecasts for the City of Houston’s population, household, and employment.

2.0 Data Sources

The 2017 H-GAC Study relied on data published in the “2016 Regional Water Plan” by the Texas Water Development Board (TWDB). TWDB population projections are available in ten-year increments beginning in 2020 and based on 2010 U.S. Census data. The determination of single-family and multi-family housing allocations is based on data from the U.S. Census Bureau: “2015 American Community Survey (ACS) Housing Estimates.”

The City of Houston’s Planning and Development Department, however, utilizes data published by H-GAC’s Socioeconomic Modeling Division for forecasting population and employment. H-GAC’s data is generated from analyses and econometric modeling regarding population, households, and employment, and are considerably more detailed than TWDB’s projections.¹ Therefore, the waste forecast in this analysis uses H-GAC’s population, households, and employment forecasts for population, households, and employment which are available in five-year increments. The H-GAC forecasts are developed in three steps:

1. Forecast the total number of people and households in the City.
2. Forecast the total number of jobs.
3. Use the H-GAC macroeconomic model to forecast expected growth in households and jobs based on the location, type, and size of residential and non-residential development in the City of Houston.

H-GAC’s five-year incremental projections are the basis for calculating the compound annual growth rates (CAGR) during each five-year increment for population, household, and employment forecasts.

2.1 Population

H-GAC’s demographic model recognizes that population, over a period of time, is derived from either the addition or removal of residents, as compared with a prior time period. An increase in population is from births and from the migration of people from other regions; a decrease in population is from deaths and the out-migration of local residents to other regions. The H-GAC demographic model considers all four of these processes in forecasting population and utilizes a computer simulation which forecasts the

¹ Because TWDB forecasts population for the entire state, they are limited in the amount of detailed analysis they can conduct for individual cities.



“probabilistic approach to imitate both biologic events (dying, giving birth) and social events (marriage, divorce, migrating in or out of the area) for the forecasting of population and household growth.”²

Table 2-1 summarizes population projections for the City of Houston using H-GAC’s forecast.

**Table 2-1
City of Houston
Population Forecast**

	2019	2020	2025	2030	2035	2040
Population						
Single-Family	1,313,556	1,316,795	1,336,256	1,362,049	1,383,652	1,395,743
Multi-Family	1,070,119	1,090,697	1,199,631	1,326,114	1,503,522	1,649,287
Total Population	2,383,675	2,407,492	2,535,887	2,688,163	2,887,174	3,045,030

The compounded annual growth rates applied in each 5-year increment of the population forecast are noted below:

- 2015 – 2020: 1.00%
- 2020 – 2025: 1.04%
- 2025 – 2030: 1.17%
- 2030 – 2035: 1.44%
- 2035 – 2040: 1.07%

As a point of reference, the City of Houston’s population in 2000 was 1,953,631 (2000 U.S. Census Bureau).

2.2 Households

H-GAC estimates the annual demand for housing units and non-residential space based on the forecasted change in the number of households and jobs. H-GAC also projects the future percentage of single-family and multi-family housing units (both current and future construction). For instance, the percentage of multi-family housing is projected to increase in future years, as a percentage of total housing units. Currently, the ratio between single-family (SF) and multi-family (MF) housing is approximately 50% SF and 50% MF; however, H-GAC predicts that housing will be reflective of a 40% SF and 60% MF ratio for the City of Houston by 2040.

Table 2-2 summarizes household projections for the City of Houston using H-GAC’s forecast.

**Table 2-2
City of Houston
Household Forecast**

	2019	2020	2025	2030	2035	2040
Households						
Single-Family	462,736	464,696	474,620	484,756	495,109	505,683
Multi-Family	478,538	488,601	540,884	599,117	682,942	758,524
Total Households	941,274	953,297	1,015,504	1,083,873	1,178,051	1,264,207

The compounded annual growth rates applied for each 5-year increment of the total household forecast are noted below:

- 2015 – 2020: 1.28%

² “A Brief Overview of H-GAC’s Regional Forecast Methodology.” November 8, 2017.



- 2020 – 2025: 1.27%
- 2025 – 2030: 1.31%
- 2030 – 2035: 1.68%
- 2035 – 2040: 1.42%

2.3 Employment

H-GAC forecasts employment based on residential population, the unemployment rate, and a third parameter that controls labor force participation (i.e. age, disability, family responsibilities, etc.). In the base year of the forecast (2015), jobs were linked to specific locations (i.e. individual buildings) by matching companies and parcel addresses. H-GAC additionally utilizes a Real Estate Development Model to generate forecasts associating specific construction projects to specific parcels of land, given the physical availability of land, as well as the economic feasibility of each construction project in forecasting future employment.

Table 2-3 summarizes employment projections for the City of Houston using H-GAC’s forecast.

**Table 2-3
City of Houston
Employment Forecast**

	2019	2020	2025	2030	2035	2040
Employment	1,882,233	1,903,278	2,037,272	2,187,204	2,306,186	2,368,224

The compounded annual growth rates applied for each 5-year increment of the employment forecast are noted below:

- 2015 – 2020: 1.12%
- 2020 – 2025: 1.37%
- 2025 – 2030: 1.43%
- 2030 – 2035: 1.07%
- 2035 – 2040: 0.53%

3.0 Disposal Forecast

It is important to recognize that a portion of the City’s single-family household population is not currently served by the City’s Solid Waste Management Department. The number of single-family households served by the City’s Solid Waste Management Department are identified in Table 3-1.³ Waste generation tonnage (i.e. garbage, bulky waste, yard waste, and recycling) collected by the City of Houston Solid Waste Management Department was provided for FY 2016 through FY 2018 and is summarized in Table 3-1.

³ Approximately 84% of all single-family households located within the City of Houston are currently served by the City’s Solid Waste Management Department. The remaining 16% are collected through subscription services.



**Table 3-1
City of Houston
Single-Family Waste Generation¹**

	FY 2016 ²	FY 2017	FY 2018 ³
# of Single-Family (SF) Households Served	386,232	386,531	386,830
SF Garbage (tons/year)	385,660	431,717	445,397
SF Bulky Waste (tons/year)	287,064	174,742	195,829
SF Yard Waste (tons/year)	54,479	54,569	30,612
SF Recycling (tons/year)	62,287	51,497	36,595

1. This is tonnage that is collected by the City of Houston Solid Waste Management Department.
2. FY 2016 metrics, from the 2017 H-GAC Study, concerning the number of single-family homes and curbside recycling tonnage were modified slightly based on more accurate data that was provided by the City as part of this report.
3. The recycling and yard waste tonnage decreased in FY 2018 due to Hurricane Harvey and the City of Houston having to suspend these specific collection services for several months to focus on debris clean up.

The Project Team's analysis forecasts waste disposal using *total* population metrics, and it is therefore necessary to determine the single-family *population* served by the City's Solid Waste Management Department. Table 3-2 estimates the single-family *population* served by the City's Solid Waste Management Department for FY 2016, FY 2017, and FY 2018. This estimate is based on data provided by H-GAC and U.S. Census data.

**Table 3-2
Single-Family Population
Served by the City of Houston Solid Waste Management Department**

	2016	2017	2018
SF Population Served the City	1,089,544	1,095,066	1,100,014

Table 3-3 identifies the City's single-family per capita rates for both disposal and diversion. Due to slight differences in population and household forecasts between H-GAC's current forecast and NewGen's 2017 H-GAC Study, the FY 2016 per capita calculations for the City are adjusted slightly downward from those noted in the 2017 H-GAC Study. It is also worthwhile to note that after Hurricane Harvey impacted the City in August 2017 (FY 2018), the City of Houston's Solid Waste Management Department briefly suspended curbside collection of yard waste, and single-stream recycling. As such, the per capita metrics for FY 2018 were not representative of a typical year, and the per capita ratios used to forecast waste disposal for FY 2019 – FY 2040 are based on the averages of FY 2016 and FY 2017.

**Table 3-3
Single-Family Per-Capita Disposal and Diversion
(Tons/Person/Year)¹**

	FY 2016 Per Capita	FY 2017 Per Capita	FY 2018 Per Capita	Average per Capita ²
SF Disposal				
SF Garbage	0.3540	0.3942	0.4049	0.3741



	FY 2016 Per Capita	FY 2017 Per Capita	FY 2018 Per Capita	Average per Capita ²
SF Disposal				
SF Bulky Waste	0.2635	0.1596	0.1780	0.2115
SF Disposal	0.6175	0.5538	0.5829	0.5856
SF Diversion				
SF Recycling	0.0572	0.0470	0.0333	0.0521
SF Yard & Wood Waste	0.0500	0.0498	0.0278	0.0499
SF Diversion	0.1072	0.0968	0.0611	0.1020
Total Generation	0.7247	0.6506	0.6440	0.6876

1. Example: 385,660 tons (Table 3-1, 2016, Single-Family Garbage) / 1,089,544 SF Population (Table 3-2) = 0.3540 tons per person per year
2. The average per capita generation rates used to forecast waste disposal in this analysis are based on the averages of FY 2016 & FY 2017.

3.1 Residential Disposal Forecast

The single-family waste disposal forecast for 2019 to 2040 is based on the calculated disposal rates and single family population forecasts. The per capita disposal rate is held constant for the entire forecast, which is a similar approach utilized in the 2017 H-GAC Study. Due to limitations in the availability of multi-family specific data, the same per capita disposal rate for single-family and multi-family units were used. This is a conservative approach that is also consistent with the approach used in the 2017 H-GAC Study.⁴ Table 3-4 summarizes the single-family and multi-family residential waste disposal for the City of Houston.

**Table 3-4
City of Houston
Residential Disposal Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
Residential Disposal						
Single-Family	769,218	771,115	782,512	797,616	810,267	817,347
Multi-Family	626,662	638,712	702,504	776,572	880,462	965,823
Total Residential Disposal	1,395,880	1,409,827	1,485,016	1,574,188	1,690,729	1,783,170

3.2 Commercial Disposal Forecast

The commercial disposal forecast for the City of Houston is based on an average annual disposal rate of 1.51 tons per employee. This is then applied to the employment forecast identified in Table 2-3. This metric was derived from the 2017 H-GAC Study and is

⁴ Some studies assume that multi-family households generate less waste for disposal, on a per capita basis versus single-family households. One of the reasons for making this assumption is the belief that single-family households generate more yard waste than multi-family households for disposal. However, since the City of Houston has an active yard waste and wood waste collection and diversion program, the vast majority of yard waste and wood waste collected from single-family homes is processed at Living Earth (and turned into compost or mulch). In addition, because multi-family households often have limited access to recycling programs, many of the materials that are recycled by single-family households are oftentimes disposed of by multi-family households, thus increasing the multi-family disposal rate. For these reasons, it is assumed that the single-family and multi-family per capita disposal rate is the same.



consistent with other studies that evaluate disposal rates on a per employee basis. The disposal rate was assumed to be constant for the entire 2019 – 2040 forecast. Table 3-5 summarizes the commercial disposal forecast for the City of Houston.

**Table 3-5
City of Houston
Commercial Disposal Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
Commercial Disposal	2,842,172	2,873,950	3,076,281	3,302,678	3,482,341	3,576,018

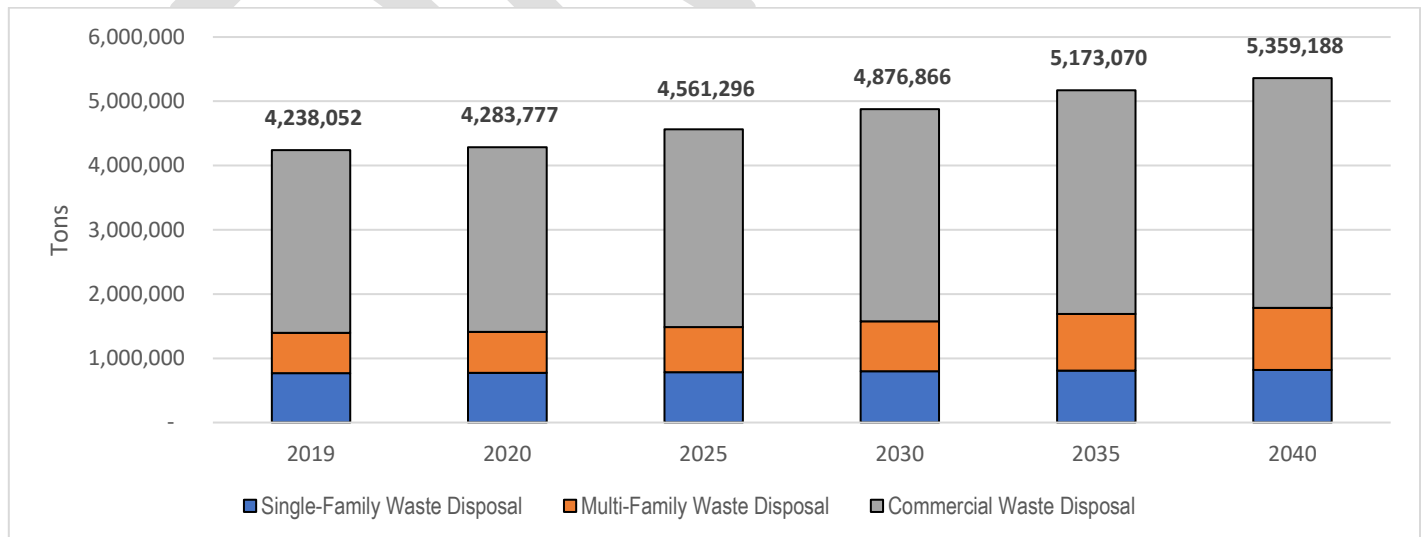
3.3 Total Disposal Forecast

Table 3-6 and Graph 3-1 summarize the total disposal forecast, which is comprised of waste disposed by both the residential and commercial populations.

**Table 3-6
City of Houston
Total Disposal Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
Residential Disposal						
Single-Family	769,218	771,115	782,512	797,616	810,267	817,347
Multi-Family	626,662	638,712	702,504	776,572	880,462	965,823
Commercial Disposal	2,842,172	2,873,950	3,076,281	3,302,678	3,482,341	3,576,018
Total Disposal	4,238,052	4,283,777	4,561,296	4,876,866	5,173,070	5,359,188

**Graph 3-1
City of Houston
Total Disposal Forecast (Tons)**





4.0 Diversion Forecast

Estimated diversion efforts within the City are based on the quantities of yard and wood waste, recyclables, construction & demolition, and other recyclables diverted annually within the City of Houston.⁵ The survey-based “Study on the Economic Impacts of Recycling”⁶ commissioned by the Texas Commission on Environmental Quality (TCEQ) and released in 2017 (2017 TCEQ Study) was used to quantify the amount of these materials diverted. According to the 2017 TCEQ Study, approximately 9.17 million tons of material was diverted from landfills in 2015. These 9.17 million tons are based on data collected through the TCEQ survey, as well as supplemental data received from other sources. The data does not include the extrapolation of recyclables and is, therefore, a conservative estimate. Table 4-1 summarizes the diverted material per the results of the 2017 TCEQ Study.⁷

**Table 4-1
State of Texas
2015 Diverted Material per 2017 TCEQ Study (Tons)**

	Total	% of Total
Typical Recyclable Material ¹	3,129,530	34.1%
Organics ²	2,747,128	30.0%
Construction & Demolition Material ³	3,136,727	34.2%
Other Recyclables ⁴	158,322	1.7%
Total	9,171,707	100%

1. Includes glass, metals, paper, and plastics.
2. Includes biosolids, food and beverage materials, yard trimmings, brush, and leaves.
3. Includes concrete aggregate.
4. Includes electronic materials, household hazardous waste, textiles, tires, and other uncategorized materials.

Approximately 8.17% of all Texas residents reside within the City of Houston. Therefore, it is assumed that 8.17% of all reported diverted material (approximately 749,328 tons of the 9,171,707 tons) were generated within the City in 2015.⁸ Table 4-2 summarizes the diverted material for the City of Houston, estimated from the 2017 TCEQ Study.⁹

**Table 4-2
Estimated 2015 Diverted Material in Houston (Tons)**

	Total	% of Total
Typical Recyclables ¹	255,683	34.1%
Organics ²	224,440	30.0%
Construction & Demolition Material ³	256,271	34.2%
Other Recyclables ⁴	12,935	1.7%
Total	749,328	100%

1. Includes glass, metals, paper, and plastics.

⁵ The amount of material estimated to be diverted includes both material collected by the City of Houston Solid Waste Management Department, as well as the private sector.

⁶ Referred to as the 2017 TCEQ Study throughout this report.

⁷ Page 1-3 of the “Study on the Economic Impacts of Recycling” Report. July 2017.

⁸ Per the US Census (reported as of July 2017): 2,312,717 Houston population / 28,304,596 Texas population = 8.17%

⁹ This is a conservative assumption because people within the City of Houston have better access to recycling than Texans in many rural areas.



	Total	% of Total
2. Includes biosolids, food and beverage materials, yard trimmings, brush, and leaves.		
3. Includes concrete aggregate.		
4. Includes electronic materials, household hazardous waste, textiles, tires, and other uncategorized materials.		

4.1 Curbside and Drop-Off Recyclables

The City of Houston’s Solid Waste Management Department currently maintains metrics for their single-stream curbside recycling operation, as summarized in Table 3-1. Table 4-3 is a single-family forecast for the single-stream curbside program, using the 0.0521 per capita rate identified in Table 3-3, and applying that rate to the estimated single-family population summarized in Table 2-1. This assumes no change in the types of materials collected.

**Table 4-3
City of Houston
Single-Family (SF) Curbside Recycling (Tons)²**

	2019	2020	2025	2030	2035	2040
SF Curbside Recycling	68,436 ¹	68,605	69,619	70,963	72,088	72,718

1. 0.0521 * 1,313,556 (single-family population per Table 2-1) = 68,436 tons of single-family (SF) curbside recyclables.
2. This includes projected recycling tonnage for all single-family homes, both those collected by the City, and the 16% of single-family households collected by contracted service providers.

In addition to single-family curbside recycling, the City of Houston’s Solid Waste Management Department also operates six neighborhood depositories/recycling centers and four neighborhood recycling drop-off locations. Tonnage collected at these ten sites are forecasted in Table 4-4. Private companies in the City also offer commercial recycling services, although the specific tonnages associated with commercial recycling collection are not publicly available. Table 4-4 summarizes the diversion forecast for traditional recyclables in order to comprehensively capture all tonnages associated with glass, metals, paper, and plastics diversion. Table 4-4 and graph 4-1 are based on the extrapolated metrics derived from the 2017 TCEQ Study and incorporate the impact of the continued population growth within the City of Houston (see Section 2.1)

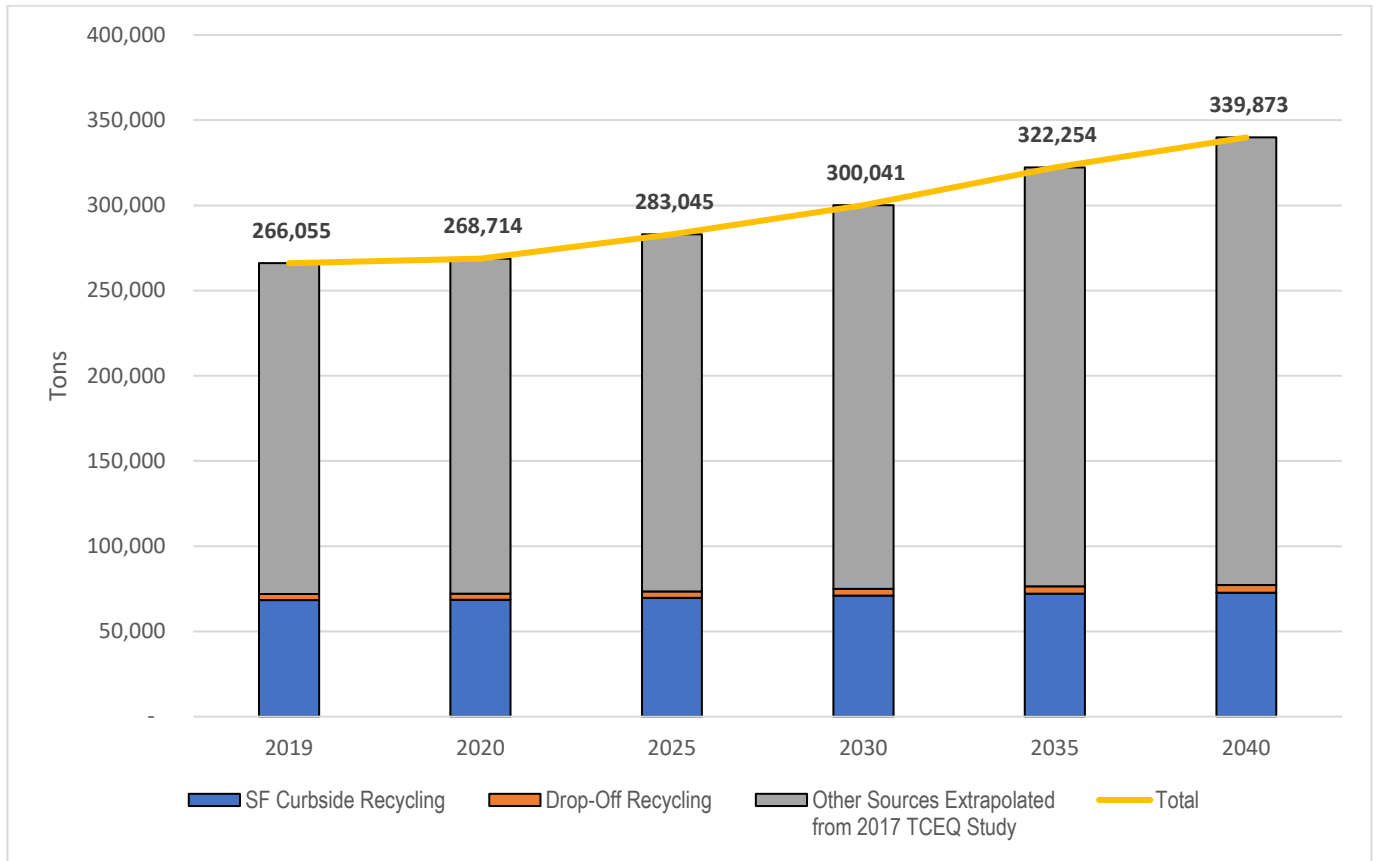
**Table 4-4
City of Houston
Typical Recyclable Material Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
SF Curbside Recycling ¹	68,436 ¹	68,605	69,619	70,963	72,088	72,718
Drop-Off Recycling ²	3,567	3,603	3,795	4,023	4,321	4,557
Glass, Metals, Paper & Plastics Diversion from Other Sources ³	194,052	196,506	209,631	225,055	245,845	262,598
Total	266,055	268,714	283,045	300,041	322,254	339,873

1. Typical recyclables collected via curbside recycling for single-family units.
2. Tonnage sourced from the City of Houston depositories/recycling centers and drop-off locations.
3. Tons of recyclables from other sources is extrapolated per the 2017 TCEQ Study.



**Graph 4-1
City of Houston
Typical Recyclable Material Forecast (Tons)**



4.2 Organics

For purposes of the Plan, organic waste is defined as the following:

- Food Residuals: Materials generated by commercial food processors, stores, restaurants, and individual residents.
- Yard and Wood Waste: Plant-based materials, not including food residuals, that include plants, leaves, brush, and trees from residential, commercial, and public utility generators.
- Biosolids: Residuals from municipal wastewater treatment processes which have been digested, typically in anaerobic digestors located at municipal wastewater treatment facilities.

An inventory of the compost facilities located inside the City of Houston (as well as for the region) is based on TCEQ databases and interviews. The compost facilities located within the City of Houston, and their estimated throughputs for 2018, are summarized in Table 4-5.¹⁰

¹⁰ Table 4-5 summarizes the estimated throughput (i.e. materials processed) from within the City of Houston. Please note that the throughput identified in Table 4-5 does not include capacity for sites immediately outside of Houston; annual throughput for all sites inside and outside of the City of Houston is estimated at approximately 613,500 tons.



**Table 4-5
City of Houston
Compost Facilities Within Houston**

Compost	Feedstocks	Products	Estimated Throughput	Estimated Capacity
All Facilities ¹	Yard waste from the City of Houston SWMD; yard waste from private contractors; pre-consumer food waste; vegetative food and wood chips	Mulch, compost	234,388 tons/year	476,000 tons/year

1. Includes nine facilities located inside the City of Houston.

Based on Table 4-5, approximately 234,388 tons of organics is currently being diverted from within the City of Houston on an annual basis. Note that this value is comparable to the 224,440 annual tons of organics (see Table 4-2) extrapolated from the 2017 TCEQ Study.

Table 4-6 summarizes the single-family yard and wood waste forecast for the City of Houston's curbside program, using the 0.0499 per capita rate identified in Table 3-3, and applying that rate to the estimate single-family population summarized in Table 2-1.

**Table 4-6
City of Houston
Single-Family (SF) Wood & Yard Waste (Tons)²**

	2019	2020	2025	2030	2035	2040
SF Wood & Yard Waste	65,546 ¹	65,708	66,679	67,966	69,044	69,648

- 0.0499 * 1,313,556 = 65,546 tons of single-family (SF) wood and yard waste.
- This includes projected wood and yard waste tonnage for all single-family homes, both those collected by the City, and the 16% of single-family households collected by contracted service providers.

Table 4-7 summarizes the organics diversion forecast for the City of Houston, and incorporates the impact of the continued population growth within the City of Houston (see Section 2.1)

**Table 4-7
City of Houston
Organics Diversion Forecast (Tons)**

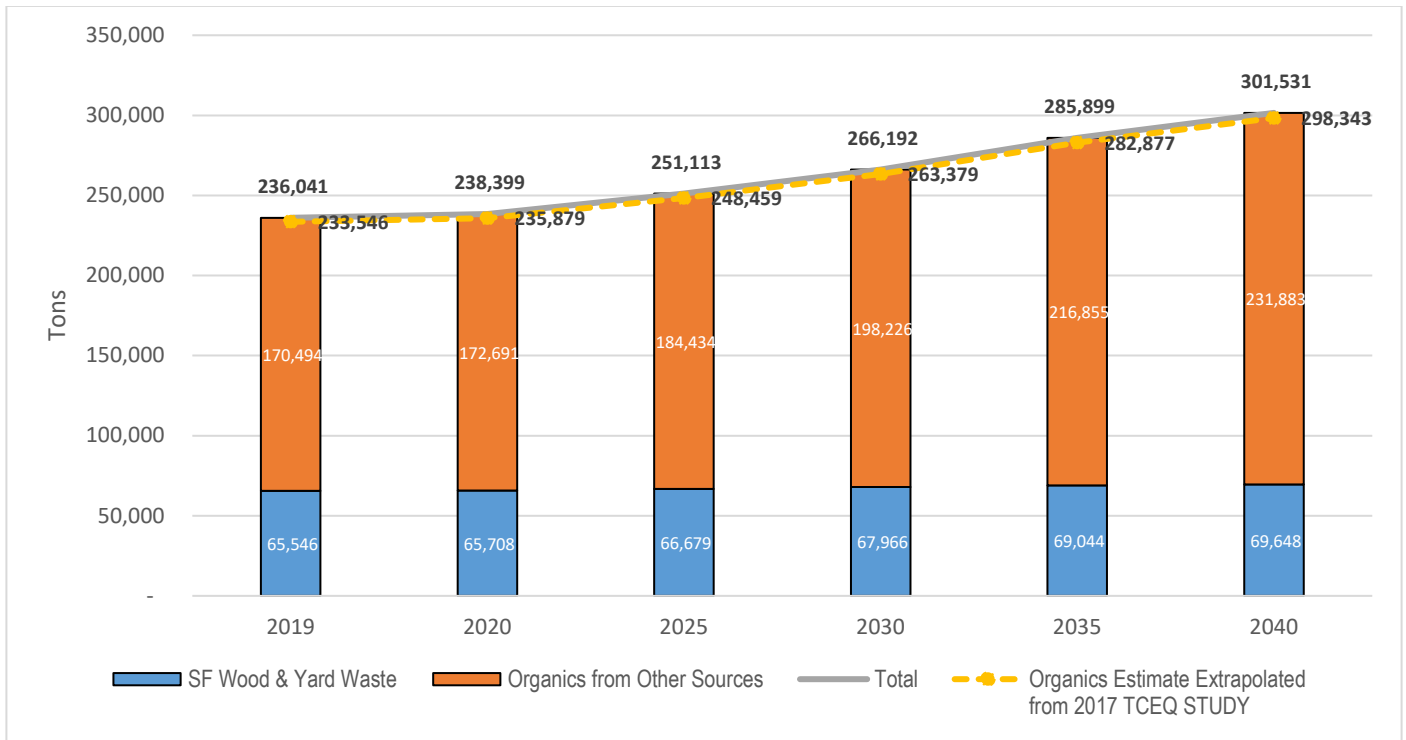
	2019	2020	2025	2030	2035	2040
SF Wood & Yard Waste ¹	65,546	65,708	66,679	67,966	69,044	69,648
Organics Diverted from Other Sources ²	170,494	172,691	184,434	198,226	216,855	231,883
Total	236,041³	238,399	251,113	266,192	285,899	301,531

- Yard waste and wood waste collected from single-family homes.
- Forecast for organics tracks with population growth. See Section 2.1.
- Values differ slightly from Table 4-5 because Table 4-7 was adjusted for growth. Table 4-5 was based on tonnage reported for 2018.



Graph 4-2 illustrates the organics diversion forecast for the City of Houston.

**Graph 4-2
City of Houston
Organic Diversion Forecast (Tons)**



4.3 Construction & Demolition Waste

There are several demolition and recycling companies that operate within the City of Houston. Based on conversations with some of these companies, it is estimated that approximately 1.5 million tons of construction and demolition (C&D) material are diverted on an annual basis from within the City of Houston. The types of C&D material include concrete (i.e. aggregate), reclaimed asphalt, steel, composition asphalt shingles, and tires.¹¹ Table 4-8 and Graph 4-3 summarize the construction and demolition diversion forecast, which is projected to increase with population growth.

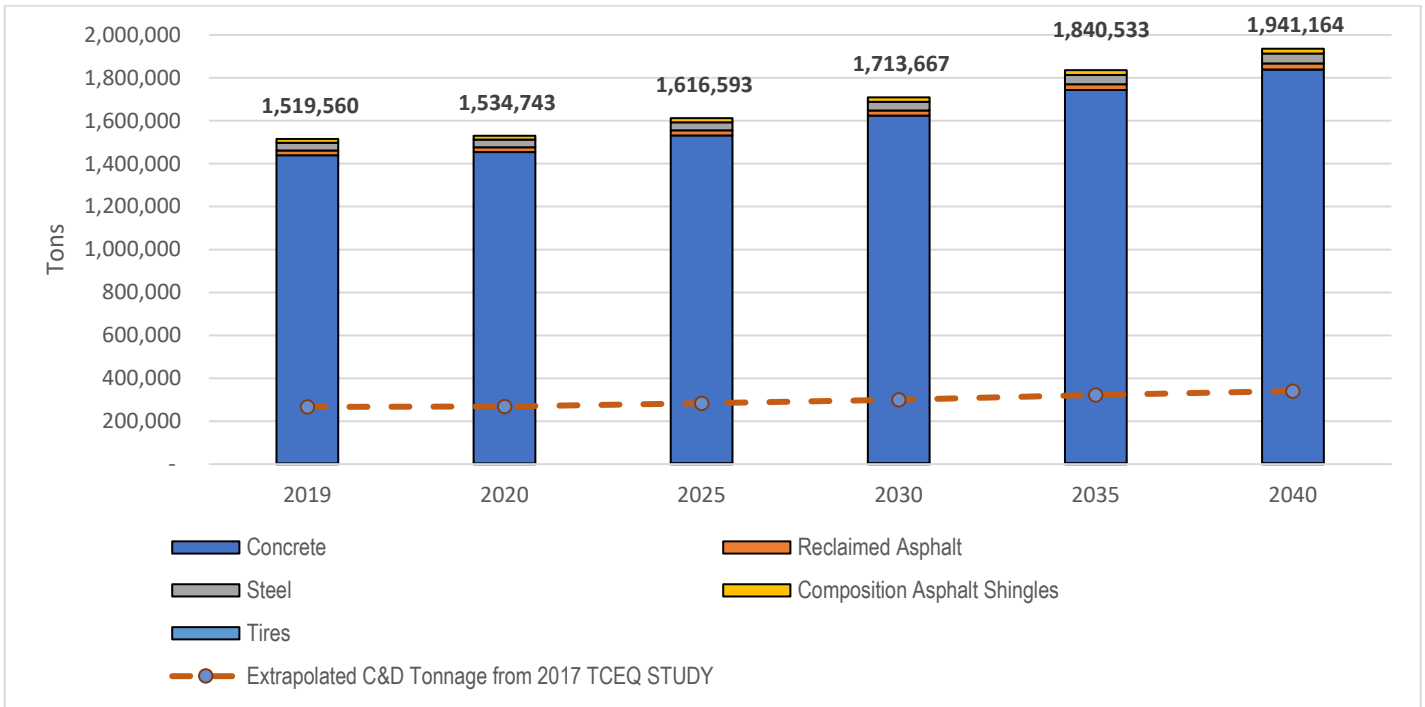
**Table 4-8
City of Houston
Construction & Demolition Materials (Tons)**

	2019	2020	2025	2030	2035	2040
C&D Materials	1,519,560	1,534,743	1,616,593	1,713,667	1,840,533	1,941,164

¹¹ It was noted that the following additional material could be diverted if a market for the following materials were established: sheet rock, carpet, treated wood, gypsum, glass. For instance, approximately 350,000 cubic yards of this material is currently being landfilled by Cherry Company on an annual basis.



**Graph 4-3
City of Houston
C&D Diversion Forecast (Tons)**



It is interesting to note that the amount of C&D actually being diverted within the City of Houston (1,519,560 tons) is significantly greater than the amount estimated per the 2017 TCEQ Study (256,271 tons). This is due to the very active C&D diversion program within the City of Houston, and Region, by a number of C&D contractors within the Houston area, most notably, Cherry Companies.

4.4 Other Recyclables

The final component of the waste diversion forecast includes other recyclables which combine for a small percentage (1.7%) of all diverted materials. These materials include electronic waste, household hazardous materials, textiles, tires, and other uncategorized materials. Table 4-9 summarizes the forecast for these types of materials, which is based on the 8.17% allocation factor (Houston residents as a percentage of the State of Texas population) as discussed in Section 4.0. These generation rates are assumed to grow at the same annual growth rates as population, which are identified in Section 2.1.

**Table 4-9
City of Houston
Other Recyclables (Tons)**

	2019	2020	2025	2030	2035	2040
Other Recyclables	13,460	13,594	14,319	15,179	16,303	17,194

4.5 Total Diversion Forecast

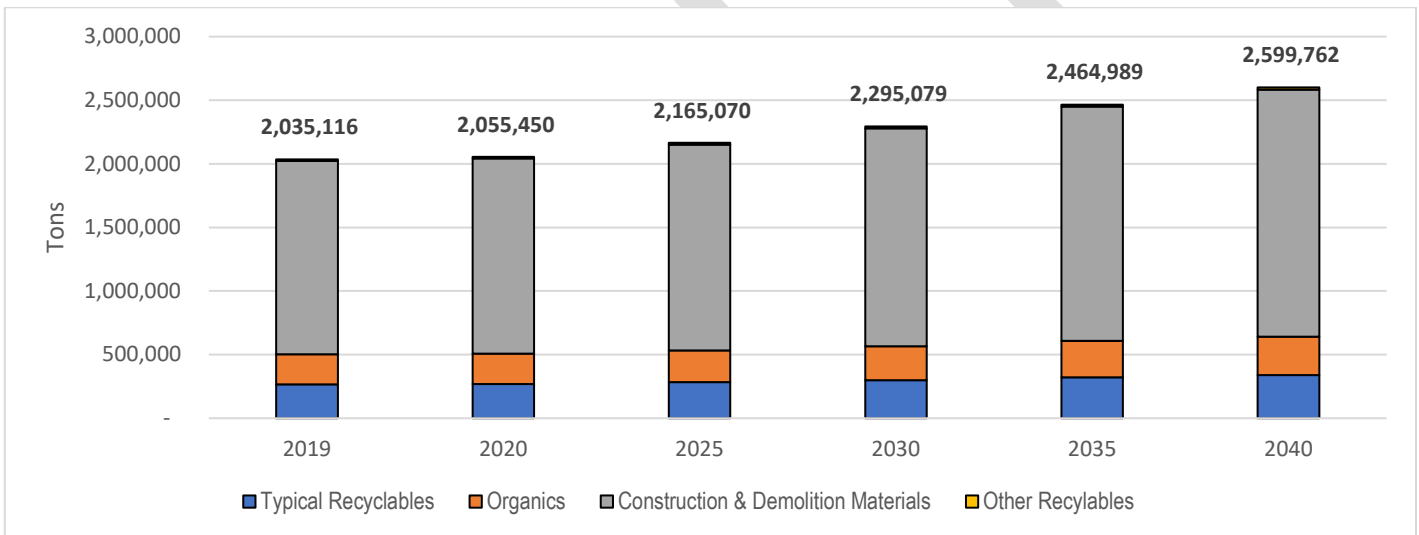
Table 4-10 summarizes the total diversion forecast, which is inclusive of the following materials: typical recyclables, organics, construction & demolition waste, and other recyclables.



**Table 4-10
City of Houston
Total Diversion Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
Typical Recyclables	266,055	268,714	283,045	300,041	322,254	339,873
Organics	236,041	238,399	251,113	266,192	285,899	301,531
Construction & Demolition Waste	1,519,560	1,534,743	1,616,593	1,713,667	1,840,533	1,941,164
Other Recyclables	13,460	13,594	14,319	15,179	16,303	17,194
Total Diversion Tonnage	2,035,116	2,055,450	2,165,070	2,295,079	2,464,989	2,599,762

**Graph 4-4
City of Houston
Total Diversion Forecast (Tons)**



5.0 Generation Forecast

The total generation forecast is comprised of both the disposal and diversion forecasts, which are summarized in Section 3.0 and Section 4.0, respectively. Table 5-1 summarizes the generation forecast.

Based on the data as shown in Table 5-1, the City has an estimated diversion rate of approximately 32.4%.¹² However, it should be noted that 75% of the diversion rate is due to C&D. Excluding C&D, the diversion rate is approximately 10.9% (515,556 tons/4,238,054 + 515,556 = 10.9%).

¹² 2,035,116 tons / 6,273,168 = 32.4%
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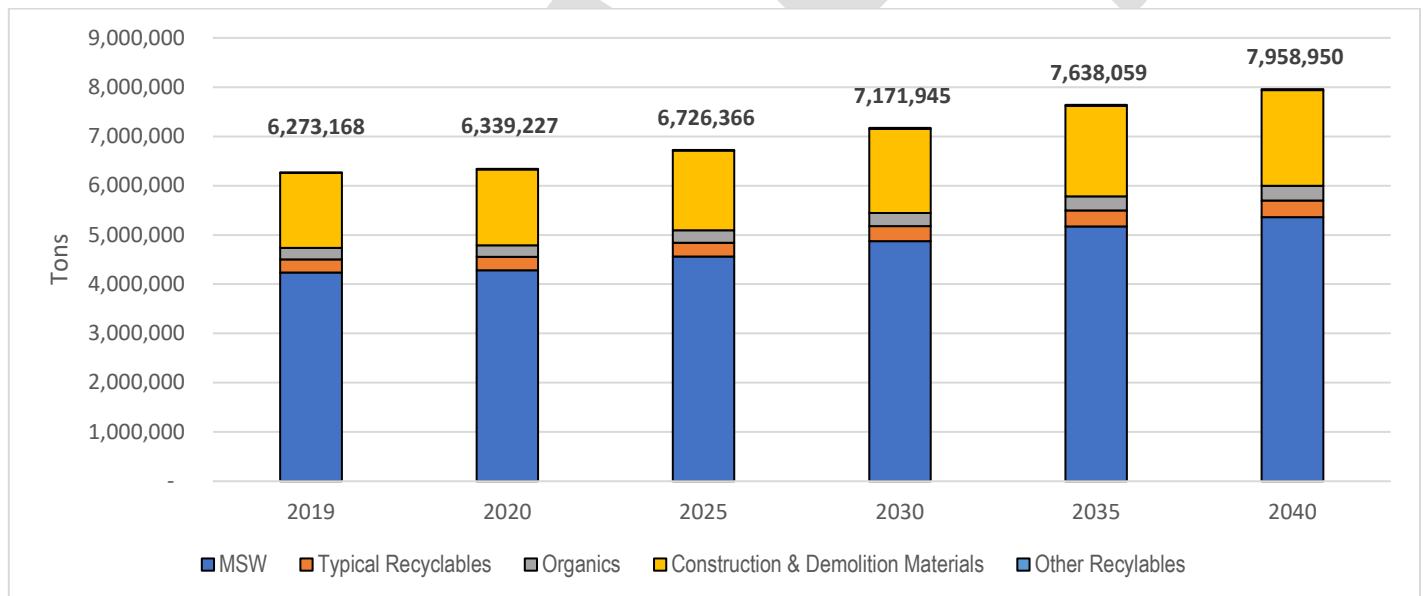


**Table 5-1
City of Houston
Total Generation Forecast (Tons)**

	2019	2020	2025	2030	2035	2040
Total Disposal	4,238,052	4,283,777	4,561,296	4,876,866	5,173,070	5,359,188
Total Diversion	2,035,116	2,055,450	2,165,070	2,295,079	2,464,989	2,599,762
Total Generation	6,273,168	6,339,227	6,726,366	7,171,945	7,638,059	7,958,950

Based on this analysis, while a significant portion of the waste stream generated within the City of Houston is diverted, there are additional opportunities to increase the diversion of materials from landfills within the City of Houston in a cost-effective manner. These opportunities will be discussed in greater detail within the Plan.

**Graph 5-1
City of Houston
Total Generation Forecast (Tons)
(By Type of Material)**





APPENDIX

DRAFT

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
POPULATION FORECAST																						
City of Houston Population Forecast	2,383,675	2,407,492	2,432,640	2,458,051	2,483,727	2,509,672	2,535,887	2,565,636	2,595,734	2,626,185	2,656,993	2,688,163	2,726,836	2,766,066	2,805,860	2,846,227	2,887,174	2,918,077	2,949,310	2,980,877	3,012,783	3,045,030
Single-Family Population	1,313,556	1,316,795	1,320,683	1,324,574	1,328,466	1,332,360	1,336,256	1,341,396	1,346,545	1,351,703	1,356,872	1,362,049	1,366,383	1,370,709	1,375,030	1,379,344	1,383,652	1,386,086	1,388,512	1,390,930	1,393,340	1,395,743
Multi-Family Population	1,070,119	1,090,697	1,111,957	1,133,477	1,155,261	1,177,312	1,199,631	1,224,240	1,249,189	1,274,482	1,300,122	1,326,114	1,360,454	1,395,357	1,430,830	1,466,883	1,503,522	1,531,990	1,560,798	1,589,947	1,619,443	1,649,287
EMPLOYMENT FORECAST																						
City of Houston Employment	1,882,233	1,903,278	1,929,353	1,955,784	1,982,578	2,009,739	2,037,272	2,066,413	2,095,970	2,125,951	2,156,360	2,187,204	2,210,499	2,234,042	2,257,836	2,281,883	2,306,186	2,318,462	2,330,804	2,343,211	2,355,684	2,368,224

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
TOTAL WASTE DISPOSAL (MSW & BULKY)																						
Single-Family Waste Disposal	769,218	771,115	773,392	775,670	777,950	780,230	782,512	785,521	788,537	791,558	794,584	797,616	800,154	802,687	805,217	807,744	810,267	811,692	813,113	814,529	815,940	817,347
Multi-Family Waste Disposal	626,662	638,712	651,162	663,764	676,521	689,434	702,504	716,915	731,525	746,336	761,351	776,572	796,682	817,121	837,894	859,006	880,462	897,134	914,003	931,073	948,346	965,823
Commercial Waste Disposal	2,842,172	2,873,950	2,913,322	2,953,234	2,993,693	3,034,706	3,076,281	3,120,283	3,164,915	3,210,185	3,256,103	3,302,678	3,337,853	3,373,403	3,409,332	3,445,643	3,482,341	3,500,878	3,519,514	3,538,249	3,557,083	3,576,018
	4,238,052	4,283,777	4,337,876	4,392,669	4,448,164	4,504,370	4,561,296	4,622,720	4,684,977	4,748,079	4,812,039	4,876,866	4,934,689	4,993,211	5,052,443	5,112,393	5,173,070	5,209,704	5,246,630	5,283,850	5,321,369	5,359,188
SINGLE-FAMILY DIVERSION (SINGLE-STREAM & WOOD/YARD WASTE)																						
Single - Family Recycling	68,436	68,605	68,808	69,010	69,213	69,416	69,619	69,887	70,155	70,424	70,693	70,963	71,189	71,414	71,639	71,864	72,088	72,215	72,341	72,467	72,593	72,718
Drop-Off Recycling	3,567	3,603	3,640	3,678	3,717	3,756	3,795	3,839	3,885	3,930	3,976	4,023	4,081	4,139	4,199	4,259	4,321	4,367	4,414	4,461	4,509	4,557
Single- Family Wood & Yard Waste	65,546	65,708	65,902	66,096	66,290	66,485	66,679	66,936	67,193	67,450	67,708	67,966	68,182	68,398	68,614	68,829	69,044	69,166	69,287	69,407	69,528	69,648
	137,550	137,916	138,350	138,785	139,220	139,656	140,093	140,662	141,232	141,804	142,377	142,952	143,527	144,102	144,677	145,252	145,827	146,402	146,977	147,552	148,127	148,702
OTHER DIVERSION																						
Typical Recyclables	194,052	196,506	199,073	201,668	204,293	206,947	209,631	212,339	215,085	217,869	220,693	223,557	226,461	229,405	232,389	235,414	238,479	241,584	244,729	247,914	251,139	254,404
Organics	170,494	172,691	174,987	177,310	179,658	182,033	184,434	187,124	189,847	192,605	195,398	198,226	201,089	203,987	206,920	209,888	212,891	215,929	218,992	222,080	225,193	228,331
Construction & Demolition Materials	1,519,560	1,534,743	1,550,774	1,566,973	1,583,342	1,599,881	1,616,593	1,633,557	1,650,744	1,668,157	1,685,796	1,703,661	1,721,761	1,740,096	1,758,665	1,777,469	1,796,509	1,815,784	1,835,294	1,855,039	1,875,019	1,895,234
Other	13,460	13,594	13,736	13,880	14,025	14,171	14,319	14,487	14,657	14,829	15,003	15,179	15,397	15,619	15,844	16,071	16,303	16,477	16,654	16,832	17,012	17,194
	1,897,566	1,917,534	1,938,570	1,959,831	1,981,317	2,003,031	2,024,977	2,049,807	2,074,933	2,100,360	2,126,090	2,152,127	2,184,645	2,217,639	2,251,113	2,285,077	2,319,536	2,345,625	2,371,997	2,398,655	2,425,601	2,452,839
TOTAL GENERATION																						
MSW	4,238,052	4,283,777	4,337,876	4,392,669	4,448,164	4,504,370	4,561,296	4,622,720	4,684,977	4,748,079	4,812,039	4,876,866	4,934,689	4,993,211	5,052,443	5,112,393	5,173,070	5,209,704	5,246,630	5,283,850	5,321,369	5,359,188
Typical Recyclables	266,055	268,714	271,521	274,357	277,223	280,119	283,045	286,365	289,724	293,123	296,562	300,041	304,358	308,736	313,178	317,683	322,254	325,703	329,189	332,713	336,274	339,873
Organics	236,041	238,399	240,889	243,406	245,948	248,517	251,113	254,059	257,040	260,055	263,106	266,192	270,022	273,907	277,847	281,844	285,899	288,959	292,052	295,178	298,337	301,531
Construction & Demolition Materials	1,519,560	1,534,743	1,550,774	1,566,973	1,583,342	1,599,881	1,616,593	1,633,557	1,650,744	1,668,157	1,685,796	1,703,661	1,721,761	1,740,096	1,758,665	1,777,469	1,796,509	1,815,784	1,835,294	1,855,039	1,875,019	1,895,234
Other Recyclables	13,460	13,594	13,736	13,880	14,025	14,171	14,319	14,487	14,657	14,829	15,003	15,179	15,397	15,619	15,844	16,071	16,303	16,477	16,654	16,832	17,012	17,194
	6,273,168	6,339,227	6,414,797	6,491,284	6,568,701	6,647,057	6,726,366	6,813,188	6,901,143	6,990,243	7,080,506	7,171,945	7,262,786	7,354,802	7,448,009	7,542,423	7,638,059	7,701,076	7,764,668	7,828,841	7,893,599	7,958,950
TOTAL RECYCLABLES																						
Typical Recyclables	266,055	268,714	271,521	274,357	277,223	280,119	283,045	286,365	289,724	293,123	296,562	300,041	304,358	308,736	313,178	317,683	322,254	325,703	329,189	332,713	336,274	339,873
Organics	236,041	238,399	240,889	243,406	245,948	248,517	251,113	254,059	257,040	260,055	263,106	266,192	270,022	273,907	277,847	281,844	285,899	288,959	292,052	295,178	298,337	301,531
Construction & Demolition Materials	1,519,560	1,534,743	1,550,774	1,566,973	1,583,342	1,599,881	1,616,593	1,633,557	1,650,744	1,668,157	1,685,796	1,703,661	1,721,761	1,740,096	1,758,665	1,777,469	1,796,509	1,815,784	1,835,294	1,855,039	1,875,019	1,895,234
Other Recyclables	13,460	13,594	13,736	13,880	14,025	14,171	14,319	14,487	14,657	14,829	15,003	15,179	15,397	15,619	15,844	16,071	16,303	16,477	16,654	16,832	17,012	17,194
	2,035,116	2,055,450	2,076,921	2,098,616	2,120,537	2,142,688	2,165,070	2,190,469	2,216,166	2,242,164	2,268,467	2,295,079	2,322,097	2,361,590	2,395,565	2,430,029	2,464,989	2,491,373	2,518,039	2,544,990	2,572,230	2,599,762