GARLAND

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CITY OF GARLAND

ENVIRONMENTAL WASTE SERVICES

Recycling and Waste Minimization Technical Study

FINAL REPORT
April 21, 2021

This study was funded through a solid waste management grant provided by the Texas Commission on Environmental Quality through the North Central Texas Council of Governments. This funding does not necessarily indicate endorsement of the study's findings and recommendations.

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EXECUTIVE SUMMARY

By 2050, the number of residents in the Dallas-Fort Worth (DFW) Metroplex is projected to almost double, significantly increasing waste collection and disposal needs regionally and for the City of Garland (City). The following Recycling and Waste Minimization Technical Study (Recycling Technical Study) provides an assessment of multiple financial, operational, benchmarking and strategic recycling and waste minimization issues, evaluating the financial impact of key operational adjustments that would allow the City to mitigate future strain on its operations as the number of customers continue to grow. Some of the anticipated challenges addressed in the Recycling Technical Study include ensuring sufficient operational capacity of recycling collection equipment and staffing, minimizing overtime requirements while providing consistently high quality service, maximizing the capacity of the City's Recycling Center, and maintaining a cost-effective program that captures synergies with the City's Landfill operation. This Executive Summary presents an overview of the analysis, key findings, and recommendations from each section of the Recycling Technical Study. The City received a grant from the Texas Commission on Environmental Quality (TCEQ) and North Central Texas Council of Governments (NCTCOG) to conduct the Recycling Technical Study.

Overview of Study Sections

Section 1.0: Introduction

Section 1.0 introduces the Recycling Technical Study, describes the project background, summarizes the results of the Strengths, Weaknesses, Opportunities, and Threats (SWOT) conducted, and provides a listing of the report sections with brief descriptions.

Section 2.0: Recycling Programs and Services

Section 2.0 provides an understanding of the ongoing material management activities and compares them to benchmark municipalities in the region including Austin, Dallas, Fort Worth and San Antonio. These municipalities were selected based on the technical and operational similarities of their recycling programs to the City's (e.g. cart-based collection). Burns & McDonnell evaluated recycling data and developed recycling program and service options by considering key performance metrics of single-stream recycling programs among the select benchmark municipalities including tonnage collected on a per-household basis, material composition, capture rate, and contamination rate. Differentiated from the other benchmark cities, the City's recycling program is automatic enrollment, as residents are able to opt-out for service. This approach ensures that residents who really want to recycle are included in the program, which includes approximately 42,500 of the 63,000 residential customers.

As shown in Section 2.1, compared to the benchmarked municipalities, the City's recycling program generates more material on a pounds per household basis than Dallas and Fort Worth but less than Austin and San Antonio. This high per-capita recycling rate is reflective of the strong participation from customers that have elected to utilize the City's recycling services.

Generally, recycling composition is in line with the benchmark municipalities. The City generates higher percentages of paper and metals than three of the benchmark municipalities and lower percentages of glass than all the benchmark municipalities. Based on the composition there are opportunities for the City to increase the percentage of certain plastic items such as soda and water bottles (PET) and milk and detergent jugs (HDPE) and to decrease the percentage of contamination that is in the recycling stream (as the City does have the highest contamination rate from the benchmarked cities).

Compared to benchmark municipalities, the City has a lower capture rate for key materials including recyclable cardboard, PET containers and ferrous metal food containers. These materials are important to target as they represent high value materials on the secondary material market. Focusing education and outreach on these materials specifically would provide value by reducing contamination and increasing the quantity of recyclables that are most advantageous for the City's contract recycling processor. Both Austin and Fort Worth are preparing to develop capture rate analyses to target key recyclable materials for increased capture rates as part of ongoing and future education and outreach campaigns.

The City's contamination rate ranges from seven to 10 percentage points higher than benchmark municipalities, although the total amount of material generated is significantly less than the benchmark municipalities. This results in a higher contamination rate on a pounds per household basis than benchmark municipalities. It is important to note that each ton of contamination that is managed by the City represents increased operational costs associated with material handling, hauling costs, and Material Recovery Facility (MRF) tipping fees.

The City's contractor, Fomento de Construcciones y Contratas (FCC), will begin charging the City $66.68 per ton, inclusive of a transportation fee, as of October 1, 2021[1]. For the purposes of this analysis, recycling processing costs are calculated based on the $66.68 per ton cost. Burns & McDonnell calculated the financial impact of hauling residentially collected contamination material to the FCC facility on an annual basis as shown in Table ES-1. With increasing tonnages of residential recycling, the cost of hauling and processing contamination in this material will continue to increase.

[1] Previously, FCC charged the City $199.42 per haul with a $20.00 tipping fee per ton delivered to the MRF. The City released a Request for Proposals and negotiated the $66.68 per ton fee that will begin October 1, 2021.

Table ES-1: Financial Impact of Contamination

Description	Amount
Total Residential Recycling Material (FY19 Tons)	11,760
Current Contamination Rate	28.2%
Estimated Contamination (FY19 Tons)[2]	3,319
Estimated Annual Compactors of Contamination[1]	415
Estimated Cost of Contamination Hauling/Processing[3]	**$221,289**

1. Average capacity of a compactor is estimated at eight tons
2. Values may not calculate exactly due to rounding
3. Calculated based on $66.68 per ton fee multiplied by total FY19 residential tons of estimated contamination to demonstrate impact when this fee takes effect on October 1, 2021. Burns & McDonnell used FY19 tons to maintain consistency with tonnages used in analyses throughout this Study.

Section 2.0 goes on to detail considerations and case studies related to developing a cart auditing program to proactively minimize contamination moving forward. Besides reducing contamination and increasing capture rate, prioritizing waste minimization is a key consideration to continue to enhance the City's recycling program. Burns & McDonnell provides several approaches to prioritizing waste minimization for the City's consideration including the following:

- Track waste minimization to make data-driven operational decisions.
- Highlight website content related to waste minimization as part of education and outreach.
- Evaluate waste minimization as part of the City's procurement policy.

Based on the analysis presented, Burns & McDonnell compiled key findings and recommendations that are detailed in Section 2.0, including rankings of priority, cost and timing that inform the implementation plan provided in Section 8.0. The following represents select recommendations:

1. **Continue providing recycling service to customers that elect to participate in the program.** If the City were to adjust its program to provide recycling service to all refuse customers, the impact would likely be an increase in overall recycling tons but a decrease in pounds per household recycled. However, to achieve this would require recycling program mandatory, which would cause additional challenges with increased contamination and is not recommended at this time.
2. **Measure recycling on a pound per household basis rather than by more traditional metrics.** This metric provides City staff with a more granular understanding of the impact of education and outreach efforts and will better support decision-making regarding future recycling program needs.
3. **Focus education and outreach on key materials that are not well captured.** By focusing education and outreach efforts on specific materials, the City would reduce contamination and increase the quantity of recyclables that are most advantageous for the City's contract recycling

processor. Both Austin and Fort Worth are preparing to develop targeted education and outreach programs to increase the capture rate of key materials.

4. **Consider developing and deploying a cart audit program to reduce contamination**. Developing a cart audit team should be considered to provide feedback to the residents regarding their set out habits. Burns & McDonnell recommends continuing, or increasing the frequency, of removing recycling carts for consistently highly contaminated set outs or implementing a penalty for violators to offset cost of deploying the cart auditing team. Ultimately, a significant reduction in contamination will decrease the number of loads required to be hauled by FCC for recycling processing.
5. **Track recycling and refuse on a pounds per household basis to support waste minimization efforts.** Burns & McDonnell recommends collecting and analyzing data on a pound per household per year basis for both refuse and recycling to identify the effectiveness of waste minimization efforts over time, assess tactical approaches to its recycling program, and communicate to residents key metrics as part of its education and outreach efforts.

Section 3.0: Recycling Collection Routing

Section 3.0 analyzes the growing number of recycling customers and tonnage that has strained the staff and equipment required to operate the current six recycling routes. The routes have not been adjusted to compensate for the growth in customers and tonnage; however, the increased efficiency associated with cart-based collection may have allowed the existing routes to remain in place up to this point.

Burns & McDonnell reviewed data from the City and developed key assumptions based on field observations of the current recycling collection operations. Burns & McDonnell then analyzed this data to develop a Recycling Collection Routing Model (Routing Model) that estimates the number of residential recycling routes required based on the current program.

The Routing Model shows that the City requires an additional 0.93 daily, or an additional 3.72 weekly routes, above the current number of routes to service recycling customers. This is reflective of the challenges indicated by City staff that the current number of recycling routes are strained to complete collection routes on time, vehicles are requiring maintenance or replacement sooner than anticipated, and overtime requirements as part of recycling collection operations are increasing.

Based on the recycling collection routing analysis, Section 3.0 goes on to describe two recycling routing options: increase recycling routes and balance routes by day. A key challenge associated with rebalancing recycling routes is maintaining refuse and recycling collection on the same day, which is an important offering of City-operated collection services.

Burns & McDonnell compiled key findings and recommendations that are detailed in Section 3.0, including rankings of priority, cost and timing that inform the implementation plan provided in Section 8.0. The following represents select recommendations:

1. **Add one daily (or four weekly) recycling routes to increase the operational efficiency of recycling collections.** Increase the operational efficiency of recycling collections could provide savings to the City associated with decreased vehicles maintenance and overtime costs.
2. **Maintain existing recycling collection days.** Although balancing routes by collection days could increase the efficiency of recycling collection operation, there are challenges associated with changing customer collection days or having recycling and refuse collection occur on different days of the week. Based on these limitations, Burns & McDonnell recommends the City maintain the existing recycling collection days.
3. **Balance routes by collection days for all residential collection services.** Burns & McDonnell recommends examining all residential collection service routing including refuse, recycling and bulk and brush collection to prepare for future operational changes (e.g. increasing recycling routes, adjusting brush and bulk collection operation). By approaching this effort on a combined basis, the City can incorporate critical service offerings as part of the implementation such as maintaining collection of refuse and recycling on the same day.

Section 4.0: Potential to Increase Commercial Recycling

Section 4.0 evaluates the commercial recycling service provided by the City using front load collection vehicles on a three day per week schedule. The current route is approximately only 60 percent utilized due to the low demand for service, and when collection of commercial recycling is complete the driver will transition to support commercial refuse collection.

There is a significant difference in the level of service provided for commercial refuse and recycling customers. Refuse collection units are serviced a total of 3,273 times per week, or a total of 20,847 cubic yards, whereas commercial recycling units are serviced 213 times per week, a total of 1,574 cubic yards.

Section 4.0 provides description and analysis of several options to increase commercial recycling including developing a business recognition program, implementing a Waste Reduction Assistance Program (WRAP), increasing access to public space recycling, expanding existing recycling collection, and developing a commercial recycling ordinance.

Additionally, Burns & McDonnell provided case studies from the cities of Austin and Dallas regarding their commercial recycling ordinance and multi-family recycling ordinance, respectively. Austin's Universal Recycling Ordinance (URO) requires commercial, multifamily and food-permitted properties to

submit annual reporting regarding diversion. Although the URO supports Austin's diversion goals, they have encountered challenges converting the data received from the 15,000 entities covered under the ordinance into tangible enforcement efforts.

Dallas' new multi-family recycling ordinance went into effect January 1, 2020 for all multi-family properties with eight or more units. Although the first year of reporting has not yet been received, the participation and engagement has been very positive and Dallas city staff are optimistic the program will evolve into a successful effort that materially increases its diversion rate over time.

Based on the analysis presented, Burns & McDonnell compiled key findings and recommendations that are detailed in Section 4.0, including rankings of priority, cost and timing that inform the implementation plan provided in Section 8.0. The following represents select recommendations:

1. **Expand the City's commercial recycling customer base to fully utilize existing route.** Expanding the City's commercial recycling customer base would allow for the staff and equipment providing collection to become more efficient and cost-effective.
2. **Develop a business recognition program in conjunction with a WRAP to increase commercial recycling customers.** Developing a business recognition program and WRAP would require an additional FTE that could coordinate between the City's collection operation and education and outreach efforts to proactively market commercial recycling. This effort would include strategic outreach to businesses, coordination of resources to provide technical assistance, and facilitation of providing recycling service to new customers.
3. **Explore stakeholder engagement process regarding the development of a commercial recycling ordinance.** To inform the development of a commercial recycling ordinance, the City would need to engage with stakeholders of commercial recycling in the City including representatives of businesses and private haulers. This stakeholder engagement process would provide critical feedback regarding the scope of a commercial recycling ordinance.

Section 5.0: Recycling Center Evaluation

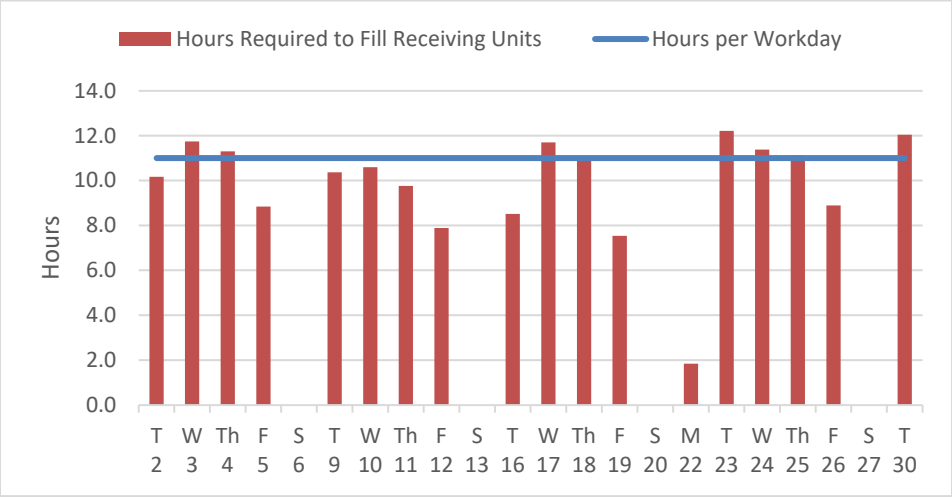
Section 5.0 provides an overview of the Recycling Center and details key changes that could be made to the existing facility and operations and provides siting, operations and cost considerations related to developing a new Recycling Center. Burns & McDonnell details the following key challenges with the current Recycling Center:

- **Unsafe traffic flow.** The location of the Recycling Center among the co-located facilities, can cause challenges with safe and clear wayfinding in the site. There is a safety concern with this

traffic pattern because passenger vehicles are directed to use the same lanes as recycling collection vehicles seeking to deposit material at the Recycling Center.

- **Growing recycling tonnages.** If the volume of material and flow of traffic at the Recycling Center increases significantly, it would likely present a challenge to receive inbound vehicles safely and efficiently, prepare receiving units for transportation, and load compacting units fast enough to clear the floor of inbound tonnages.
- **Operational challenges.** Burns & McDonnell calculated the number of receiving unit hauls required to clear the inbound material for each operating day in June 2020 and compared it against the actual receiving unit hauls. Based on the number of required receiving unit hauls compared to the total outbound receiving unit hauls, there are more hauls required than provided by FCC Tuesday through Friday. On Saturdays, FCC is able to haul the remaining tonnage that is not loaded and hauled Tuesday through Friday. Burns & McDonnell then calculated the time required to fill the total number of receiving units required to clear daily inbound recycling material and compared it to an 11-hour workday, as shown in Figure ES-1. The 11-hour workday is reflective of at least one FTE operating the Recycling Center at all times throughout the day from 7:00 AM to 6:00 PM.

Figure ES-1: Time to Fill Receiving Units Required to Clear Daily Inbound Recycling



Going forward, continued growth in tons of recycling collected and processed may cause inbound volume of material to outpace the ability of the current level of staff to operate the Recycling Center safely and efficiently.

- **Unsafe backing maneuvers.** The configuration of the Recycling Center requires that upon turning into the site from Commerce Street, recycling collection vehicles must cross the scalehouse, drive past the Recycling Center, and then pull in from the other side to reverse the

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1.0 INTRODUCTION

1.1 Introduction

The City of Garland (City) received a grant from the Texas Commission on Environmental Quality (TCEQ) and North Central Texas Council of Governments (NCTCOG) to conduct a Recycling and Waste Minimization Technical Study (Recycling Technical Study). The City retained Burns & McDonnell to advise the City on multiple financial, operational, benchmarking and strategic recycling and waste minimization issues. This Recycling Technical Study provides the vision and framework to guide future activities and to develop the infrastructure, programs and policies needed to manage the City's recycling system and move the City toward its goals.

1.2 Project Background

Burns & McDonnell conducted a kick-off meeting on May 20, 2020 with City staff to identify key issues, develop project objectives, confirm the schedule, and conduct a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis. To conduct the SWOT analysis, Burns & McDonnell utilized a virtual polling software to gain perspective on key issues that needed to be evaluated during the project. All information from the SWOT analysis was used as background information to guide our analysis. Table 1-1 communicates the specific points identified during the facilitated discussion.

Table 1-1: Strengths, Weaknesses, Opportunities, and Threats Summary

Strengths
• City customers expect recycling • There are an increasing number of recycling customers year-over-year • There is willingness from other City utilities to collaborate on sustainability projects • City owns and operates its own Recycling Center • Recycling is a "free" service to residents • Customer service; strong reputations with citizens and within organization • Ability to modify City Ordinance to benefit program (i.e. City Council supports recycling)
Weaknesses
• Brush/bulky collection program presents challenges • Priorities for different commodities not aligned with waste reduction hierarchy • Limited professional development for frontline workers • Limited focus on waste reduction compared to recycling • No "teeth" to control contamination • Recycling as a free service allows for residents to pay less attention to set out rules • Education & outreach should occur internally and externally • Cost of processing recycling is increasing along with macroeconomic trends • No annual benchmark to determine how organization is doing • No dedicated organics collection • Lack of long-term planning for resources to meet demand for recycling • Biweekly collection is challenging • Customers have a "government can't tell me what to do" attitude

Opportunities
• Inform staff on how solid waste services contributes to quality of life of the City • Big companies located in City that prioritize sustainability to partner/work with • Improve operation of Recycle Center • Communicate importance of responsible materials management • More competitive than private haulers (on commercial service) • Expansion of recycling collection program • Partnership with Garland Integrated School District (GISD) • Enhance education and outreach • Ability to collaborate among integrated solid waste system components (e.g. service delivery and disposal) • Control of entire operation (e.g. collection, processing and disposal) • More commercial revenue • Update ordinances
Threats
• Citizens thinking everything should be recyclable; limited focus on waste reduction • Current practices do not align with waste reduction hierarchy • Status quo mentality; unwillingness to change/rethink current practices and processes • Lack of understanding of integrated solid waste management • Differences in programs between surrounding cities and DFW area • Unstable recycling industry • Other cities cancelling recycling • Elimination of recycling program • Skepticism that material is being recycled • Recycling market challenges

After the kick-off meeting, Burns & McDonnell conducted field observations of the Recycling Center, transfer station, and followed recycling routes to collect time and motion data. These field observations provided the data to conduct the analysis related to increasing residential recycling routes, increasing commercial recycling, and developing a new Recycling Center.

Additionally, Burns & McDonnell conducted virtual interviews with City staff to discuss recycling programs, document challenges, evaluate ongoing efforts and identify potential strategies to inform the Recycling Technical Study analysis, key findings, and recommendations.

1.3 Report Organization

The report sections are organized as follows, with brief descriptions:

- **Section 1.0: Introduction.** Communicates the project background and provides an overview of the interview and field work completed as part of this Recycling Technical Study.
- **Section 2.0: Recycling Programs and Services.** Benchmarks key metrics against municipalities in the region and presents options for consideration to improve recycling program performance.

- **Section 3.0: Recycling Collection Routing.** Reviews the results of the Recycling Collection routing Model (Routing Model) based on field observations and data provided by the City. Section 3.0 presents options for consideration related to the need to increase the number of residential recycling routes.
- **Section 4.0: Potential to Increase Commercial Recycling.** Evaluates the commercial recycling service provided by the City and presents several options for the City's consideration to increase commercial recycling.
- **Section 5.0: Recycling Center Evaluation.** Provides an overview of the Recycling Center and details key changes that could be made to the existing facility and operations. Additionally, Section 5.0 presents siting, operations and cost considerations related to developing a new Recycling Center.
- **Section 6.0: Organics Recycling Program Development.** Provides an overview of the City's current organics recycling efforts and details the operational requirements, expected costs, and expected revenues associated with expanding the current organics recycling operation. Additionally, this section describes considerations for contracting with a full-service organics processing provider and bringing unprocessed material to a local organics processor.
- **Section 7.0: Cost of Recycling Service.** Presents the methodology and results of the cost of service analysis for recycling collection and presents a financial analysis of multiple operational configurations for residential and commercial collection services. This section also compares the financial impacts of continuing to divert recycling or landfilling the material and describes options for improving the cost-effectiveness of the City's recycling program.
- **Section 8.0: Implementation Plan.** Describes the implementation criteria and compiles the recommendations presented throughout the report into a summary table by section.

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2.0 RESIDENTIAL RECYCLING PROGRAMS AND SERVICES

This section compares the City's recycling program to benchmark municipalities in the region and state, discusses recycling program and service options, and provides implementation considerations, key findings and recommendations related to tracking program metrics and minimizing contamination.

2.1 Recycling Program Benchmarking

To develop and evaluate options for future recycling programs and services within the City, it is necessary to understand the material management activities that are currently occurring in comparison to benchmark municipalities in the region. The City provides refuse collection services to approximately 63,000 residential customers, including recycling to all City residents that request service on an every-other-week basis. The City's recycling program is automatic enrollment, as residents are able to opt-out of service. Approximately 42,500 residents receive curbside recycling collection service.

Single-stream recyclables are hauled to the City's Recycling Center, loaded into compactors and transported to the City of Dallas material recovery facility (MRF) that is operated by Fomento de Construcciones y Contratas (FCC) for processing. Recycling Center operations are further detailed in Section 5.0.

The City is seeking to understand key metrics that can be utilized to optimize the efficiency of managing material generated by an increasing numbers of customers year over year. Burns & McDonnell evaluated recycling data and developed recycling program and service options by considering the following key performance metrics of recycling programs among select benchmark municipalities:

- **Single-Stream Recycling Collected.** The amount of residential recyclables collected annually on a pounds per household basis.
- **Material Composition.** The composition profile of residential recycling material on a percentage basis.
- **Capture Rate.** The amount of recycling material that is captured in the residential recycling stream on a percentage basis, providing insight regarding the development of focused education and outreach initiatives.
- **Contamination Rate.** The amount of contamination (i.e. material that is not accepted by the City's contract recycling processing facility) present in the residential recycling program on a percentage basis. Contamination rate includes both non-recyclable contaminants and MRF process residue.

Burns & McDonnell benchmarked the City against other municipalities including Austin, Dallas, Fort Worth and San Antonio. Although the populations of the benchmark municipalities are higher than the City's population, the recycling programs are similar to the City's in that they have cart-based set outs with municipal provided collection with automated vehicles. Benchmarking data was compiled as part of the North Central Texas Council of Governments (NCTCOG) capture rate study, the ongoing City of Austin Zero Waste Master Plan Update, and ongoing efforts to support the City of San Antonio oversee its MRF processing agreement. The benchmarking comparison for material composition includes the recycling composition as published in the Texas Commission on Environmental Quality's (TCEQ) Study on the Economic Impacts of Recycling. As part of this analysis, Burns & McDonnell describes how these communities are considering and/or implementing alternative measurement methods to traditional recycling rates based on these performance metrics. Benchmark municipalities' approaches to measuring and managing recycling programs provide context to the options, implementation considerations, and key findings and recommendations presented in the section for the City's consideration.

2.1.1 Single-Stream Recycling Collected

This section compares the amount City's single-stream recycling material collected against the benchmark communities and provides discussion on how to utilize per-capita recycling rate as a key performance metric to continue to improve the City's recycling program. Table 2-1 compares the total households serviced, service frequency, total recycling tons sold to market, and annual tons collected on a pounds per household basis.

Table 2-1: Recycling Rate Benchmarking

	Garland	Austin	Dallas	Fort Worth	San Antonio
Households Serviced	42,439[1]	201,539	245,000	265,175	357,458
Service Frequency[2]	EOW	EOW	Weekly	Weekly	Weekly
Recycling (tons)[3]	8,441	48,775	41,923	47,037	75,419
Pounds per Household	398	484	342	355	422

1. Represents customers that participate in recycling collection
2. EOW indicates Every Other Week (EOW) recycling collection service frequency
3. Recycling tons represents material sold to market (i.e. net of contamination)

Compared to the benchmarked municipalities, the City's recycling program generates more material on a pounds per household basis than Dallas and Fort Worth but less than Austin and San Antonio. This high per-capita recycling rate is reflective of the strong participation from customers that participate in City's recycling program.

Another consideration in comparing the City's recycling rate are the level of service provided to customers. In each of the benchmarked municipalities, recycling service is provided to all customers and

second recycling carts are made available upon request. Conversely, the City only provides recycling service to about two-thirds of the refuse collection customers and does not provide second recycling cart. The customers that do not participate in the recycling program have opted-out of receiving service. If the City were to adjust its program to provide service to all refuse customers rather than only a portion of customers, there would likely be higher overall recycling tons but less recycling on a pounds per household basis. Moving toward tracking recycling material collected on a pounds per household basis rather than by more traditional metrics would provide City staff with a more granular understanding of the impact of education and outreach efforts and better support decision-making regarding future program changes. The City of Austin is currently working to implement tracking recycling material on a pound per household basis as part of its Zero Waste Master Plan Update.

2.1.2 Material Composition

This section compares the City's recycling composition profile against the benchmark municipalities and provides discussion on how to utilize ongoing evaluations of recycling composition to support the City's recycling program. Table 2-2 compares recycling composition data among the benchmark municipalities and includes the Texas statewide recycling composition as published in the TCEQ's Study on the Economic Impacts of Recycling. Recycling composition data for individual cities is reflective of the single most recent audit available.

Table 2-2: Recycling Composition Benchmarking[1]

Material Category	Garland	Texas Statewide	Austin[2]	Dallas	Fort Worth	San Antonio
OCC	13.1%	12.0%	19.3%	12.6%	15.7%	15.0%
Mixed Paper	36.1%	35.5%	26.9%	39.6%	29.3%	35.9%
Paper Subtotal	**49.3%**	**47.5%**	**46.1%**	**52.1%**	**45.0%**	**50.9%**
PET	4.9%	4.5%	2.3%	3.4%	6.0%	6.2%
HDPE Color	1.5%	2.0%	0.5%	1.2%	1.2%	1.9%
HDPE Natural	1.3%	1.5%	0.6%	0.6%	1.6%	1.3%
Plastics #3-#7	0.4%	1.0%	1.1%	0.8%	2.1%	1.5%
Rigid Plastics	0.2%	0.0%	0.4%	0.4%	1.2%	0.3%
Plastic Film	0.0%	0.0%	0.0%	0.5%	0.5%	0.0%
Plastic Subtotal	**8.2%**	**9.0%**	**4.9%**	**6.9%**	**12.5%**	**11.1%**
Glass	10.2%	19.0%	26.6%	16.5%	16.1%	15.9%
Glass Subtotal	**10.2%**	**19.0%**	**26.6%**	**16.5%**	**16.1%**	**15.9%**
Aluminum	1.2%	1.0%	1.9%	0.8%	1.8%	1.7%
Steel/Tin	2.3%	2.0%	1.6%	1.6%	2.1%	2.0%
Scrap Metal	0.7%	0.0%	0.7%	0.3%	1.0%	0.4%
Metal Subtotal	**4.2%**	**3.0%**	**4.2%**	**2.8%**	**4.9%**	**4.0%**
Contamination	28.2%	21.5%	18.2%	21.7%	21.5%	18.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

1. Note that the comparison of recycling composition profiles is meant to provide context for the City's program, but results may vary among benchmark municipalities due to their specific recycling facility configuration and audit procedures.
2. The City of Austin has two MRF contractors that process its recycling material. The composition shown represents percentages from the Balcones Resources MRF.

Generally, the City's recycling composition is in line with the benchmark municipalities. The City generates higher percentages of paper and metals than three of the benchmark municipalities and lower percentages of glass than all the benchmark municipalities. Based on the composition there are opportunities for the City to increase the percentage of certain plastic items such as PET and HDPE and to decrease the percentage of contamination that is in the recycling stream (as Garland does have the highest contamination rate from the benchmarked cities).

2.1.3 Capture Rate

This section compares the City's capture rate on a material-by-material basis against the benchmark communities and provides discussion on material values and recycling quantities to indicate the most effective way to leverage capture rate as a performance metric to maximize the capture of high value materials. Capture rate is an effective metric that provides a more granular indication of the effectiveness

of a recycling program in capturing specific materials. Table 2-3 compares the capture rate among benchmark municipalities including Austin, Fort Worth and Dallas.

Table 2-3: Capture Rate Benchmarking[1]

Material Category	Garland	Austin[1]	Fort Worth	Dallas
Recyclable Cardboard	72%	79%	93%	78%
Mixed Paper	74%	57%	75%	77%
PET Containers	39%	57%	70%	42%
HDPE Containers - Natural	54%	63%[2]	81%	38%
HDPE Containers - Colored	56%		78%	31%
Plastic 3-7 Containers	28%	22.7	45%	27%
Aluminum Used Beverage Containers	66%	45%	71%	43%
Ferrous Metal Food Containers	30%	36%	53%	26%
Recyclable Glass	82%	70%	73%	65%

1. Capture rates for Garland, Fort Worth, and Dallas are derived from the most recent capture rate analysis as part of the NCTCOG waste characterization study. These figures are provided for informational purposes only and may not be representative over time due to limited sample size.
2. The City of Austin's most recent waste characterization was completed in 2014 and therefore these capture rate figures are reflective of this historical information. Austin is planning to develop a capture rate study in the near future to update these figures.
3. Breakout between capture of natural and colored HDPE unavailable.

The capture rate data presented is from the most recent capture rate analysis as part of the NCTCOG waste characterization study and Austin's Zero Waste Master Plan Update. The capture rates from the NCTCOG waste characterization study were derived by using the composition profile of hand sorted refuse and recycling to calculate the capture rate of between four and 12 samples delivered by each city, where each recycling sample represented about 100 pounds of material and each refuse sample represented about 250 pounds of material. The capture rate from the Austin Zero Waste Master Plan Update was derived using the most recent waste and recycling characterization data and applying it to the total annual tons generated in that year to calculate the capture rate. Both sets of data have limitations, where the capture rates from the NCTCOG study only include a limited number of samples and the Austin data from 2014 is dated, and therefore may not be reflective of capture rate based on its current collection program.

Compared to benchmark municipalities, the City has a lower capture rate for key materials including recyclable cardboard, PET containers and ferrous metal food containers. These materials are important to target as they represent high value materials on the secondary material market. Focusing education and outreach on these materials specifically would provide value by reducing contamination and increase the quantity of recyclables that are most advantageous for the City's contract recycling processor. Both

Austin and Fort Worth are preparing to develop capture rate analyses to target key recyclable materials for increased capture rates as part of ongoing and future education and outreach campaigns.

2.1.3.2 Material Values

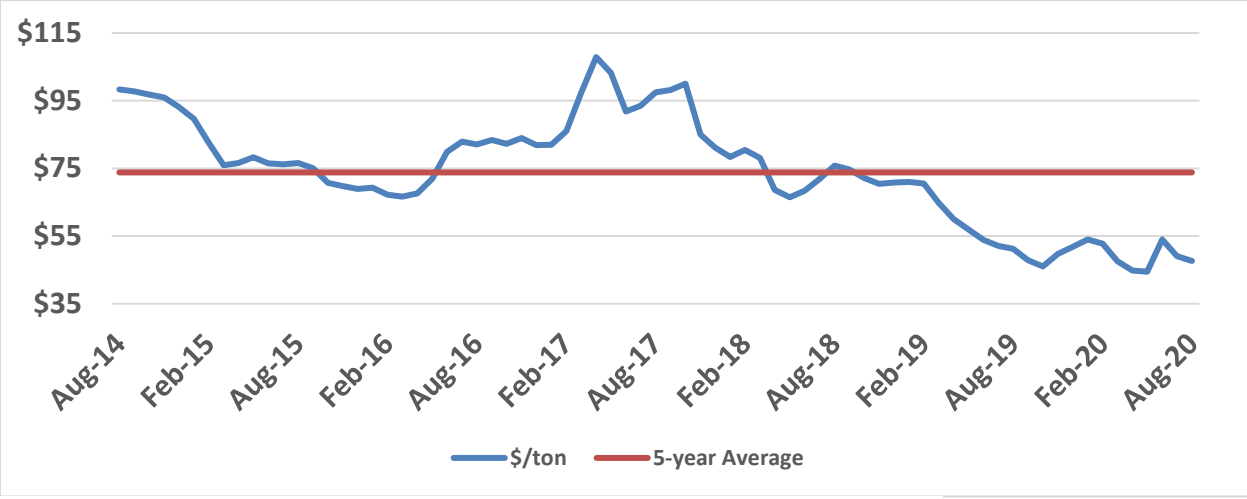
This section provides information on the commodity value of single-stream recycling based on the City's composition profile to provide context for the importance of increasing capture rate of key materials in the recycling stream.

Historically, high demand for recyclable metals, paper, and plastics, especially in China, has helped to drive expansion of curbside recycling in the U.S. and worldwide for over two decades. In recent years, global demand has fallen while supplies remained relatively flat. Reduced demand for recyclable materials has led to lower pricing and stricter quality standards by manufacturers, exacerbating MRF profitability concerns.

These market conditions allow manufacturers to pay lower per ton prices to MRFs while requiring higher quality with lower contamination rates, which increases processing costs. These trends cause challenges for MRFs and have led many recycling industry observers to call for investment in new or expanded U.S. manufacturing facilities that utilize recycled content material as a feedstock to increase domestic demand for recyclable materials. Like all commodities markets, demand and pricing for recyclable materials is cyclical, but some fear it could be years before demand and prices return to the high levels of the past decade.

Figure 2-1 shows historical commodity values for single stream material based on the City's recycling composition profile and the five-year average price. Starting in mid-2017, there has been a steady decline in the value of recycling materials.

Figure 2-1: Single Stream Material Commodity Values



Source: recyclingmarkets.net; southcentral regional average prices

Much of this decline is attributed to a decision by China to ban multiple material types and to intensify contamination thresholds. Of the materials included in municipal recycling programs, much of the financial decline is due to decreases in the value of mixed paper. While there certainly is a reason for concern about the financial viability of recycling there are also reasons for cautious optimism as 17 new paper manufacturing facilities are being built in the United States. While several of these facilities will not be operational for two or three years, there should eventually be increased demand and pricing for materials like paper.

Communities taking action to decrease contamination is a key long-term strategy to enhance the financial viability of a recycling program. Largely due to the financial challenges, multiple communities have examined the viability of their recycling programs over the past couple of years. In doing so, many of these cities have reset their financial expectations for their recycling programs. Where recycling programs may have previously generated net revenue from the processing of materials, this is now an annual expense. For this reason, focusing on decreasing contamination and increase the capture of the most valuable commodities (e.g. PET, HDPE, metals) is critical to support ongoing and sustainable recycling programs.

2.1.4 Contamination Rate

This section focuses on the City's recycling contamination rate compared to other benchmark municipalities and discusses the financial impacts of reducing contamination. Table 2-4 compares benchmark municipality MRF operators, contamination rates, total recycling tons generated annually, and estimated tons of contamination material generated annually.

Table 2-4: Contamination Rate Benchmarking

	Garland	Austin	Dallas	Fort Worth	San Antonio
Operator	FCC	Balcones /TDS	FCC	Republic Services	Republic Services
Contamination Rate	28.2%	18.2%	21.7%	21.5%	18.0%
Total Recycling (Tons)	11,760	59,290	53,541	60,000	75,419
Contamination (Tons)	3,316	10,791	11,618	12,900	13,575
Contamination (lbs/HH)[1]	156	107	95	97	76

1. Pound per household figure calculated based on households serviced as shown in Table 2-1

The City's contamination rate ranges from seven to 10 percentage points higher than benchmark municipalities, although the total amount of material generated is significantly less than the benchmark municipalities. This results in a much higher contamination rate on a pounds per household basis than

benchmark municipalities. It is important to note that each ton of contamination that is managed by the City represents increased operational costs associated with material handling, hauling costs, and MRF tipping fees.

2.1.4.2 Reducing Contamination

This section provides an estimate of the costs associated with current level of contamination in the recycling stream. Under the City's current contract, FCC hauls recycling material via FCC-provided compactors from the Recycling Center to its MRF located in Dallas. FCC charges the City $199.42 per haul, and a $20.00 tipping fee per ton delivered to the facility.

Table 2-5 shows the financial impact of hauling contamination from residentially collected recycling material to the FCC facility on an annual basis.

Table 2-5: Financial Impact of Contamination

Description	Amount
Total Residential Recycling Material (FY19 Tons)	11,760
Current Contamination Rate	28.2%
Estimated Contamination (FY19 Tons)[1]	3,319
Estimated Annual Compactors of Contamination[2]	415
Estimated Cost of Contamination Hauling/Processing[3]	**$221,289**

1. Values may not calculate exactly due to rounding
2. Average capacity of a compactor is estimated at eight tons
3. Calculated based on $66.68 per ton fee multiplied by total FY19 tons of estimated contamination. Burns & McDonnell used FY19 tons to maintain consistency with tonnages used in analyses throughout this Study.

The City spends approximately $221,000 (based on $66.68 transportation and tip fee that will be implemented on October 1, 2021) to have its residential contamination hauled and processed by FCC. With increasing tonnages of residential recycling, the cost of hauling and processing contamination in this material will continue to increase. Reducing the generation of this material would serve to decrease the demand of staff and equipment at the Recycling Center and ultimately reduce the number of trips required on an annual basis.

It is important to note that if contamination material were to be diverted, there would be associated costs with managing and disposing of the material. Further analysis of the cost impact of reducing contamination and diverting it to disposal is provided in Section 7.2.

2.2 Recycling Program and Service Options

Based on the recycling program benchmarking, Burns & McDonnell has provided recycling program and service options for the City's consideration including prioritizing waste minimization efforts, reducing contamination through cart auditing.

2.2.1 Prioritize Waste Minimization

Prioritizing waste minimization is a key consideration of effective recycling programs because minimizing the amount of material that enters the solid waste and recycling streams is the most environmentally beneficial and cost-effective material management approach. The following presents several approaches to prioritizing waste minimization for the City's consideration:

- **Track waste minimization to make data-driven operational decisions**. Leveraging per capita waste and recycling rates as a key metric to gauge the effectiveness of technical approaches and education and outreach initiatives will support the City to maximize the efficiency of its recycling program over time. As the recycling program grows, minimizing material generated will help reach operational and diversion targets and reduce the long-term cost of solid waste management.
- **Highlight website content related to waste minimization as part of education and outreach.** Education and outreach materials are intended to communicate key messaging to customers and potential customer of City services. To prioritize waste minimization, the content that is deployed may suggest tactics or considerations for changing behavior (i.e. practices related to how post-consumer material is handled). Communicating statistics that inform the City's data-driven decisions is an effective approach to changing the behavior of customer. Communicating per capita waste and recycling rates would provide data to inform outreach material that communicates tangible, positive impact of waste minimization on the City's services.
- **Evaluate waste minimization as part of City procurement policy.** The City procures material to support ongoing operations and events. The City should evaluate and implement changes that minimize the procurement of materials that will ultimately be discarded in the waste or recycling stream (e.g. digitizing information to reduce the amount of paper required to conduct operations, reducing the amount of promotional items purchased). For materials that are procured, the City should prioritize that products that are manufactured using recycled content material. The new Governmental Entity Recycling Program specifies the rules that municipalities must incorporate regarding recycling programs.

2.2.1.1 Governmental Entity Recycling Program

The governmental entity recycling and purchasing of recycled materials rules are found in Title 30 Chapter 328 Subchapter K. These rules require governmental entities to create and maintain a recycling program for their operations, as well as create a preference in purchasing for products made of recycled materials when the cost difference is less than 10 percent and are effective as of July 2, 2020.

Entities must give preference to products made with recycled materials, so long as the products meet applicable specifications as to quantity and quality and the average price of the product is not more than 10% greater than the price of comparable non-recycled products.

TCEQ rules require municipalities to:

- Separate and collect all recyclable materials[1]
- Provide procedures for collecting and storing recyclable material and making contractual or other arrangements with buyers of recyclable materials
- Evaluate the amount of recyclable material recycled and modify the recycling program as necessary to ensure that all recyclable materials are effectively and practicably recycled
- Establish educational and incentive programs to encourage maximum employee participation

To establish a governmental entity recycling program, municipalities should review purchasing procedures, prioritize purchasing products that are recyclable or contain recycled content, encourage the community buy recycled, and leverage the Texas Smart Buy Membership program (State of Texas Cooperative Purchasing program).

Although there is no specific rule requiring the City to incorporate waste minimization practices, Burns & McDonnell recommends prioritizing waste minimization as a fundamental part of its recycling program.

2.2.2 Reduce Contamination Through Cart Auditing

Benchmark municipalities including Austin, Fort Worth, and San Antonio deploy dedicated cart auditing crews to identify contaminated recycling set outs and provide education and outreach to decrease these occurrences. Although there are equipment and manpower costs to conducting regular cart audits, the ability to target generators and intervene with education and outreach at the point of generation is a powerfully effective method to reducing contamination and minimizing unacceptable set outs (e.g. overflowing refuse carts, excessive brush and bulky material, household hazardous waste).

[1] Recyclable materials include aluminum, steel containers, aseptic packaging and polycoated paperboard cartons, high-grade office paper, and corrugated cardboard.

As part of cart auditing program, when contamination is observed in a recycling cart, the cart audit team would place adhesive sticker over the cart lid, signifying that the cart contents should be treated as refuse. When this occurs, the City should consider charging the customer an on-call refuse collection fee of in the range of $20-$30 to influence behavior change and support the cost of an additional collection. As exemplified by the cart audit case studies identified below, this fee can be used to target specific and recurring forms of contamination, such as diapers.

For the purposes of collecting data from cart audits, Burns & McDonnell has provided descriptions of the following key considerations to support cart audit crews:

- **Tablet-based data entry.** Based on experience with similar surveying, handheld tablets loaded with dedicated software allow a cart audit team to most effectively track and record data collected in the field. The deployment of this equipment would allow the team to inspect the most households with the highest level of accuracy in data recording with the ability to conduct real-time analysis based on information being generated in the field. Figure 2-2 shows an example of a tablet-based data entry software interface from CityGovApp.com, a tool that has been utilized by the City of El Paso to coordinate several components of its solid waste collection services including complaint resolution, on-route data collection, and inventory management.

Figure 2-2: Example of Tablet-based Data Entry Software Interface

- **Integrated data management.** By utilizing handheld tablets with dedicated software for recording and analyzing data, the cart audit team would generate information critical to increasing the effectiveness of the City's residential collection program including identifying areas of the City that have consistently unacceptable set outs. Working with a vendor to generate a software package that can communicate and analyze data in association with other programs or departments within the City may serve to streamline the ability to impose fines or other penalties associated with cart audits. Also, the generation of helpful graphics and heat maps will help understand where violations are occurring and can support education and outreach efforts.
- **Image collection and analysis.** Capturing images can become a critical tool for validating the data collected in the field and ensuring that penalties associated with the cart audit program are delivered to the correct household. Additionally, in the event that there are complaints submitted to the City based on the observations of the cart audit team, images of the data entered by the cart audit team can support the findings and decision-making process.

Note that in addition to assessing fees, the City should consider opportunities to waive fee associated with contaminated set outs. Although it potentially softens the penalty for repeatedly contaminated set outs, it may serve to ease the process of implementing the cart audit program among potential criticisms by residents and decision-makers.

2.2.2.1 Cart Audit Case Studies

This section presents cart audit case studies from the cities of Fort Worth and San Antonio to provide perspective on the efforts to minimize contaminated or unacceptable set outs.

Fort Worth, Texas. The City of Fort Worth's "Blue Crew" checks the contents of residential set outs each day and leaves tags to inform the resident of any contamination that are found in recycling carts. The Blue Crew remove bags that are identified as contaminated and attach a cart or bag tag explaining the situation to the customer, as shown in Figure 2-3.

Figure 2-3: Example of Bags Tagged as Contaminated

The Blue Crew contains 6 to 7.5 full time employees (FTEs) and effectively educates customers. Those who repeatedly are found to have put non-recyclable goods in the recycling carts can be charged additional garbage fees, and have their blue carts taken away. Additionally, Fort Worth has found that by informing the community of the importance of reduction contamination, there are few complaints about the auditing of set outs from residents.

San Antonio, Texas. The City of San Antonio's Solid Waste Management Department (SWMD) issues violations and collects fees for cart contamination that is added to residents' monthly utility bills from CPS Energy. Residences whose set outs are identified as contaminated are issued an initial warning tag on the cart and a letter sent in the mail that informs residents of the problem. SWMD staff conducting the audit collects data including a picture of the cart, the serial number on the cart, a picture of the home and pictures of the contaminated items to ensure that violations are sent to the correct customer and information regarding the cart audit can be tracked. The second time that a cart is identified as contaminated, SWMD staff leave a contamination fee tag to indicate that a fee will be placed on the resident's next utility bill.

Generally, contamination fees are $25 but increases to $50 for diaper contamination. Increased fees for diaper contamination were added in 2018 because this specific contaminant represented a major problem for San Antonio's MRF processor. Another addition to the program has been the ability to wave a violation fee. If a resident is assessed a fee, they can have it waived by participating in an online educational activity within 10 days of the date of the fee notice letter that will serve to remove the fee from the upcoming monthly utility bill. Note that the city allocates the revenue collected through contamination fees to fund the dispatch of a collection truck to haul contaminated material for disposal rather than recycled.

As part of the SWMD's FY2018 Annual Report, blue recycling carts on average had 26 percent contamination in 2008 and had been reduced to 20.6 percent in 2018.

2.3 Implementation Considerations

Based on the recycling program options, Burns & McDonnell has provided implementation considerations for recycling program and service options including the priority, timeline, and financial impact of each option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Implementation considerations described in Table 2-6 provide context for the following key findings and recommendations.

Table 2-6: Recycling Program Option Implementation Considerations

Option	Priority	Timeline	Financial Impact
Prioritize Waste Minimization	Prioritizing waste minimization is a high priority. The earlier waste minimization practices are implemented, the greater positive impact it will have on the long-term efficiency of the recycling program.	Near-Term.	The resources required to prioritize waste minimization include developing education and outreach content and assessing the City's existing procurement practices.
Reduce Contamination through Cart Auditing	Reducing contamination is important to the City's recycling program; however, there may be challenges implementing fees associated with cart auditing	Near-Term.	The resources required to deploy a cart auditing team include equipment and staffing to check set outs including one vehicle and one or more staff. Further discussion of the financial impacts is provided in Section 7.0.

2.4 Key Findings and Recommendations

This section presents key findings and recommendations related to recycling programs and services. Each recommendation is followed by a description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

2.4.1 Key Findings

1. **Compared to the benchmarked municipalities, the City's recycling program is consistent with material recycled on a pounds per household basis.** The City recycles more than Dallas and Fort Worth, but less than Austin and San Antonio on a pound per household basis. This high recycling rate is reflective of the strong participation from customers that opt-in as part of the City's recycling program.
2. **Recycling composition is consistent with the benchmark municipalities.** The City generates higher percentages of paper and metals than three of the benchmark municipalities and lower percentages of glass than all the benchmark municipalities. Based on the composition there are opportunities for the City to increase the percentage of certain plastic items such as PET and HDPE and to decrease the percentage of contamination that is in the recycling stream.
3. **City has a lower capture rate for key materials compared to benchmark municipalities.** These materials include recyclable cardboard, PET containers and ferrous metal food containers. These materials are important to target as they represent high value materials on the secondary material market.
4. **The City's contamination rate is higher than benchmark municipalities.** At 28 percent, the City's contamination rate ranges from seven to 10 percentage points higher than benchmark municipalities. This results in a much higher contamination rate at 156 pounds per household per year compared to benchmark municipalities that range from 76 to 107 pounds per household per year.
5. **The City spends approximately $221,000 to have its contamination hauled and processed by FCC.** Each ton of contamination that is managed by the City represents increased operational costs associated with material handling, hauling costs and tipping fees. Reducing the amount of contamination in the recycling stream would decrease the demand of staff and equipment at the Recycling Center and ultimately reduce the number of trips required on an annual basis.
6. **There is an opportunity to prioritize waste minimization benefits and best practices as part of the City's education and outreach efforts.** Waste minimization metrics such as waste and recycling rates on a pound per household per year basis are not currently tracked. Additionally,

the importance of minimizing waste and best practices to do so are not highlighted as part of existing education and outreach materials.

2.4.2 Recommendations

1. **Continue providing recycling service to customers that elect to participate in the program.** If the City were to adjust its program to provide recycling service to all refuse customers, the impact would likely be an increase in overall recycling tons but a decrease in pounds per household recycled. However, to achieve this would require recycling program mandatory, which would cause additional challenges with increased contamination and is not recommended at this time. [**Priority:** Low; **Timeline:** Near-term; **Financial Impact:** N/A]
2. **Measure recycling on a pound per household basis rather than by more traditional metrics.** This metric provides City staff with a more granular understanding of the impact of education and outreach efforts and will better support decision-making regarding future recycling program needs. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** N/A]
3. **Focus education and outreach on key materials that are not well captured.** By focusing education and outreach efforts on specific materials, the City would reduce contamination and increase the quantity of recyclables that are most advantageous for the City's contract recycling processor. Both Austin and Fort Worth are preparing to develop targeted education and outreach programs to increase the capture rate of key materials. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** Minimal]
4. **Consider developing and deploying a cart audit program to reduce contamination**. Developing a cart audit team should be considered to provide feedback to the residents regarding their set out habits. Based on experience with similar surveying, Burns & McDonnell recommends handheld tablets loaded with dedicated software are provided to the cart survey team to most effectively track and record data collected in the field. The deployment of this equipment will allow the team to inspect the most households with the highest level of accuracy in data recording with the ability to conduct real-time analysis based on information being generated in the field. Burns & McDonnell recommends continuing, or increasing the frequency, of removing recycling carts for consistently highly contaminated set outs or implementing a penalty for violators to offset cost of deploying the cart auditing team. Ultimately, a significant reduction in contamination will decrease the number of loads required to be hauled by FCC for recycling processing. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** High - the resources required to deploy a cart auditing team include equipment and staffing to check set outs including one vehicle and one or more staff.]

5. **Track recycling and refuse on a pounds per household basis to support waste minimization efforts.** Burns & McDonnell recommend collecting and analyzing data on a pound per household per year basis for both refuse and recycling to identify the effectiveness of waste minimization efforts over time, assess tactical approaches to its recycling program, and communicate to residents key metrics as part of its education and outreach efforts. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** Minimal]

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3.0 RECYCLING COLLECTION ROUTING

This section estimates required number of daily recycling routes, discusses balancing routes by collection days, and provides implementation considerations, key findings and recommendations related to increasing the number of residential recycling collection routes.

3.1 Recycling Collection Routing Analysis

The City began collecting curbside recycling material in 2010 and transitioned to single-stream recycling collection in 2017. Since the transition to single-stream collection, there has been an increase in both tonnage collected and customers that participate in the program due to the shift from bin collection to cart-based collection. The growing number of customers and tonnage has caused strain on the staff and equipment required to operate the current six recycling routes. The routes have not been adjusted to compensate for the growth in customers and tonnage; however, the increased efficiency associated with cart-based collection may have allowed the existing routes to remain in place up to this point.

As part of this effort Burns & McDonnell reviewed data from the City and developed key assumptions based on field observations of the current recycling collection operations. Burns & McDonnell analyzed this data to develop a Recycling Collection Routing Model (Routing Model) that estimates the number of recycling routes required based on the current program. The results of the Routing Model are presented as follows:

- **Overview of Routing Model Assumptions.** Provides descriptions of the key assumptions and inputs of the model, further detailed in Appendix A.
- **Number of Routes.** Describes the results of the Routing Model analysis including the number of daily and weekly routes required.

3.1.1 Overview of Routing Model Assumptions

The number of required recycling routes is dependent on the following key assumptions:

- **Recycling Customers and Level of Service.** The City currently services 42,439 residential recycling customers and provides every other week collection (i.e. half the recycling customers are collected during the "yellow" week, and the other half are collected during the "blue" week). Recycling collection routes run four days per week, Tuesday through Friday, 10 hours per day using automated side-loading collection vehicles.
- **Non-Collection Time.** Non-collection time includes the time it takes to prepare for routes such as pre-trip inspection, morning meetings, and travel time to route, as well as travel time to/from the

Recycling Center, lunch breaks, post-trip inspection and fueling. Non-collection time effects how long vehicles can be on-route throughout the day.

- **Set out Rate.** The set out rate represents the total expected cart set outs on a given week. Based on the Recycling Container Inventory data presented in Appendix B, the program has a very high set out rate at 99 percent. Typically, curbside recycling programs do not achieve such a high set out rate.
- **Collection Efficiency.** Collection efficiency is the rate that collection vehicles can service customers. Based on field observations, the City's collection vehicles are able to drive from the prior set out to the next set out, service the cart, and place the cart back at the curb at a rate of 29.0 seconds per set out. Further detail about collection efficiency is provided in Appendix A.
- **Extra Carts.** The Routing Model takes into consideration the additional time required to service extra recycling carts. However, in this case, the City does not provide extra recycling carts to its recycling customers, so this variable was set to "zero" in the Routing Model.

3.1.2 Number of Required Routes

Table 3-1 lists key assumptions of the Routing Model. Further detail on the assumptions and calculations of the Routing Model are provided in Appendix A.

Table 3-1: Key Routing Model Assumptions

Assumption	Value	Unit
Households Serviced	21,220	Customers per Week
Collection Days	4	Days per Week
Working Hours per Day	10	Hours per Day
Collection Time	6.75	Hours per Day
Non-Collection Time	3.25	Hours per Day
Set out Rate	99%	Set out Rate per Route
Collection Efficiency	29.0	Seconds per Set out
Extra Carts	0%	Extra Carts per Route

Table 3-2 shows the results of the Routing Model including the current daily and weekly routes, required routes, and additional routes required.

Table 3-2: Routing Model Results

Routes	Daily	Weekly
Current	6.00	24.00
Required	6.93	27.72
Additional Required	**0.93**	**3.72**

The Routing Model shows that the City requires an additional 0.93 daily, or an additional 3.72 weekly routes, above the current number of routes to service recycling customers. This is reflective of the challenges indicated by City staff that the current number of recycling routes are strained to complete collection routes on time, vehicles are requiring maintenance or replacement sooner than anticipated, and overtime requirements as part of recycling collection operations are increasing.

3.2 Recycling Routing Options

Based on the recycling collection routing analysis, Burns & McDonnell has provided recycling routing options for the City's consideration including staffing and equipment required to increase recycling routes and balancing routes by collection day.

3.2.1 Increase Recycling Routes

The City could consider increasing the number of daily recycling routes from six to seven based on the Routing Model analysis. The Routing Model analysis is reflective of the challenges indicated by City staff that the current number of recycling routes are strained to complete collection routes on time, vehicles are requiring maintenance or replacement sooner than anticipated, and overtime requirements as part of recycling collection operations is increasing. Increasing the number of routes from six to seven will provide enough routes to finish collections on time more consistently.

3.2.1.1 Equipment and Staffing

Based on the results of the Routing Model, adding one more route would alleviate the challenges associated with the current recycling collection operations. Table 3-3 shows the current equipment and backup ratio dedicated to recycling operations and compares against the required equipment to increase the number of routes from six to seven.

Table 3-3: Recycling Equipment Requirements

	Collection Vehicles Available	Collection Vehicles Used	Backup Ratio[1]
Current Routes	10	6	67%
Increased Routes	10	7	57%

1. Typical backup ratio is 20 - 30 percent based on industry standards

Based on the Routing Model, the City requires seven front-line vehicles to increase to the recommended seven routes. There are currently 10 vehicles dedicated to residential recycling, representing a 67 percent backup ratio. Increasing the number of trucks to seven would decrease the backup ratio, but not to the point where there would be concerns providing equipment to run seven recycling routes. Additionally, refuse collection vehicles could be used as backups for the recycling operation.

However, the average age of the recycling collection vehicles is five years old, including five vehicles that are above five years in age. Since the typical replacement lifecycle of automated side-load collection vehicles is five to seven years, it can be expected that the recycling vehicles in the City's fleet would require additional downtime for maintenance in the next few years. If the City retires some of the older recycling vehicles without replacement, the backup ratio for recycling operations may drop and cause challenges with maintaining consistent recycling service or more frequently rely on refuse collection vehicles as backups, particularly if another recycling route is added.

Table 3-4 shows the staffing dedicated to recycling operations and compares against the required staffing to increase the number of routes from six to seven.

Table 3-4: Recycling Staffing Requirements

Recycling Vehicle Operators	Total
Current	6
Required	7
Additional	1

Based on the Routing Model, the City requires one additional operator to increase to the recommended seven routes. Currently there are six operators dedicated to recycling collection service and increasing the number of routes would require that the City hire another FTE to staff the additional recycling route.

Unlike the equipment, there are no back up operators assigned to the residential recycling operation, meaning that any required back up staff would need to be pulled from other operations. Typically, the Recycling Supervisor fills in when the operation is short-staffed. When two or more drivers are unavailable, drivers from other operations fill in. In considering the addition of another recycling route,

ensuring that there is sufficient back up staff to support this expansion will be critical so that the additional route does not come at the expense of the efficiency of other collection operations.

3.2.2 Balancing Routes by Collection Day

Since the recycling program was initially implemented, there have been no changes to the day or collection routing. Even after the program expanded to include single stream material and has since increased tonnage generated by about five percent year over year, the routing and collection days have remained the same. This has created imbalances in the daily recycling routing boundaries due to individual recycling customers being added on an ad-hoc basis as the program has expanded over the years.

Since the recycling program was initially implemented, there have been no changes to the day or collection routes. Table 3-5 shows the number of set outs recycling for collection each collection each week.

Table 3-5: Recycling Collection by Day[1]

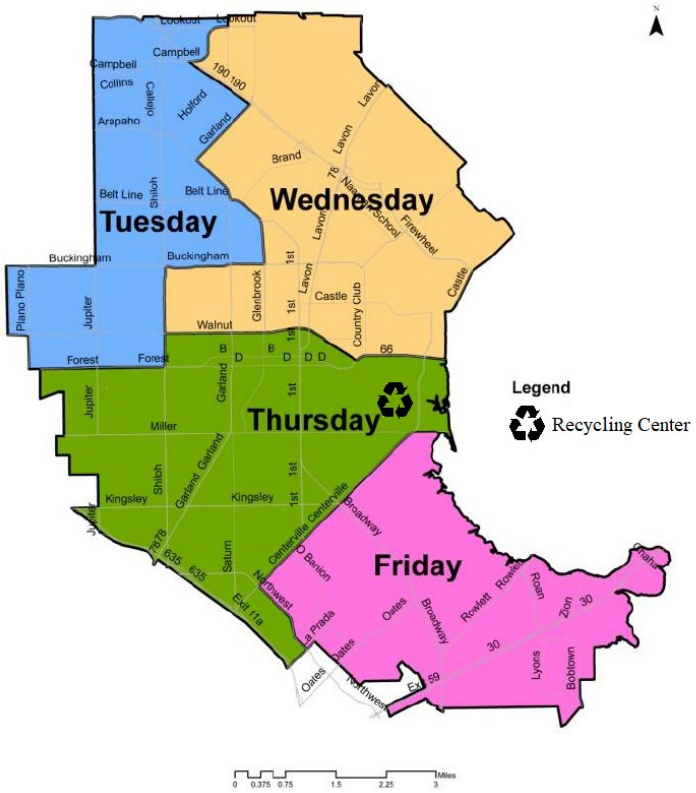
	Tuesday	Wednesday	Thursday	Friday	Total
Week 1					
Daily Collections	5,918	5,468	5,071	5,047	**21,504**
Percentage	28%	25%	24%	23%	**100%**
Week 2					
Daily Collections	5,202	5,656	5,158	4,845	**20,861**
Percentage	25%	27%	25%	23%	**100%**
Total					
Total Collections	11,120	11,124	10,229	9,892	**42,365**
Percentage	26%	26%	24%	23%	**100%**

1. Recycling collection data provided by the City as part of its most recent Recycling Container Inventory audit. The daily collections represent total set outs observed during this study. The complete Recycling Container Inventory audit is provided in Appendix B.

Balancing collection days for recycling would ensure that routes that have the highest number of collections are located closest to the Recycling Center. Based on the recycling collection information by day, there are a higher number of collections on Tuesday and Wednesday.

Figure 3-1 shows the routing daily boundaries for recycling collection, where each day includes both weeks.

Figure 3-1: Routing Daily Boundaries



Based on the routing boundaries the Tuesday routes, parts of the Wednesday routes, and parts of the Friday routes are located furthest from the Recycling Center. Balancing the recycling routes so that routes with fewer collections are located further from the Recycling Center would decrease vehicles travel time and increase the efficiency of recycling collection operation. However, there are challenges associated with rebalancing recycling routes because it is a key offering of City-operated collection services that customers receive refuse and recycling collection on the same day. Providing refuse and recycling service on the same day is critical to maintain customer satisfaction with the program and to emphasize the importance of recycling relative to refuse collection. Given the organic growth of the City's recycling collection service over time, more residents in certain areas of the City may receive recycling collection compared to other areas, which contributes to the recycling routing imbalance. Burns & McDonnell did not analyze refuse routes to understand if balancing recycling routes would cause customers to receive collection on different days, and recommends that the City assess residential refuse and recycling routing holistically before implementing changes to the current recycling routes.

3.3 Implementation Considerations

Based on the recycling routing options, Burns & McDonnell has provided implementation considerations for increasing recycling routes and balancing collection days including the priority, timeline, and financial impact of each recycling routing option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Implementation considerations described in Table 3-6 provide context for the following key findings and recommendations.

Table 3-6: Recycling Routing Options Implementation Matrix

Option	Priority	Timeline	Financial Impact
Increase Recycling Route	Increasing the operational efficiency of the recycling collection operation is a high priority given the strain on the current operations equipment and increasing overtime costs.	Near-term.	Requires hiring one FTE and purchasing a new vehicle (or allocating existing equipment to service an additional route). Increased operational efficiencies may decrease the overtime costs associated with the recycling collection operation.
Balance Routes by Collection Day	Although there may be efficiencies achieved by balancing the collection routes by day, it is not essential and may cause challenges associated with changing customers refuse and recycling collection days.	Mid-term.	Balancing routes by collection days would require staff time to execute implementation and may increase education and outreach costs to inform customers of operational changes.

3.4 Key Findings and Recommendations

This section presents key findings and recommendations related to recycling collection routing. Each recommendation is followed by description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

3.4.1 Key Findings

1. **The City requires 0.93 additional daily recycling collection routes.** Based on the results of the Routing Model, adding an additional route daily (or four routes weekly) would increase the efficiency of the City's recycling collection operation.
2. **Increasing daily recycling routes from six to seven would require one additional vehicle and vehicle operator.** The City will need to hire one FTE and purchase a collection vehicle, or dedicate an existing collection vehicle to service an additional route. Note if the decision is made to dedicate an existing vehicle for an additional route, the backup ratio for the recycling operation would decrease from 67 percent to 57 percent.
3. **Tuesday and Wednesday have a higher number of collections compared to other collection days.** Recycling routes on Tuesday and Wednesday represent 26 percent of collections each, compared to 24 and 23 percent on Thursday and Friday, respectively.

3.4.2 Recommendations

1. **Add one daily (or four weekly) recycling routes to increase the operational efficiency of recycling collections.** Increase the operational efficiency of recycling collections could provide savings to the City associated with decreased vehicles maintenance and overtime costs. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** Moderate - one FTE and dedicating a vehicle to operate the route]
2. **Maintain existing recycling collection days.** Although balancing routes by collection days could increase the efficiency of recycling collection operation, there are challenges associated with changing customer collection days or having recycling and refuse collection occur on different days of the week. Based on these limitations, Burns & McDonnell recommend the City maintain the existing recycling collection days. [**Priority:** Low; **Timeline:** Long-term; **Financial Impact:** N/A]
3. **Balance routes by collection days for all residential collection services.** Burns & McDonnell recommends examining all residential collection service routing including refuse, recycling and bulk and brush collection to prepare for future operational changes (e.g. increasing recycling routes, adjusting brush and bulk collection operation). By approaching this effort on a combined basis, the City can incorporate critical service offerings as part of the implementation such as maintaining collection of refuse and recycling on the same day. [**Priority:** Low; **Timeline:** Mid-term; **Financial Impact:** Minimal - staff time to rebalance and increased education and outreach to inform customers of changes to service days.]

4.0 POTENTIAL TO INCREASE COMMERCIAL RECYCLING

This section provides a description of the commercial recycling program, discusses options to increase commercial recycling, and provides implementation considerations, key findings and recommendations related to commercial recycling collection.

4.1 Commercial Recycling Overview

The City competes with private haulers to provide commercial recycling services in an open market; however, there is minimal competition from the private sector due to limited demand from commercial customers for recycling service. Commercial recycling service is provided using front load collection vehicles, where the City services its customer-base on a three day per week schedule. The staffing and equipment providing service to commercial customers are under-utilized because the number of customers is not enough to make up a full collection route. The current route is approximately only 60 percent utilized primarily due to low demand for service, and when collection of commercial recycling is complete the driver will transition to support commercial refuse collection.

To provide perspective on the difference between commercial recycling and refuse, Table 4-1 and Table 4-2 compare the number of collection units and weekly service frequency for each type of commercial customer.

Table 4-1: Commercial Refuse Collection Service Matrix

Cubic Yards	Collection Units Serviced per Week					
	1	2	3	4	5	6
2	257	8	3	0	0	0
3	129	19	11	1	0	0
4	231	43	17	0	3	0
6	218	98	37	2	2	1
8	372	203	197	26	61	13

Table 4-2: Commercial Recycling Collection Service Matrix

Cubic Yards	Collection Units Serviced per Week					
	1	2	3	4	5	6
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
6	51	7	0	0	0	0
8	100	24	0	0	0	0

These service matrices indicate that refuse collection units are serviced a total of 3,273 times per week, a total of 20,847 cubic yards, whereas commercial recycling units are serviced 213 times per week, a total of 1,574 cubic yards.

By comparison, the City of Denton with an estimated population of 138,541 (compared to the City's estimated 237,982) provides front load commercial collection to 494 total customers (compared to the City's 182 customers) and charges similar rates compared to the City's fee of $130.41 for once per week collection of both six and eight cubic yard containers. Denton markets its services through its Green Business Program.[1]

4.2 Commercial Recycling Options

Based on the commercial recycling overview, Burns & McDonnell has provided options to increase commercial recycling for the City's consideration, as communicated in Table 4-3. There are several commercial recycling options that the City could pursue to support the effective diversion of recyclable material generated by commercial establishments. The options are presented from voluntary to mandatory, and would require City Council approval before implementing one or more of the options presented. More detailed descriptions of each option are described in the sections following Table 4-3.

[1] More information on the City of Denton's Green Business Program can be found at the following hyperlink: https://www.cityofdenton.com/en-us/all-departments/quality-of-life/sustainability-(1)/green-business-program

Table 4-3: Commercial Recycling Options Description

Option	Description
Business Recognition Program	A business recognition program would provide certifications based on a series of waste reduction and recycling best practices like proper signage, green purchasing policies, and regular recycling training.
Waste Reduction Assistance Program	A Waste Reduction Assistance Program (WRAP) would provide local businesses with technical assistance in assessing its potentially recyclable waste stream (pre- and post-consumer material), handling and collection infrastructure, and other issues related to waste reduction and environmentally preferable purchasing.
Increase Access to Public Space Recycling	Increasing access to public space recycling would provide additional capacity and signage for disposing post-consumer materials to increase diversion in high traffic areas, particularly during events.
Expand Existing Recycling Collection	This option would expand existing recycling collection to support the recycling of source separated materials from commercial establishments.
Commercial Recycling Ordinance	A commercial recycling ordinance would mandate recycling from commercial generators. A commercial recycling ordinance could also close, or partially close, the current open market for commercial recycling. To construct an ordinance, the City would need to determine the criteria for inclusion of businesses, develop the minimum requirements of the program, set penalties for non-compliance, provide technical assistance to local businesses, and ensure that there are enough cost-effective collection service providers for businesses to use.

4.2.1 Business Recognition Program

As part of a business recognition program, the City would provide an application for businesses to identify a series of waste reduction and recycling best practices that they choose to incorporate in their operations. These best practices could include, but are not limited to, proper signage, green purchasing policies, donation programs, business-to-business material swap, or regular recycling training. Each practice implemented would earn the participant points and the more points earned, the higher the tier certification achieved.

Implementing a business recognition program would require that the City develop practices for recognition and a series of award packages. To launch this type of program, the City would need to dedicate staff time and funding to deploy a submission webpage and digital presence to support businesses that participate in the program. The City could consider developing this type of program by working with a digital provider to support the development of web or tablet-based applications that would be used by businesses to input information associated with award submittals.

As a reference, the City of San Antonio recently implemented a Commercial Recycling Recognition program in February 2018. This program includes 27 practices for a variety of different types of commercial establishments to choose from. More information about San Antonio's program can be found here: https://www.reworkssa.org/. The City of Plano has also had a similar program in place since 1999, and information is available here: https://www.plano.gov/711/Commercial-Waste-Recycling.

4.2.2 Waste Reduction Assistance Program

To develop a WRAP, the City would dedicate resources to provide businesses with technical assistance to assess their potentially recyclable materials and develop individual waste reduction and recycling strategies. The resources dedicated to this effort could be strategically deployed to leverage the City's existing commercial refuse customers to include recycling service and support the expansion of existing recycling collection.

A WRAP could serve as an opportunity for the City to collect and analyze data on the existing commercial recycling management practices of business establishments. Providing technical support could be combined with efforts to market the City's commercial recycling collection services and support businesses that manage or generate material in various ways and require varying levels of service. For example, restaurants and banks generate different types of materials. Some industries have standard practices for recycling material and others do not.

4.2.3 Public Space Recycling

Public space recycling is typically challenging due to unmonitored receptacles and high levels of contamination. Providing a standard type of recycling container in public spaces, especially in high traffic areas (e.g. downtown) or during public events could support increased diversion of recycling material. Consistency in container types, colors and signage would allow residents and visitors to become accustomed to one system that they can expect and use in the same manner throughout the City, and could be serviced as a part of expanded commercial recycling collection services.

4.2.4 Expand Existing Recycling Collection

Based on the limited number of commercial recycling customers, there is opportunity for the City to increase the routing efficiency and cost-effectiveness of commercial recycling by increasing the number of customers serviced. This option would seek to expand the services of the City's current commercial recycling program. The City does not actively advertise or market commercial recycling service, nor are any staff dedicated to pursuing new customers. The City should consider proactively acquiring commercial recycling customers by identifying target customers based on feedback from collection drivers, knowledge of existing collection routes, and monitoring utility billing and account data.

Dedicated City staff could place calls to targeted customers to engage customers; however, before beginning its marketing campaign, the City would need to ensure it has adequate collection staff and equipment ready to service additional customers.

Through taking on new customers, collection costs per customer would decrease due to increased route densities, as long as customer acquisition is focused on areas where commercial recycling collection already takes place. Before expanding commercial recycling collection, the City should consider assessing the rates charged to ensure that costs associated with the service are fully recovered. The cost of service for commercial recycling is further described in Section 7.0.

4.2.5 Commercial Recycling Ordinance

To develop commercial recycling ordinance the City would enact ordinances that incentivize or compel commercial and institutional customers to implement commercial recycling. Key criteria for the design of this policy approach would include the criteria for inclusion (i.e. specific types of businesses, or minimum waste generation thresholds), penalties for non-compliance, availability of technical assistance, stakeholder engagement, and any challenges associated with existing or pending local or state legislation. Additionally, a commercial recycling ordinance could close, or partially close, the commercial recycling market. The NCTCOG Recycling Ordinances and Building Design Guidelines describes multiple options for the development of commercial recycling ordinances.[2]

If a commercial recycling ordinance is implemented, the City must ensure that there are sufficient cost-effective collection service options for businesses that are required to recycle. If a commercial recycling ordinance required customers to use the City for collection service, the City would need to ensure that it could provide services to the expanded customer base more cost-effectively than the City currently provides commercial recycling. Either type of commercial recycling ordinance would require a stakeholder engagement process, increased education and outreach effort, and an expansion of the City's commercial recycling staff and equipment.

4.2.5.1 Commercial Ordinance Case Studies

This section presents commercial ordinance case studies from the cities of Austin and Dallas to provide perspective on the efforts to increase commercial recycling.

Austin, Texas. The Universal Recycling Ordinance (URO) supports the City of Austin's zero waste goals by requiring commercial, multifamily, and food-permitted properties to provide access to diversion services for their employees, and tenants and to participate in diversion practices. The goals of the URO

[2] This document is available from the NCTCOG at https://www.nctcog.org/nctcg/media/Environment-and-Development/Documents/Materials%20Management/Final_Report-Ordinances_Guidelines_August_2009.pdf

are to increase waste reduction and diversion, extend the life of local landfills, reduce harmful environmental impacts, and encourage economic development.[3]

The URO was adopted by City Council in November of 2010, with the first set of requirements becoming effective October 1, 2012. Implementation was tiered and based on size (square footage) of a business, with larger businesses becoming subject earlier, and smaller businesses subsequently becoming subject to the URO. Though the URO was adopted a decade ago, it was not fully implemented until 2018. Currently, approximately 15,000 entities within the City are subject to URO requirements including:

- **Commercial properties.** All non-residential properties.
- **Multifamily properties.** Those with five or more dwelling units.
- **Food-permitted properties.** Commercial properties required to have a food permit from the City.

The City provides guidance and resources to support URO-subject property owners and managers in understanding and complying with the URO through the City's URO website[4] and the ARR Business Outreach Team. Properties subject to the URO must meet the following requirements:[5,6]

- **Convenient access to services.** URO-subject properties are required to provide employees and tenants of the property with access to collection receptacles for single-stream recyclable materials and for organic materials if the property is food-permitted. The URO does not include requirements to provide diversion opportunities to the public (e.g., customers or patrons of the property or business) and does not include requirements for actual diversion of materials or a minimum diversion rate.
- **Collection and diversion.** Access to diversion opportunities for recyclable and organic materials must be provided; however, property owners may choose the method by which materials are collected and diverted, including:
  - Contracting with a City-licensed hauler for recycling and/or organics collection services
  - Self-hauling materials to a MRF or composting facility

[3] Source: City of Austin URO webpage, Commercial Recycling Requirements. http://www.austintexas.gov/department/commercial-recycling-requirements
[4] https://www.austintexas.gov/department/universal-recycling-ordinance-uro
[5] Summary of requirements for properties subject to the URO are based on the requirements described in the City of Austin Code of Ordinances, Chapter 15-6, Article 5 (*Solid Waste Services; Universal Recycling*).
[6] Under certain circumstances, properties otherwise subject to the URO may apply for waivers to URO requirements, as outlined the City of Austin Code of Ordinances, Chapter 15-6, *Solid Waste Service Administrative Rules*.

- Alternative food diversion methods that follow the hierarchy of beneficial use,[7] such as donation to food banks, farms, or community gardens.

For recycling, commercial entities may comply with the ordinance by meeting a 50 percent diversion capacity by volume (measured by service capacity ratios; most entities choose this option) or by meeting an 85 percent diversion rate by weight. Multifamily properties comply with the URO if they provide a minimum capacity of single-stream recycling per unit per week.[8] For organics, food-permitted entities comply by providing one or more organics diversion options (including waste reduction) to employees. URO organics diversion requirements do not address businesses that generate organic materials (e.g., from landscaping activities) but are not food-permitted businesses.

- **Education.** There are two primary education requirements under the URO. The property owner or manager must ensure that all tenants and employees at the property are provided diversion information and instruction (for single-stream recycling and organics, as applicable) on an annual basis. Additionally, informational, and instructional signage must be posted prominently for each material stream in multiple languages (minimum of English and Spanish), incorporate universal symbols, and include affixing signage to each collection container provided on the property.
- **Reporting.** Each URO-subject property must submit an Annual Diversion Plan for recyclables and food-permitted properties must also submit an Organics Diversion Plan to the City. Plans are submitted online through the Re-TRAC Connect platform and provide the City with the property's:
  - List of materials to be diverted
  - Service capacities available at the property for landfill refuse, recyclables, and organic materials (as applicable)
  - Collection method and service provider(s) for the three material streams (as applicable)

Annual Diversion Plans and Organics Diversion Plans allow the City to compile data regarding compliance with the URO service requirements. In 2019, commercial entities covered by the URO submitted 8,895 annual diversion plans for recycling and 3,530 for annual organics plans totaling 12,425 total plans. Data contained in the plans was limited and city staff had challenges using the plans to

[7] The hierarchy of beneficial use of scrap food is defined in the Good Faith Donor Act set forth in Chapter 76 of the Texas Civil practice and Remedies code, and is (beginning with the most beneficial use) feeding hungry people, feeding animals, providing for industrial uses, and composting.

[8] Prior to October 1, 2020, the multifamily properties are required to provide 6.4 gallons of recycling capacity per unit per week. Effective October 1, 2020, the multifamily recycling capacity requirement will be increased to 24 gallons per unit per week, or provision of equal capacity for recycling and landfill recycling.

directly measure progress toward its ultimate zero waste goal. Generally, businesses do not report data on material quantities, so the City relies on semi-annual reports for material tonnage data. Haulers are required to provide the City with semi-annual tonnage reports to maintain a hauling license with the City.

Dallas, Texas. The City of Dallas' Multifamily Recycling Ordinance went into effect January 1, 2020, for all multifamily properties with eight or more units with the intention of providing access to recycling for all residents. Multi-family properties with eight or more units are required to provide recycling services to their tenants and employees by offering access to either valet, dual stream, or single stream recycling service. Property owners and managers must use a permitted recycling collector for recycling collection service. [9]

Permitted recycling collectors servicing multifamily sites need to obtain a multifamily site recycling collection service by applying and paying the associated permit application fee, renewing every 12 months. As a permitted multifamily site recycling collector haulers are required to, at a minimum, service clients weekly and provide color coded recycling containers with specific signage for clients to use onsite. Containers may be roll carts, bins, wheelie bins, dumpsters, or compactors. Containers that are more than two cubic yards may have restricted openings to prevent gross contamination and must contain signage at least 18" x 12" in size and affixed to the front of the container and include information or a graphics indicating “Recycling Only,” “No Plastic Bags,” cardboard boxes should be broken down and contact information for how to report overflowing or contaminated containers.

Haulers are also required to submit a Recycling Collector Annual Report by February 1 of each year that includes the following information:

- Business contact information
- The tonnage of recyclables collected from multifamily properties located in the City of Dallas in the prior calendar year
- The total average number of units served and the total recycling capacity for multifamily sites served in Dallas
- Name and location of material recovery facilities/recycling processing facilities utilized in the prior calendar year
- The recycling hauler's load reject rate as reported by the material recovery facilities/recycling processing facilities utilized in the prior calendar year

[9] City of Dallas Multifamily Recycling Ordinance webpage.
https://dallascityhall.com/departments/sanitation/Pages/multifamilyrecycling0.aspx

- The recycling hauler's residue percentage rate as reported by the material recovery facilities/recycling processing facilities utilized in the prior calendar year
- Documentary evidence, if requested, of payment of ad valorem taxes owed on the real and personal property used if the business is located in the City of Dallas
- Any other information that may be reasonably requested by the City of Dallas regarding recycling collection services

The first annual reports since the program began are due in February 2021. Based on the extensive stakeholder engagement in the development of the program including the Apartment Association of Greater Dallas and requirements for newly planned developments to participate, Dallas city staff are confident of a high participation rate in the program.

4.3 Implementation Considerations

Based on the commercial recycling options, Burns & McDonnell has provided implementation considerations for increasing commercial recycling including the priority, timeline and financial impact of each option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Implementation considerations described in Table 4-4 provide context for the following key findings and recommendations.

Table 4-4: Commercial Recycling Options Implementation Matrix

Option	Priority	Timeline	Financial Impact
Business Recognition Program	This program is medium priority. It is not an immediate priority but could be combined with other efforts to expand commercial recycling in the future.	Mid-term.	The resources required to establish this program are minimal including half of a FTE and start-up costs including developing a webpage and digital presence to support businesses that participate in the program.
Waste Reduction Assistance Program	Developing a WRAP is a high priority for increasing commercial recycling.	Near-term.	The resources required to establish the program include half of a FTE to respond to coordinate and respond to requests for technical support from the business community.
Increase Access to Public Space Recycling	It is important to provide access to public space recycling that has uniform City-wide standard for signage, particularly during City events, but it is not a high priority for increasing commercial recycling and there are challenges with high contamination rates.	Long-term.	The resources required include and placing and servicing equipment front load, roll off, or other designated containers for recycling in public spaces.
Expand Existing Recycling Collection	This is a high priority for increasing the cost effectiveness of commercial recycling, and it could be implemented in conjunction with a WRAP. There may be challenges due to high cost of service.	Long-term.	The resources required include half of a FTE dedicated to marketing of recycling services to customers in strategic areas and dedicating collection vehicles to servicing customers.
Commercial Recycling Ordinance	This is not a high priority because there may be challenges for certain businesses to receive equitable or cost-effective service options given the open market for commercial services.	Long-term.	The resources required to develop and implement a commercial recycling ordinance include a stakeholder engagement process, education and outreach effort, and expansion of commercial recycling staff and equipment.

4.4 Key Findings and Recommendations

This section presents key findings and recommendations related to commercial recycling collection. Each recommendation is followed by description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

4.4.1 Key Findings

1. **The City's commercial service collect a higher number of collection units for commercial refuse collection compared to recycling.** Refuse collection units are serviced a total of 3,273 times per week, a total of 20,847 cubic yards, whereas commercial recycling units are serviced 213 times per week, a total of 1,574 cubic yards.
2. **Current recycling routes are not fully utilized.** The commercial recycling route operates three days per week and is approximately 60 percent utilized.
3. **Business recognition program is an effective voluntary approach to increasing commercial recycling**. A business recognition program could be combined with other initiatives to increase the number of commercial recycling in strategic locations.
4. **WRAP could be leveraged to support the marketing and education and outreach effort to increase commercial recycling.** Providing technical assistance to businesses that receive refuse collection service to source separate recyclables would be an effective way to have City staff identify and engage with potential commercial recycling customers.
5. **Increasing access to public space recycling for events in the City presents challenges with high levels of contamination.** Providing unrestricted access to recycling containers often lead to high levels of contamination. Even with coordinated signage there is still a challenge of minimizing contamination.
6. **Implementing a commercial recycling ordinance would require stakeholder engagement and expansion of commercial recycling services.** There are multiple approaches to implementing a commercial recycling ordinance including requiring businesses provide commercial recycling or closing the commercial recycling collection market. In either case, the City would need to carry out a stakeholder engagement process, including getting approval from City Council, to inform the policy development and justify increasing commercial recycling service staff and equipment.

4.4.2 Recommendations

1. **Expand the City's commercial recycling customer base to fully utilize existing route.** Expanding the City's commercial recycling customer base would allow for the staff and equipment providing collection to become more efficient and cost-effective. **[Priority:** Medium; **Timing:** Long-term; **Financial Impact:** Minimal - increase cost effectiveness of existing commercial recycling collection by dedicating existing personnel and equipment to service customers]
2. **Develop a business recognition program in conjunction with a WRAP to increase commercial recycling customers.** Developing a business recognition program and WRAP would require an additional FTE that could coordinate between the City's collection operation and education and outreach efforts to proactively market commercial recycling. This effort would include strategic outreach to businesses, coordination of resources to provide technical assistance, and facilitation of providing recycling service to new customers. [**Priority:** Medium; **Timing:** Mid-term; **Financial Impact:** Moderate – addition of one FTE]
3. **Explore stakeholder engagement process regarding the development of a commercial recycling ordinance.** To inform the development of a commercial recycling ordinance, the City would need to engage with stakeholders of commercial recycling in the City including representatives of businesses and private haulers. This stakeholder engagement process would provide critical feedback regarding the scope of a commercial recycling ordinance. [**Priority:** Low; **Timing:** Long-term; **Financial Impact:** High – require increase in staffing and equipment to provide mandated commercial recycling services]

5.0 RECYCLING CENTER EVALUATION

This section provides an overview of the City's Recycling Center, discusses options related to continued use of the Recycling Center recycling program and service options, and provides implementation considerations, key findings and recommendations.

5.1 Recycling Center Overview

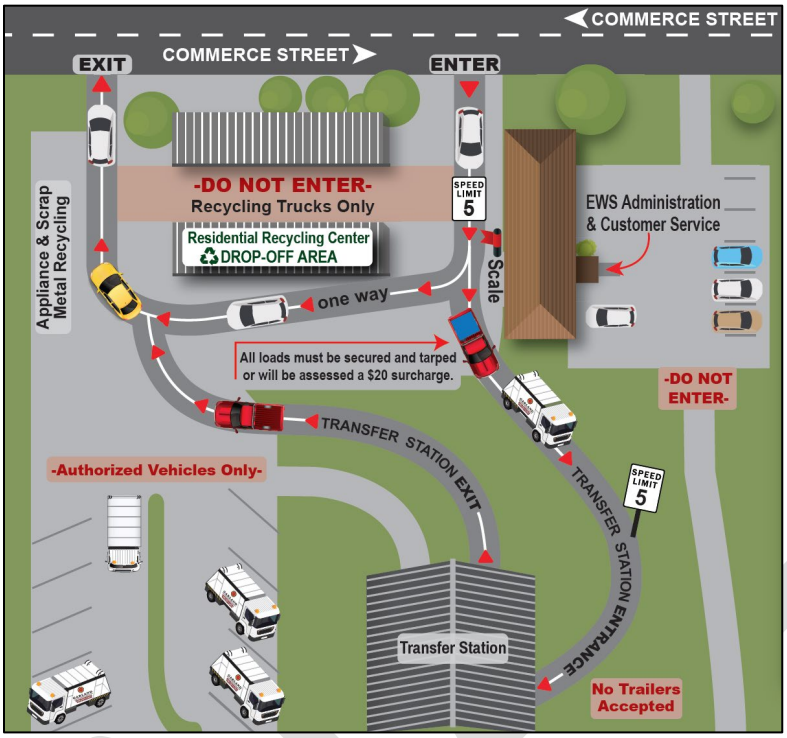
This section provides a brief overview of the key considerations related to the Recycling Center to provide context for the following Recycle Center Options discussion.

- **Location and Operating Hours.** The Recycling Center is located at 1426 Commerce Street on the eastern border of the City and is co-located with residential drop off and the City's transfer station facilities. The Recycling Center operators work at the site from 7:00 AM to 6:00 PM Tuesday through Saturday. The site is open to the public Monday through Friday 8:00 AM to 5:00 PM and on Saturday from 8:00 AM to 3:00 PM.
- **Site Configuration.** The Recycling Center operators direct the City's vehicles containing residential and commercial single stream recycling to deposit material under the canopy, shown in Figure 5-1.

Figure 5-1: Front View of Recycling Center

The Recycling Center site map, including traffic flow and the location of other City facilities is shown in Figure 5-2.

Figure 5-2: Recycling Center Site Configuration



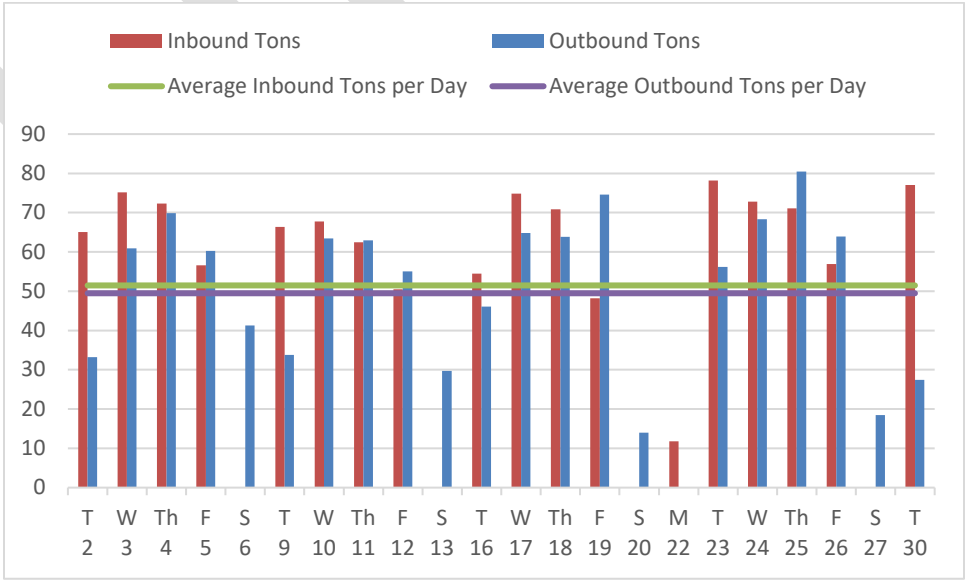
The Recycling Center is co-located with the City's Transfer Station, scalehouse, vehicle lot, and administration building. Note that the scalehouse is located adjacent to the Recycling Center, indicated by the red square that reads "DO NOT ENTER Recycling Trucks Only." This configuration requires recycling collection vehicles to cross the scales, continue on the one-way road shared with passenger vehicles, and loop around to the Recycling Center.

- **Staffing.** The Recycling Center is staffed by two full-time equivalents (FTE) that receive, handle and load recycling material into the two roll off compacting units provided by FCC. The staff are available at the facility in two eight-hour shifts, one FTE from 7:00 AM to 4:00 PM and the other from 9:00 AM to 6:00 PM (assuming one hour for lunch). Based on conversations with the City, the two FTEs are able to manage operations at the Recycling Center as part of this staggered staffing schedule. When both FTEs are at the Recycling Center (i.e. from 9:00 AM to 4:00 PM), one staff will operate a skid steer to load material into the compactor and the other will prepare the receiving units for transportation. Recycling staff focus on the material handling operation, and do not typically interact with residential customers.
- **Equipment.** The equipment located at the Recycling Center includes a skid steer with claw that is used to handle and transfer material to the two compacting hoppers and receiving units provided by FCC shown in Figure 5-3.

Figure 5-3: Skid Steer Loader Operation and FCC Servicing Compactor Unit

- **Capacity.** Based on discussions with City staff, six recycling trucks of single stream material, or two loads of commercial recycling material can fill one side of the Recycling Center. It takes Recycling Center staff 1 to 1.5 hours to fill each FCC-provided receiving unit that have average payload of approximately eight tons of recycling material.
- **Material Flow.** The material that is delivered to the Recycling Center includes residential and commercial collected single stream recycling. There are commercial customers that recycle cardboard only, as well. Burns & McDonnell analyzed inbound tons delivered (1,132 total monthly tons) by the City and outbound tons (1,088 total monthly tons) hauled by FCC throughout the month of June 2020, as shown in Figure 5-4.

Figure 5-4: June 2020 Inbound and Outbound Tons



The material flow through the Recycling Center indicates that during June the City delivered an average of 51 tons and FCC hauled away 49 tons per day. Inbound tons exceed the outbound tons

Tuesday through Friday, and the operators catch up with excess material on Saturday when there is no inbound material. Based on June 2020 tonnage flows the Recycling Center operations have the capacity to manage the amount of recycling material currently collected. The capacity constraints of the Recycling Center are further discussed in Section 5.2.1.3. The analysis provided by Burns & McDonnell represents a snapshot in time, and the volume of material may fluctuate seasonally causing larger gaps between the average daily inbound and outbound tons at other times of year (e.g. more material generated during holidays).

- **Operational Challenges.** There are several key challenges to consider related to the Recycling Center's continuing safe and efficient operations to meet growing demand. These challenges are addressed in this section and include hazardous traffic patterns, increased frequency of facility repairs (e.g. reinforcing damaged walls), and inefficiencies associated with double handling material.

5.2 Recycling Center Options

Based on the Recycling Center overview, Burns & McDonnell has provided options for the City's consideration including considering key changes to the existing Recycling Center and building a new Recycling Center.

5.2.1 Consider Key Changes to Existing Facility and Operations

Based on the challenges described in Section 5.1, this section provides key changes to the existing facility and operation for the City's consideration including optimizing traffic flow, increasing staffing to handle growing recycling tonnage, increasing capacity to handle recycling tonnage, and minimizing backing maneuvers. These key changes for consideration are intended to present best practices and support safe and efficient operation of the Recycling Center among its growing demand. Given the current Recycling Center configuration, it may not be possible to fully address all the challenges described herein.

5.2.1.1 Optimize Traffic Flow

The location of the Recycling Center among the co-located facilities, as shown in Figure 5-2, can cause challenges with safe and clear wayfinding in the site. The configuration of the site requires recycling collection vehicles to cross the scale, follow the road around the Recycling Center, and then turn into the site. There is a safety concern with this traffic pattern because passenger vehicles are directed to use the same lanes as recycling collection vehicles seeking to deposit material at the Recycling Center. Additionally, both collection vehicles and passenger vehicles use the same routes of entrance and egress from the site. With this traffic pattern there is a greater risk of vehicle-to-vehicle collision or vehicle-to-pedestrian collision, particularly if the demand for the citizen drop off and Recycling Center increase.

Based on the site visit conducted by Burns & McDonnell, there is clear signage indicating the routes to take to get to various locations at the site including the Recycling Center, citizen drop off, transfer station, and administration building; however, even with clear signage there is a potential that vehicles will make an incorrect turn, need to turn around, or encounter obstacles. Given the proximity of the citizen drop off center and the Recycling Center, if another City or passenger vehicle travels the wrong direction, parks in an incorrect location, or a compactor is being serviced by FCC when collection vehicles arrive, it may cause delays in the Recycling Center operations. Figure 5-5 shows how close the Recycling Center and citizen drop off are together, and shows an example of the Recycling Center equipment configuration when a compactor is being serviced to demonstrate how it would block collection vehicles from depositing material in the designated location.

Figure 5-5: Example of Equipment Configuration Blocking Recycling Center Operations

In the case that City collection vehicles arrive when an obstacle (e.g. vehicle collision, car parked out of place, etc.) is blocking the Recycling Center or a receiving unit is being serviced by FCC, it may force a queue to form. The traffic configuration in the site does not allow for a safe queuing space while obstacles are removed and could contribute to delays to other operations at the site (e.g. citizen's drop off, transfer station) or increased risk of safety incidents.

To optimize traffic flow, the City should consider developing roadways in the site that separate the routes that passenger vehicles and collection vehicles are directed to use. This may be challenging as the site is already space constrained and developing a new traffic pattern would disrupt ongoing operations.

5.2.1.2 Growing Recycling Tonnages May Drive Increased Staffing Needs

Based on conversations with the City, the two FTEs that staff the Recycling Center are able to manage operations with a staggered staffing schedule. However, due to the staggered staffing schedule there are

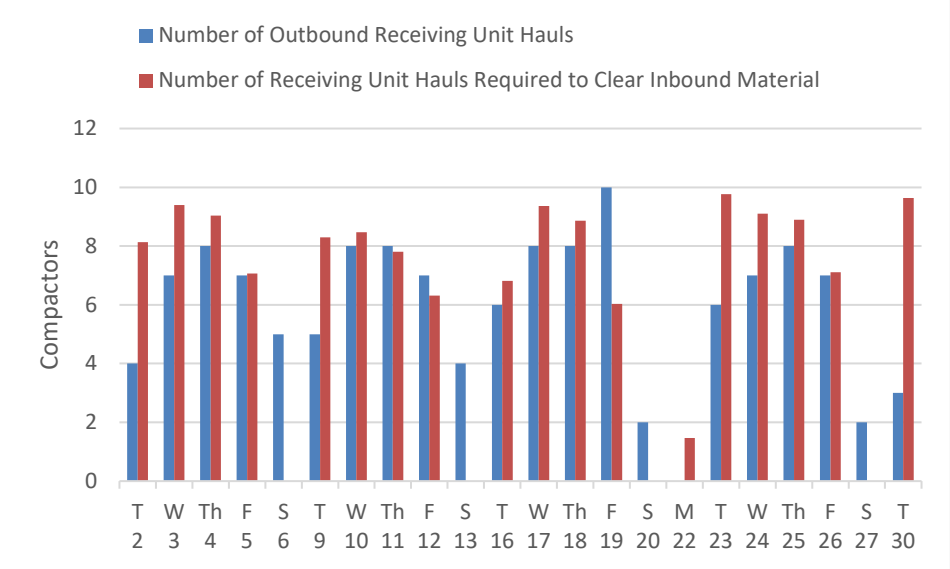
occasions when it is challenging for staff to complete daily tasks, particularly at times when only one staff member is operating the facility.

If the volume of material and flow of traffic at the Recycling Center increases significantly, it would likely present a challenge to receive inbound vehicles safely and efficiently, prepare receiving units for transportation, and load compacting units fast enough to clear the floor of inbound tonnages. The intermittent challenges for staff to complete daily tasks as part of the current operation may become more pronounced going forward, particularly in the case that the City adds a recycling route or increases commercial recycling customers. If recycling tons and vehicle throughput at the Recycling Center continue to increase, the City should consider dedicating a half FTE to support ongoing Recycling Center operations. This half FTE would help to cover the facility so at least two staff members are operating the facility during all operating hours.

5.2.1.3 Increase Capacity to Handle Growing Recycling Tonnages

Capacity constraints are a critical concern with the Recycling Center. Burns & McDonnell calculated the number of receiving unit hauls required to clear the inbound material for each operating day in June 2020 and compared it against the actual receiving unit hauls, as shown in Figure 5-6. This analysis assumed that each fully loaded a receiving unit can hold eight tons of material.

Figure 5-6: Number of Required Hauls to Clear Daily Inbound Material



Based on the number of required receiving unit hauls compared to the total outbound receiving unit hauls, there are more hauls required than provided by FCC Tuesday through Friday. On Saturdays, FCC is able to haul the remaining tonnage that is not loaded and hauled Tuesday through Friday. Based on an average 1.25 hours required for the skid steer to fully load a receiving unit, Burns & McDonnell calculated the

time required to fill the total number of receiving units required to clear daily inbound recycling material and compared it to an 11-hour workday, as shown in Figure 5-7. The 11-hour workday is reflective of at least one FTE operating the Recycling Center at all times throughout the day from 7:00 AM to 6:00 PM.

Figure 5-7: Time to Fill Receiving Units Required to Clear Daily Inbound Recycling

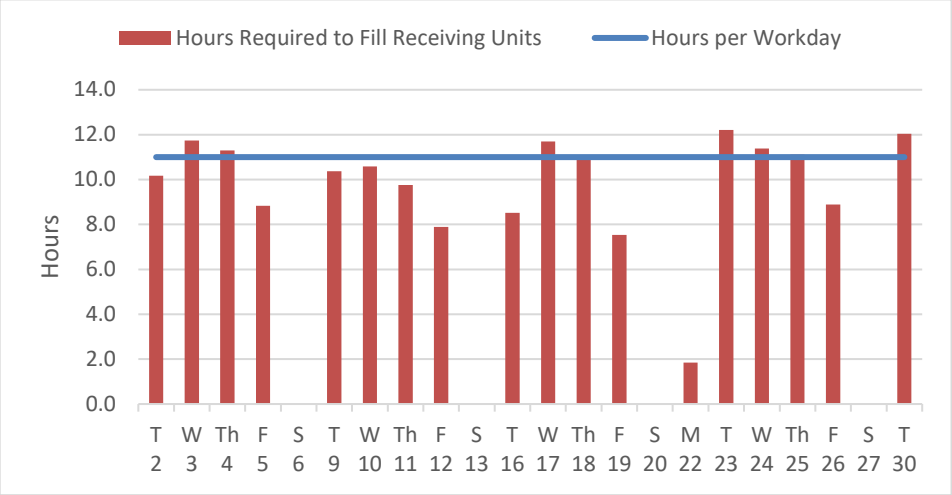


Figure 5-7 is reflective of the current operations where the total inbound material on Tuesdays through Fridays is slightly above or below operating staff's capacity to load and haul receiving units to completely clear the Recycling Center of material. Then, with no inbound tonnage on Saturday (reflected in Figure 5-7 by zero hours required to fill receiving units on June 6, 13, 20 and 27) the operating staff can catch up on the workload and clear the tonnage that is left over from the previous Tuesday through Friday.

Based on this analysis, the current operations are sufficient to handle the amount of recycling material collected by the City. Going forward, continued growth in tons of recycling collected and processed may cause inbound volume of material to outpace the ability of the current level of staff to operate the Recycling Center safely and efficiently. If inbound tonnage increases significantly the Recycling Center may experience operational challenges such as:

- Increasing vehicles queues and wait times
- Inability to load sufficient material during working hours to clear backlog of material
- Attracting vectors and vermin to the facility due to uncontained material

There are methods the City could explore to increase capacity, but the Recycling Center's space-constrained configuration presents technical challenges. Capacity could be expanded if the City increases the number of receiving units located on site and requests FCC service compactors more frequently. However, handling more receiving units throughout the workday will cause increased disruptions in operating workflow when receiving units are changed out, as described in Section 5.2.1.1.

Another approach the City could take to increase capacity is to add more compaction hoppers or skid steer equipment to increase the rate of loading recycling into receiving units, but the current configuration of the Recycling Center will not allow for safe and efficient placement and/or operation of this additional equipment.

5.2.1.4 Minimize Backing Maneuvers

The configuration of the Recycling Center requires that upon turning into the site from Commerce Street, recycling collection vehicles must cross the scalehouse, drive past the Recycling Center, and then pull in from the other side to reverse the vehicle between the compacting units to deposit material in the designated areas. This backing maneuver allows for the collection vehicles to pull forward and out of the Recycling Center as shown in Figure 5-8

Figure 5-8: Backing Maneuver Required to Deliver Material at Recycling Center

There are risks associated with requiring trucks reverse into the Recycling Center, including increased risk for property damage to City vehicles and the Recycling Center walls and support structure. Increases in the number of vehicles and tonnage throughput at the Recycling Center may result in a corresponding rise in repair costs. Table 5-1 summarizes applicable best backing practices from the Solid Waste Association of North America's (SWANA) Backing Best Management Practices for the City's consideration, and to inform the following discussion to minimize backing maneuvers.

Table 5-1: Description of Applicable Best Backing Practices

Best Backing Practices	Description
Plan Ahead	Plan to avoid backing whenever possible and work to avoid unnecessary backing situations (e.g. plan your exit in alleys, park vehicle so it can be pulled out forward). If in a backing situation, back in slowly so that when leaving the vehicle can be driven forward into traffic.
Determine Space Limitations	Determine any horizonal or vertical space limitations (e.g. adequate clearance for lifting devices) and utilize equipment that will avoid backing situations due to obstacles.
Riding Position	Collection operators should be in the cab or standing in a location visible to the driver and wearing high visibility PPE. No riding on step when in reverse.
Utilize Technology	In a backing situation, utilize four-way flashers and back-up alarms, ensuring alarms are operational; periodically tap horn prior to backing and use radar or other detection devices if installed.
Get Out and Look (GOAL)	Before backing, get out of the cab and look around to check for workers, pedestrians, muddy areas, potholes and equipment hazards. Hills and other obstacles (i.e. cars, utility equipment) make it hard to judge what is in the path. Assume that other vehicles or individuals do not see you coming.
Backing	When in a backing situation (e.g. route does not provide room to turn around or drive all the way through an alley), clear area of people and know what is behind making sure alarm sounds. Use well trained spotters in high visibility PPE to assist backing maneuvers and check both side mirrors repeatedly, stopping if spotters must change positions. Back slowly in the lowest possible gear or idle speed and do not accelerate, especially when there are blind spots or when someone could enter vehicle path. Maintaining visual contact between driver and spotters or other workers on foot is critical. Ensure that no one stands behind a vehicle operating, or about to operate in reverse and maintain appropriate separation from mobile equipment operating near work area.

Although backing into the Recycling Center is the most efficient means of delivering material and pulling out in the forward direction, there is an increased safety and collision risk because drivers are not able to execute a straight-line backing maneuver (i.e. drivers must turn while backing to best position the vehicle at the Recycling Facility). Based on SWANA's Backing Best Management Practices, planning to use a spotter to back vehicles into the Recycling Center is advisable. Since the majority of vehicles depositing recycling at the Recycling Center are automated side loaders that only require one staff to operate, Recycling Center staff need to direct vehicles rather than a second member of the collection crew. Unfortunately, there is limited space for a spotter to direct drivers, and having a spotter stand behind a collection vehicle backing into an enclosed space raises concern for potential crushing injury.

To minimize the risk of executing backing maneuvers, the City make sure drivers are utilizing in-cab camera technology to support backing maneuvers into the Recycling Center, and have the Recycling Center staff provide support as a spotter without standing directly behind the vehicle.

5.2.2 Construct New Recycling Center

Based on the key changes described in Section 5.2.1, this section describes siting, operations, and cost considerations related to permitting, building, and operating a new Recycling Center. Developing a new Recycling Center would allow the City to mitigate challenges associated with the current Recycling Center and support safe operations to effectively meet growing demand for recycling.

5.2.2.1 Site Selection and Permitting

The time required to site and permit a new Recycling Center can vary considerably depending on the site-specific location and the amount of recycling materials that are anticipated to be accepted. City Council has purchased land located to the west of the transfer station that has the potential to host a new Recycling Center, although the development of a new Recycling Center is not yet approved. Burns & McDonnell has not evaluated the land purchased by the City to identify the technical feasibility of constructing a new Recycling Center, but have provided the following key considerations related to site selection and permitting:

- **Size requirement.** A site should be selected that is able to accommodate the growing demand of recycling services and address the challenges of the current Recycling Center. The space needed will vary depending on the configuration of the new Recycling Center and required staffing and equipment needs.
- **Permit.** While it is not required to apply for an operating permit, a new Recycling Center would need to be developed consistent with key solid waste rules and regulations such as providing official notification of its operation. The notification process is detailed in Texas Administrative Code Chapter 330, Subchapter A[1].
- **Topography.** It is important to consider the site topography because it impacts the configuration and cost of developing a new Recycling Center. For example, if the design utilizes grade separation to minimize handling requirements, and amount of cut and fill material required will impact site development costs.
- **Traffic flow.** The site of the new Recycling Center will need to have proximity to the scalehouse, efficient access to the site to deliver material, traffic separation from passenger vehicles, available

[1]This document is available from the Texas Office of the Secretary of State at https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=330&sch=A&rl=Y

queuing space for traffic overflow, and flexibility to continue operations when receiving units are being serviced.

5.2.2.2 Operations

The operations of a new Recycling Center should be structured to mitigate the challenges described in Section 5.1 as cost-effectively as possible. The following provide brief description of key operational and design considerations for a new Recycling Center:

- **Site Configuration.** The City will need to consider the structure type (e.g. open air, partially enclosed), determine access to utilities, develop clear signage and evaluate available storage space. The site configuration should provide the flexibility to minimize the effort of double handling material (e.g. take advantage of grade separation to fill compactors), potentially by top loading vehicles or compaction hoppers.
- **Staffing.** A new Recycling Center will require a minimum of two FTEs dedicated to the material handling operations to operate the facility while it is open. These FTEs can be staffed in a staggered schedule like the current Recycling Center.
- **Equipment.** Additionally, if space allows, a third compaction unit could be added so more receiving units could be filled and serviced during the working day. With sufficient space at a new Recycling Center that takes advantage of grade separation, this would not disrupt material handling tasks as it does the current Recycling Center and would not require additional staffing.
- **Material Flow.** Material flow through the facility could be increased by adding additional equipment and leveraging site configuration to increase the efficiency of loading the compaction units. To increase the loading speed, the City could take advantage of grade separation so a skid steer can push material over the lip of a platform into a compaction hopper. This would minimize the time required to double handle material (i.e. pushing down into the compaction hopper rather than lifting material from the ground into the hopper).
- **Capacity**. The new Recycling Center should be developed with the flexibility to increase capacity to meet growing throughput. This would require dedicating enough space to store additional receiving units on site or adding a third compaction hopper in the case the new Recycling Center experience an increase in recycling tons over time.

5.2.2.3 Cost Considerations

The following provides cost considerations for a new Recycling Center. This is not meant to be an exhaustive list of all costs, but a general description of the key considerations in developing a new Recycling Center:

- **Site Development.** The site development costs include activities such as grading, infrastructure development leading to and from the facility.
- **Capital.** Capital costs include cost of developing the building structure, floor, fencing, equipment replacement, and signage.
- **Operating**. Operating costs include administrative costs, labor costs, maintenance, utilities, material hauling, processing and disposal. A key component of constructing a new Recycling Center would be to reduce the operational costs by minimizing the time required to fill a receiving unit and FTEs needed to operate the site.

5.2.2.4 Financing

The following provides a brief summary of several options for financing a new Recycling Center:

- **Pay as you go financing.** Items are purchased out of current year funds as they are available.
- **Debt financing.** Money is borrowed from an outside lender with the promise to return the principal, in addition to an agreed upon interest percentage. Publicly owned facilities can take advantage of lower cost of capital.
- **Grant in aid financing.** Federal or state grants in aid can significantly reduce costs. Grant opportunities vary from year to year. Funding resources include catalog of federal domestic assistance and TCEQ regional solid waste grants program. The Study on the Economics of Recycling developed by the TCEQ communicates potential funding sources; the report is available at https://www.tceq.texas.gov/assets/public/assistance/P2Recycle/study/TheStudyontheEconomicImpactsofRecycling.pdf.
- **Reserve fund financing.** Government equivalent of a savings account for capital item acquisition, a portion of current revenues invested each year in order to accumulate sufficient funds to purchase equipment, land, vehicles or other items.

5.3 Implementation Considerations

Based on the Recycling Center options, Burns & McDonnell has provided implementation considerations including the priority, timeline, and financial impact of each option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).

- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Implementation considerations described in Table 5-2 provide context for the following key findings and recommendations.

Table 5-2: Recycling Center Option Implementation Considerations

Option	Priority	Timeline	Financial Impact
Consider Key Changes to Existing Facility and Operations	Improving the operations of the existing facility is a medium priority because the ongoing challenges may prevent growth of the recycling program, but there are limited available solutions given the current site configuration.	Near-term	The financial impact of increasing the efficiency of the current operation is moderate and includes adding a half FTE to have at least two operators at the facility throughout the hours it is open to receive material.
Build New Recycling Center	This is a medium priority because the current Recycling Center is able to operate with current staff, equipment and throughput. However, the current facility does not provide the ability for collection vehicles to use separate lanes of traffic from passenger vehicles nor does it provide the ability to meet growing demand for recycling services.	Mid-Term	The financial impact of building a new recycling is high, including the site development, capital and operating costs of a new facility. However, a new Recycling Center could leverage the site configuration to provide flexibility to increase the efficiency of material handling operations and overall site capacity.

5.4 Key Findings and Recommendations

This section presents key findings and recommendations related to recycling programs and services. Each recommendation is followed by a description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

5.4.1 Key Findings

1. **Current traffic patterns at the Recycling Center present operational and safety challenges.** The current site configuration requires recycling collection vehicles to cross the scales, continue on the one-way road shared with passenger vehicles, and loop around to the Recycling Center. This route requires collection vehicles to share traffic lanes with passenger vehicles, which increases the risk of collisions or other safety incidents. Additionally, collection vehicles need to back into the facility in a path that is not a straight-line backup increasing the risk of damage to equipment and the facility.

2. **The current equipment at the Recycling Center is sufficient to manage current operations.** The equipment located at the Recycling Center includes a skid steer with loader that is used to handle and transfer material to the two compaction hoppers and receiving units provided by FCC. This equipment is sufficient for the current staffing and throughput.
3. **Two FTEs are able to manage current operations at the Recycling Center.** The two FTEs are able to operate the facility in a staggered shift schedule; however, operations are most efficient when both are working at the same time. Recycling staff focus on the material handling operation, and do not typically interact with residents using the citizen drop-off.
4. **The current volume of material throughput at the Recycling Center is manageable with current staffing and equipment.** Based on analysis of tonnage flows during June and the time requirements to fill receiving units with inbound tonnage, the City is able to handle inbound material during the 11-hour workday with a staggered staffing schedule. Although there are days when the inbound tonnage exceeds the available time to fill receiving units, operating staff catch up on Saturdays when there is no inbound material.
5. **The size constraints of the Recycling Center prohibit expansion and cause interruptions in material handling operations.** Each side of the Recycling Center can handle a maximum of six recycling trucks of single stream material, or two loads of commercial recycling material on one side of the Recycling Center. The City is unable to increase the capacity of the Recycling Center because it cannot add more compactors or receiving units due to space constraints and safety concerns. Additionally, when a compactor is being serviced the facility cannot accept material.
6. **The Recycling Center has several additional operational challenges.** In addition to size constraints the Recycling Center has several key operational challenges that would become more pronounced as tonnage grows including increased frequency of facility repairs, higher risk of damage to equipment, limited truck queuing space and inefficiencies associated with handling material by lifting it from the ground into the hopper.

5.4.2 Recommendations

1. **Optimize traffic flows at current or new Recycling Center.** Burns & McDonnell recommends developing separate lanes of traffic for collection vehicles and passenger vehicles to and around the Recycling Center. This may not be feasible to do this at the current Recycling Center but should be a key consideration for developing a new facility. [**Priority:** High; **Timeline:** Near-term; **Financial Impact:** N/A]
2. **Maintain current number of equipment and staffing.** Although the current operation may not be able to support adding receiving units or compaction hoppers due to space constraints, doing

so would allow increased the frequency of material hauling from the Recycling Center. [**Priority:** Medium; **Timeline:** Mid-term; **Financial Impact:** N/A]

3. **Ensure drivers continue to utilize in-cab camera technology to safely execute backing maneuvers.** The City employs in-cab camera technology to support drivers safely operating collection vehicles. The City should ensure drivers continue to utilize the in-cab cameras to reverse into the Recycling Center and have the Recycling Center staff provide support as a spotter without standing directly behind the vehicle to avoid potential injuries. [**Priority:** Low; **Timeline:** Near-term; **Financial Impact:** N/A]
4. **Develop new Recycling Center.** Burns & McDonnell recommends the City develop a new Recycling Center that mitigates the safety and operational challenges of the current facility. The City would need to determine the site, site-specific configuration, site-specific costs and financing method. The City should seek to leverage a site that provides enough space to install a third compaction hopper and receiving unit and minimizes the effort to handle material by taking advantage of grade separation so equipment could push material into the top of a compaction unit hopper, rather than lifting it from the ground into the hopper. Additionally, the areas where vehicles tip and compaction units are located should be separated to allow for continuous operation even when a compactor is being prepared for transportation. [**Priority:** Medium; **Timeline:** Mid-term; **Financial Impact:** High – determine the site, financing structure, engineering design, construction costs and operations of a new Recycling Center]

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6.0 ORGANICS RECYCLING PROGRAM DEVELOPMENT

This section provides a description of the current organics processing operation at the landfill and ongoing development, discusses options to expand organics recycling, and provides implementation considerations, key findings and recommendations related to organics recycling collection.

6.1 Organics Recycling Overview

The City's current organics recycling efforts include stockpiling brush material at the C.M. Hinton Jr. Regional Landfill (Landfill) and hiring a third-party contractor to grind the material. Recently, the City's contractor processed a stockpile of an estimated 40,000 cubic yards (CY) over a three-week period on an unconstructed portion of the Landfill site. This stockpiled material had minimal contamination (i.e. dirt, inert materials) and is being screened using a rented trommel screen operated by City staff over a period of several months. To load ground material into the trommel screen, the City plans to direct landfill staff to operate a loader and an excavator on a part-time basis. Once screened, the material is expected to be sold to local end-markets at a rate of $4.00 per ton where it will be further processed and sold on the wholesale market as soil amendment.

6.2 Organics Recycling Options

Burns & McDonnell has provided organics processing options for the City's consideration including expanding the current operation, hiring a full-service contractor, and delivering unprocessed material to a third-party processor.

6.2.1 Expand Current Organics Recycling Operation

Expanding the current operation of processing stockpiled brush material would include continuing to accept brush material and periodically hiring a contractor to grind the material when a sufficient quantity is stockpiled. Based on conversations with City staff, there is minimal interest in the near term to expand the operation to include wet organic wastes such as biosolids or food waste, as this would require infrastructure upgrades to manage the increased moisture content, odor, and equipment requirements. This analysis assumes that the City would continue to process dry, clean brush and green waste in batches, where a processor would be hired on an as-needed basis. The following sections describe the operational requirements, expected costs, and expected revenues associated with expanding the current organics recycling operation.

6.2.1.1 Operational Requirements

Burns & McDonnell analyzed the cost and revenue associated with expanding the current organics recycling operation. Table 6-1 shows the operational considerations to expand the current operation to

collect an inbound 60,000 CY of material on an annual basis, followed by descriptions of key assumptions and information regarding operational requirement.

Table 6-1: Expanded Organics Recycling Operational Requirements

Operational Requirements	Annual Total	Unit
Inbound Volume	60,000	CY
Contamination	3,000	CY
Volume Reduction	36,000	CY
Product Provided to Residents	100	CY
Sale Volume[1]	9,248	Tons
Processing Duration	5	weeks
Screening Duration	13	weeks

1. Sale volume is calculated by converting the total 20,900 CY of sale volume to tons based on an assumed density of 885 lbs/CY for ground and screened material.

- **Inbound volume.** Represents the anticipated annual volume of material delivered to the organics recycling site at the Landfill as part of expanding operations. This material would be delivered by landscapers, City haulers, private haulers, and residents. To achieve this increase in inbound volume, the City would need to market the facility to private haulers and separate clean brush collected from residential customers to deliver it to the organics processing facility as described in Section 6.2.1.4. Burns & McDonnell selected 60,000 CY per year inbound volume to demonstrate the cost of expanded operations. This does not represent the results of a wasteshed study or reflect any contractual obligations for material to flow to the site.
- **Contamination.** Contamination is estimated at five percent of inbound material based on anticipated increase in material flowing to the site, including City collected clean brush material. Further discussion on collection of residential brush material is provided in Section 6.2.1.4.
- **Volume reduction.** Volume reduction occurs when brush and green waste is mechanically ground in a horizontal or tub grinder and left in static piles to cure. While the volume reduction from this process can range from 40 to 80 percent, Burns & McDonnell assumed a 60 percent volume reduction for this analysis. The make and model of the grinder and the composition of the material will ultimately determine the volume reduction due to grinding. Organic material that is composted does lose volume during the curing process; however, the inbound dry brush material contains minimal moisture and therefore would likely not lose significant volume due to settling.
- **Product provided to residents.** This represents the estimated amount of material that would be provided to residents free of charge as part of the operations.

- **Sale volume.** The sale volume represents the total amount of material that will be sold and is calculated by subtracting the estimated volume loss, contamination, and product given to residents from the total inbound volume. Although the City has identified an outlet for its existing material, in the future there may be a need to diversify the outlets that product is sold to avoid space constraints associated with stockpiling ground and screened material at the site.
- **Processing duration.** Processing duration is the estimated time it would take the City's contractor to grind the material through a horizontal grinder based on an annual 60,000 CY of inbound material. The actual grinding may occur several times per year rather than waiting to grind a full year of stockpiled material. Burns & McDonnell assumed there would be no additional cost for the City's contractor to mobilize equipment and grind material multiple times per year. The duration of processing has been extrapolated from the three-week time period it took for the current contractor to process 40,000 CY of inbound material, adjusted proportionally to process 60,000 CY.
- **Screening duration.** Screening duration is the estimated time it would take the City to load the processed material into a trommel screen and handle the post-screened material, assuming the material is screened once all the material has been ground. The duration of screening has been calculated based on the two-month time period it is estimated for City staff to screen the ground stockpiled material, adjusted proportionally to screen the amount of ground product from 60,000 CY of inbound material. Note that the total screening duration is 13 weeks, shown rounded to 17 weeks in Table 6-1.

6.2.1.2 Operational Costs

Based on the operational requirements, Burns & McDonnell evaluated the cost of expanding the current organics recycling operation. Table 6-2 shows the costs of the expanded operation, followed by descriptions of key assumptions and information regarding the costs of each operational requirement.

Table 6-2: Expanded Organics Recycling Operational Costs

Operational Costs	Cost
Processing Contractor	$67,200
Trommel Screen Rental	$24,000
Equipment Fuel	
Front End Loader Fuel	$7,794
Excavator Fuel	$5,456
Personnel	
Front End Loader Operator	$9,353
Excavator Operator	$9,353
Spotter	$41,600
Material Transportation	$0
Contamination Disposal	$0
Total	**$164,755**
Cost per Inbound CY	**$2.75**
Cost per Inbound Ton[1]	**$16.90**

1. Conversion factor is 325 pounds per CY based on the Environmental Protection Agency (EPA) Volume-to-Weight conversion factors published April 2016, indicating uncompacted mixed yard waste is 250 pounds per cubic yard and leaves range from 250 to 500 pounds per cubic yard.

- **Processing contractor.** This represents the cost of hiring a third-party entity to mobilize equipment and manpower to grind brush and green waste material through horizontal grinding equipment. The City has recently hired a processing contractor to grind material at the rate of $1.12 per CY of inbound volume. This rate is guaranteed through 2025. For the purposes of this analysis, Burns & McDonnell has assumed that there would be no additional cost of having the contractor grind material multiple times throughout the year, and that the City would be able to contract for services at this price in the future. However, upon discussion with local organics processors, it may be the case that this a relatively low rate and there is potential for it to increase going forward.
- **Trommel screen rental.** The trommel screen rental is the cost of renting a rotary trommel screen at the cost of $8,000 per month. Note that the purchase price of a trommel screen is estimated at $292,000, or an annual cost of $31,100 assuming a four percent cost of capital and a 12-year useful life. At 60,000 CY per year of inbound material, the cost of renting a trommel screen ($24,000) for the screening duration of 13 weeks is less than the annual debt service payments of purchasing the equipment. The City should look to purchase a trommel screen only if the organics

processing program expands above 80,000 CY per year, as this is when it will likely become cost effective in comparison to renting on a monthly basis.

- **Equipment fuel.** This represents the cost of fueling a front-end loader and excavator required to manage material at the organics processing site and load material into the trommel screen one time through. It is assumed that each piece of equipment would be required on a part time basis (three days per week) for the screening duration and the City would utilize back-up equipment from the landfill operation. The amount of fuel required is estimated based on the fuel efficiency of 10 gallons per hour for a front-end loader and 7 gallons per hour for an excavator based on equipment information provided by the City.
- **Personnel.** This represents the cost of staff to operate the required equipment on a part time basis (24 hours per week), as well as a spotter to inspect inbound material to minimize contaminated material that enters the site year-round. The cost for equipment operators is assumed to be $30.00 per hour and $20.00 per hour for a spotter, including salary and benefits. Burns & McDonnell assumed that the spotter would inspect material on an ongoing basis, even when equipment operators are not processing material at the site.
- **Material transportation.** This represents the cost of transporting processed and screened material to end-markets and is assumed to be at the expense of the buyer who would collect and transport material using their own vehicles. Therefore, there is no operational cost associated with material transportation.
- **Contamination disposal.** This is the cost of disposing contamination material that is separated from inbound volume. Burns & McDonnel assumed that the City would incur no cost associated with disposing of this material at the Landfill.

6.2.1.3 Revenue

Table 6-3 shows the annual revenues of the expanded organics recycling operation, followed by a brief description of key assumptions and information regarding each.

Table 6-3: Expanded Organics Recycling Annual Revenue

Description	Revenue
Ground and Screened Material Revenue	$36,993
Landfill Development Cost Avoidance	$33,808
Composting Refund Program	$81,780
Total	**$152,581**

- **Ground and screened material revenue.** The annual revenue generated from the sale of ground and screened brush and green waste. The revenue is estimated at $4.00 per ton based on local

outlets identified by the City and based on a total sale volume of 9,248 tons as shown in Table 6-1. Note the amount shown in Table 6-3 may not calculate exactly due to rounding.

- **Landfill development cost avoidance.** The cost for developing new landfill cells and providing future closure and post closure care services is estimated at $3.65 per ton based on the financial analysis completed for the Landfill Business Plan. Based on this cost, the cost avoidance of disposing of the processed organics is considered a revenue as part of the calculations for the net revenue of the operation.
- **Composting refund program.** The Texas Commission on Environmental Quality (TCEQ) offers a composting refund for facilities that submit a composting plan to of up to 15 percent of solid waste fees paid to TCEQ annually (i.e. the refund is capped at 15 percent of the City's annual solid waste fees) [1]. This cap would increase to 20 percent if the City implements a yard waste disposal ban. The refund is calculated based on the City's equipment and operator expenses incurred as a direct result of composting operations (i.e. the estimated $164,755 for equipment and operators required to screening ground material and inspecting inbound loads). Based on the estimated 580,000 tons of material disposed at the Landfill and a $0.94 per ton fee, the total rebate the City is eligible to receive is $81,780 (580,000 tons x $0.94 per ton x 15% = $81,780). These funds would be used to support the cost of dedicating personnel to operate equipment at the composting site. The City would need to submit a Compost Plan to the TCEQ that provides sufficient information to demonstrate that the refunds are used to purchase and/or operate equipment necessary to compost yard waste, that composting operations are actually performed, and that the finished product is beneficially reused. Additionally, the City would need to comply with record-keeping requirements including documenting volumes of finished material, records of material being beneficially reused, and documentation of expenses. A quarterly summary would need to be provided to the TCEQ breaking down all expenses incurred and the TCEQ will perform an annual audit to ensure activities are being conducted in accordance with the composting plan. Upon meeting these requirements, the refund will be applied as a credit against the fees collected by the TCEQ as part of Landfill operations.

6.2.1.4 Net Revenue

Table 6-3 shows the annual revenues, expenses and net revenue of the expanded organics recycling operation, followed by descriptions of key assumptions and information regarding the revenue, expenses and net revenue calculation. Table 6-4 shows there the composting net revenue per incoming ton is

[1] See more information related to the composting refund here: https://www.tceq.texas.gov/assets/public/permitting/waste/msw/compostrefundguidelines.pdf

minimal, estimated at $1.25 per incoming ton, and therefore the cost composting program nearly pays for itself through revenues, cost avoidance and refunds.

Table 6-4: Expanded Organics Recycling Annual Net Revenue

Description	Revenue
Revenue	$152,581
Operational Expenses	$164,755
Net Revenue	($12,174)
Net Revenue per Inbound CY	**($0.20)**
Net Revenue per Inbound Ton[1]	**($1.25)**

1. Value may not calculate exactly due to rounding

- **Annual revenues.** The annual revenues including material sales and landfill development cost avoidance as shown in Table 6-3.
- **Operational expenses.** The annual operational expenses including the contractor, equipment rental, personnel, and equipment fuel as shown in Table 6-2.
- **Net revenue.** The annual net revenue calculated by subtracting the annual expenses from the annual revenue.
- **Net revenue per inbound CY/ton.** The net revenue per CY is the annual net revenue divided by the total inbound 60,000 CY. The net revenue per ton is the annual net revenue divided by the total inbound 9,750 tons.

6.2.1.5 Residential Curbside Collected Brush

The curbside collection of brush and bulk material is a key offering that the City provides to its residential customers. To expand inbound volume to 60,000 CY per year, the clean brush collected from residents would need to flow to the organics processing facility. The City collected 43,923 tons of co-mingled brush and bulk in FY 2019 and would need to separate clean brush from bulk for organics processing going forward. Clean brush will be important for any organics recycling option considered, and co-mingled or contaminated loads will be landfilled.

The City operates six brush routes where each crew contains a rear load vehicle, grapple truck and two long trucks. There may be operational challenges to cost effectively collect brush separately from bulk and implementation challenges to educate customers to separate them at the curb. If set outs are co-mingled, the material will be too highly contaminated to process at the organics processing facility and will be landfilled.

6.2.2 Hire Full-Service Contractor

Hiring a full-service contractor would include entering into an agreement with a third-party organics processing contractor to mobilize equipment and personnel to receive, handle, grind, screen, and sell material. A full-service contractor would be responsible for installing a mobile office, equipment, and staffing, and transportation of material to end-markets.

Based on discussions Burns & McDonnell has had with a local organics material processor, they would be able to provide a full service operation including grinding, screening and handling equipment, three full time employees and temporary labor to inspect material, and a temporary building to administer operations. The following terms are typical under this type of contract:

- The Contractor would lease the land from the City at the Landfill site
- The Contractor would own all material that flows to the site
- The Contractor would charge a fee for handling and disposal of contamination
- The Contractor would be responsible for selling all processed material

Based on these conversations, the organics processor indicated that to provide a full-service operation, they would require a minimum guaranteed revenue of $40,000 per month or $480,000 per year. Based on the estimated 60,000 CY that would be delivered to the site annually, or 9,750 tons of material[2], there would likely not be sufficient material for the contractor to support the operations financially. Assuming that the contractor would charge the City between $20 to $30 per ton delivered, this would generate revenues for the contractor in the range of $195,000 to $292,500 per year, or $16,250 to $24,375 per month, well below the minimum revenue to support this type of operation.

There are benefits to bringing on a full-service contractor, as the City would typically receive a certain amount of material free of charge, would not need to dedicate equipment or manpower to the operation of the facility, would continue to retain the tip fee of material coming across the scales, and would not be responsible for identifying and delivering material to end markets.

6.2.2.1 Full-Service Contractor Case Studies

This section presents full-service contractor case studies from the cities of Fort Worth and San Antonio to provide perspective regarding contracted full-service organics processing services.

Fort Worth, Texas. The City of Fort Worth leases space at the Southeast Landfill to its contract landfill operator, Republic Services (Republic), to process organic waste. Fort Worth amended its lease agreement with Republic in 2013 to allow for the delivery, mulching and composting of yard waste. Fort

[2] This conversion is calculated by multiplying the annual CY by an assumed material density of 325 pounds per CY (60,000 CY * 325 lbs per CY / 2000 pounds per ton = 9,750 tons)

Worth delivers yard waste collected by its contract collection provider to the Southeast Landfill and pays $14.26 per ton. Under this agreement, Fort Worth receives 30 CY of mulch product for every 1,000 tons of yard waste its hauler provides. Any additional material more than 30 CY costs Fort Worth $11.00 per cubic yard.

Yard waste must be free from plastic bags, household garbage, trash or non-organic debris, root balls, stumps, and tree limbs great than six inches in diameter or eight feet in length. Any load of yard waste that contains an unreasonable amount of prohibited items is disposed as solid waste and Fort Worth is assessed a $75.00 handling fee and $16.50 per ton disposal fee.

San Antonio, Texas. The City of San Antonio leased approximately 70 acres of land at the Nelson Gardens Landfill to Atlas Organics (Atlas) to design, construct and install permanent infrastructure improvement, pick line assets and equipment for an organics processing facility. The contractor is expected to operate the facility over the life of the contract at a rate of $27.50 per ton and requires a minimum tonnage of 58,000 tons per year. Note that San Antonio collects green waste and food scraps curbside, which is significantly different from Fort Worth or the City.

Atlas is responsible for the removal, including costs of handling, transportation and disposal, of all contamination up to and including five percent by weight. In the event that contamination exceeds five percent, San Antonio shall pay Atlas a fee of $66.78 per ton for transportation and disposal of contamination volume over five percent.

6.2.3 Deliver Unprocessed Material to Third Party Processor

Clean brush is accepted at third party processors that own facilities in the area, but there may be challenges with limited capacity and cost-effective transportation. Living Earth, The Organic Recycler, Alpine Materials, Silver Creek Materials, the City of Plano, and the City of Denton operate green waste recycling facilities in the region, but these facilities are not located within proximity to the City to cost-effectively deliver unprocessed material. Additionally, among the operators that Burns & McDonnell contacted, there is limited capacity for accepting additional material and careful consideration regarding the specification of any unprocessed material that is accepted to avoid high levels of contamination.

6.2.4 Disposal of Organic Waste

This section provides a planning level understanding of how the costs of diverting organic material from the landfill compare to the cost of disposal. Mulched green waste can be diverted from disposal in several different ways, listed here with brief descriptions:

- **Landfill operations.** Can be used in landfill operations as daily cover, cell construction, and erosion management.
- **Construction projects**. Can be used as road bed, or for grading construction sites.
- **Inter-departmental usage.** Can be used by various City departments such as Parks & Recreation.
- **Sold to market.** Can be sold to end-users such as nurseries, or to organic processors that further develop the material before sold as soil amendment.

As described in Section 6.2.1.3, expanding the organics processing facility would result in a cost to the City of $1.25 per ton. Although the expanded operation would not produce a positive net revenue, the cost of $1.25 per ton is less than the cost to landfill the material. Based on prior studies that Burns & McDonnell has completed for the City, the cost for the City to landfill material is approximately $20.00 per ton. Despite the net cost to process organic material, based on that disposal cost figure it is less expensive to process the material than dispose the material at the landfill.[3]

6.3 Implementation Considerations

Based on the organics processing options, Burns & McDonnell has provided implementation considerations for organics recycling options including the priority, timeline, and financial impact of each option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Implementation considerations described in Table 6-4 provide context for the following key findings and recommendations.

[3] Note this assumes the City would incur no additional costs for handling and disposing of contamination or transporting ground and screened material to market.

Table 6-5: Organics Recycling Options Implementation Considerations

Option	Priority	Timeline	Financial Impact
Expand Current Operation	Expanding the current operations is of medium priority because there may be challenges to separate and collect clean brush material to expand the operation up to 60,000 CY of annual inbound material.	Near-term.	The resources required to expand the current operations are high and would likely incur a negative net revenue. However, the negative net revenue is less than the cost to dispose of the material.
Hire Full-Service Contractor	Hiring a full-service contractor that would lease space at the Landfill to recycle organics is low priority because the City does not currently receive enough material to generate revenue that would support full-service operations.	Long-term.	The resources required to enter an agreement with a full-service contractor are high as the City would need to pay a fee to the contractor and would not realize revenue from the sale of material.
Deliver Unprocessed Material to Third Party Processor	This is a low priority, as there are limited organics processors within proximity of the City to support cost-effective delivery of unprocessed material.	Long-term.	The resources required to deliver unprocessed material to a third-party processor are high because the City would need to pay a fee to deliver material and would incur costs to transport material.

6.4 Key Findings and Recommendations

This section presents key findings and recommendations related to organics recycling. Each recommendation is followed by a description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

6.4.1 Key Findings

1. **The expanded organics recycling facility will be nearly break-even and is less expensive relative to landfilling organic material.** Given the cost of hiring a contractor to grind material at $1.12 per CY, personnel and equipment costs to manage the organics recycling site and the market prices of $4.00 per ton, the cost of expanding operations to process 60,000 CY of material would realize a minimal negative net revenue of $1.25 per inbound ton, including up to $81,780 in reduced fees to the TCEQ as part of the composting refund program. Based on the cost of approximately $20.00 to dispose material in the Landfill, the cost to recycle organic material is less than the cost than dispose it in the Landfill.
2. **The current cost of hiring a contractor will likely increase.** Based on conversations with local organics processors, the rate of $1.12 per CY is very competitive and would likely increase in the future.
3. **Expanding the operation would draw on the City's existing equipment and personnel.** To expand operations, the City would direct existing personnel and equipment to recycle organic material on a part time basis. As the organics processing facility expands, not having dedicated staff or equipment could cause challenges with ongoing Landfill operating requirements, although funds from the Composting Refund program would support personnel costs to operate equipment as part of the program.
4. **To expand inbound volume to 60,000 tons per year, the clean brush collected from residents would need to flow to the organics processing facility.** There may be significant challenges adjusting collection operations to separate brush and bulk material due to increased cost of collection and educating customers to separate set outs.
5. **City of Fort Worth and San Antonio contract for full-service providers.** These cities lease spaces at their landfill facilities to full-service providers for organic processing operations. Fort Worth developed an addendum to its existing landfill operations contract with Republic to process organic material at a rate of $14.26 per ton, and San Antonio entered into an agreement with Atlas to install, operate and maintain equipment for organics processing at $27.50 per ton.
6. **The City does not bring in enough material to attract a full-service operator.** Based on conversations with local organics recyclers and the case studies presented, the City does not bring

in enough material to generate the minimum $40,000 per month required to justify a full-service operation.

7. **There are several third-party processors in the area, but capacity is limited and the distance to deliver material would be prohibitively expensive.** Although there are facilities that accept unprocessed organic material, these facilities are located too far from the City to cost-effectively transport material.

6.4.2 Recommendations

1. **Expand existing operation to process 60,000 CY annually.** Expanding the organics recycling operation to 60,000 CY would cause the facility to operate at a negative net revenue. However, the cost of diverting the organics is less than the cost of landfilling. Burns & McDonnell recommends expanding the facility to take in this volume of material annually by separating residential clean brush and accepting private sector material at the site. [**Priority:** Medium; **Timeline:** Near-term; **Financial Impact:** High – the resources to expand the operations are high, but are less expensive than landfill disposal]
2. **Assess operational needs of adjusting bulk and brush collection operation.** To reach 60,000 CY of annual inbound volume, the City will need to separate and deliver clean brush material to the organics processing sort site. Given the challenges associated with this from both an operations and customer education perspective, the City should assess the operational needs required to adjust the operation. [**Priority:** Medium; **Timeline:** Near-term; **Financial Impact:** Moderate – requires an operational study of the City's existing brush and bulk collection program]

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7.0 COST OF RECYCLING SERVICE

7.1 Current Cost of Service

This section provides a brief summary of current collection programs, describes the methodology and results of the recycling cost of service analysis, discusses options for recycling service, and provides implementation considerations, key findings and recommendations related to implementing alternative service configurations.

7.1.1 Summary of Current Programs and Services

The City collects both curbside residential and commercial recycling. Table 7-1 presents a summary matrix of each type of residential and commercial collection service the City provides, including both refuse and recycling services. The purpose of this summary is to provide context for the discussion of options for recycling service, implementation considerations and key findings and recommendations.

Table 7-1: Overview of Residential and Commercial Collection Services

Service	Frequency	Description
Residential		
Refuse	Once per week	Collection via automated side load vehicles in City-provided carts.
Brush and Bulky	Once per week	Collection via combination of dump truck, grapplehook, and rear load vehicles.
Recycling	Every other week	Collection via automated side load vehicles in City-provided carts.
Commercial		
Front Load Refuse	Weekly, varied collection frequency	Collection via front load vehicles in City provided dumpsters ranging from two to eight cubic yards (CY).
Roll off Refuse	Scheduled and on-call	Collection via roll off vehicles of open-top and compacting units ranging from 20 to 42 CY.
Front Load Recycling	Weekly, varied collection frequency	Collection via front load vehicles in City provided dumpsters ranging from six to eight CY.

Residential customers pay $20.58 per household per month for residential services. Customers that participate in the recycling program do not pay an additional fee. Charges for commercial service are provided in Section 7.2.1.

7.1.2 Methodology Overview

This section provides the methodology that Burns & McDonnell followed to complete the cost of service analysis for recycling collection services.

- **Development of the Test Year Revenue Requirement.** The first task in conducting the cost of service analysis is the development of an annual revenue requirement for a Test Year. The revenue requirement represents the total revenue that the Environmental Services Division will need to recover during a year to fund all expenses associated with the provision of services. Burns & McDonnell worked with City staff to select a period that reflected the typical operation. City staff and Burns & McDonnell selected the proposed Fiscal Year (FY) 2020 budget as the basis of the Test Year. Burns & McDonnell then reviewed the financial data and worked with City staff to make any adjustments to costs to make them representative of a typical year. The resulting Test Year (FY 2020) was used as the basis for determining cost of service.
- **Allocation of Costs to Cost Centers.** Burns & McDonnell worked with staff to assign and allocate costs to a set of cost centers. The cost centers represent the primary services provided by the City. All non-recycling services are combined into the Other Non-Recycling Service cost center.
- **Determination of Billing Units/Service Requests.** Burns & McDonnell identified the appropriate billing units/service requests for each recycling service.
- **Calculation of the Cost of Service.** Burns & McDonnell distributed the costs across the billing units/service requests to determine the cost of service for recycling customers.

Appendix C includes the following financial schedules for the cost of service analysis:

- Schedule 1: Test Year
- Schedule 2: Revenue Requirement
- Schedule 3: Residential Recycling Cost of Service
- Schedule 4: Commercial Recycling Cost of Service

7.1.3 Development of the Test Year Revenue Requirement

In developing the Test Year revenue requirement for the City, Burns & McDonnell used the FY 2020 proposed budget as the basis for the Test Year. Burns & McDonnell and City staff reviewed each line of the budget to determine whether any adjustments were required for FY 2020 budget to represent a typical

year. Based on the adjustments to the FY 2020 budget, the resulting Test Year revenue requirement was $21,719,080, including both recycling and non-recycling services. Schedule 1 in the Appendix provides the detailed Test Year with footnotes for any adjustments. The following are some key adjustments to the FY 2020 proposed budget relating to recycling services that were used to develop the Test Year:

- **Staff Vacancies.** Decrease FY 2020 proposed amount by $13,753 for the Test Year. The adjustment accounted for anticipated staff vacancies that would not be filled going forward and the addition of salaries that are currently funded from the Disposal Operation. Given this change in staffing levels, several benefits costs have been adjusted proportionally.
- **Education and Outreach.** Decrease FY 2020 proposed amount by $15,000 for the Test Year. The adjustment is intended to reflect more typical annual expenses associated with recycling education and outreach.
- **Commercial Disposal Fee.** Increase FY 2020 proposed amount by $361,573 to reflect typical annual expenses for landfill disposal from commercial collection.
- **Increase in Recycling Fee.** Increase in FY 2020 proposed amount by $275,178 to reflect an increase in recycling cost to $66.68 per ton that will take effect October 1, 2021.

7.1.3.1 Relationship between the Budget and Revenue Requirement

Burns & McDonnell would like to emphasize that there is a fundamental difference between a budget and a revenue requirement. The budget represents the costs associated with operations that directly support a specific program. However, there are typically more service offerings than budgets, and people and other resources may often be shared between services. The revenue requirement shows the annual cost for each service offering.

In addition, the revenue requirement focuses on the annual revenue that must be generated through rates. The revenue requirement is net of non-rate revenues that are included in the budget. These revenue offsets reduce the overall amount that the City must recover from the rates charged to customers. Non-rate revenues include penalty charges, extra container charges, vehicle auction sales, interest and miscellaneous revenue.

7.1.4 Allocations to Cost Centers

Burns & McDonnell allocated the revenue requirement from the Test Year to various cost centers associated with City services related to recycling. Table 7-2 provides a list of the costs allocated to each cost center for recycling services.

Table 7-2: Revenue Requirement Allocations to Cost Centers

Cost Center	FY 2020
Administration	$4,858,384
Residential Curbside Recycling	$1,655,225
Commercial Front Load Recycling	$81,245
Recycling Events	$26,823
Drop Off	$0
Education and Outreach	$120,451
Recycling Processing[1]	$1,190,878
Other Non-Recycling Activities	$13,786,074
Total Revenue Requirement[2]	**$21,719,080**

1. Recycling Processing costs include the tipping fee at the MRF, hauling costs, and the City's operation of the Recycling Center. This value has been updated to reflect the per-ton fee that will take effect October 1, 2021.
2. Values may not sum exactly due to rounding

Burns & McDonnell allocated the revenue requirement for each cost center to residential recycling and commercial front load recycling customer classes to calculate the cost of service associated with each recycling customer.

7.1.5 Billing Units

Billing units are important for determining the per customer per month cost of service. Residential customers for recycling service include households that elect to receive recycling service, and represent approximately 67 percent of the total residential refuse customers serviced by the City, as shown in Table 7-3.

Table 7-3: Residential Collection Customers

Service	Households
Refuse	62,969
Recycling	42,439
Percentage of Recycling Customers	67%

Commercial recycling customers are serviced based on the service matrix provided in Table 7-4

Table 7-4: Commercial Recycling Collection Unit Serviced per Week

Container Size	Collection Units Serviced per Week	
	1	2
6	51	7
8	100	24

The number of units serviced per week represent a total of 11,076 annual collections and 81,848 annual CY serviced.

7.1.6 Cost of Service

Using the costs assigned to each cost center and the billings units, Burns & McDonnell calculated the cost of service for residential and commercial recycling. Table 7-5 shows the breakdown of the $6.93 monthly cost of service for residential recycling on the total number of households serviced in the program, including an allocation of $1.38 per month for administrative costs.

Table 7-5: Residential Recycling Cost of Service

Cost Center	Total Cost	Cost per Household per Month	
		Recycling Customers	All Customers
Administration	$703,054	$1.38	$0.93
Residential Curbside Recycling	$1,655,225	$3.25	$2.19
Recycling Events	$26,823	$0.05	$0.04
Education and Outreach	$76,399	$0.15	$0.10
Recycling Processing	$1,069,729	$2.10	$1.42
Total[1]	**$3,531,230**	**$6.93**	**$4.67**

1. Total may not sum exactly due to rounding

The amount required to recover costs associated with residential recycling is $4.67 per household per month when the total cost is distributed over all residential customers (including those that have opted-out of the recycling program), which is less than the cost of service based on the number of customers that participate in the recycling program.

Table 7-6 shows the total cost of commercial recycling by cost center.

Table 7-6: Cost of Commercial Recycling by Cost Center

Cost Center	Total Cost
Administration	$58,953
Commercial Frontload Recycling	$81,245
Education and Outreach	$789
Recycling Processing	$121,149
Total	**$262,137**

To evaluate the monthly recycling cost for each container and collection frequency, Burns & McDonnell calculated the cost per collection and cost of processing per CY serviced by dividing the total cost of commercial recycling by the total number of collections as shown in Table 7-7.

Table 7-7: Commercial Recycling Cost of Service

Category	Cost
Collection	
Annual Cost	$140,988
Annual Services	11,076
Cost per Collection	$12.73
Processing	
Cost	$121,149
Annual CY Serviced	81,848
Cost per CY	$1.48

To identify the monthly cost of service, the different component costs are added as follows for a six cubic yard container collected once per week:

- Cost per Collection times the number of collections per month ($12.73*4.33=$55.12), PLUS
- Cost per Cubic Yard of Capacity times the capacity of the container times the number of collections per month ($1.48*6*4.33=$38.45).
- For a six cubic yard container collected once per week, the cost of service is ($55.12+ $38.45 = $93.57). Note that the figures in this example to not match the monthly cost of service of $93.64 shown in Table 7-8 below due to rounding.

Table 7-8 shows the monthly cost of recycling based on collections per week.

Table 7-8: Monthly Recycling Cost of Service Based on Collections per Week

Container Size	Collections per Week	
	1	2
6	$93.64	$187.29
8	$106.47	$212.94

7.1.6.1 Adequacy of Current Rates

Burns & McDonnell has compared the cost of service commercial collection service against the rates charged to customers. This comparison is not provided for residential recycling collection because the rate includes refuse and bulk/brush collection. The cost of service for collecting refuse and brush/bulk has not been assessed as part of the Recycling Technical Study.

Effective November 1, 2020 the rate charged to commercial recycling customers has been increased to $130.41 for collections once per week, for both six and eight CY containers. Customers that are serviced twice per week are charged twice the weekly amount, or $260.82.

Table 7-9 shows the over recovery between the cost of service and rate charged. A positive number represents that the rate is in excess of the cost of service.

Table 7-9: Over Recovery Based on Collections per Week

Container Size	Collections per Week	
	1	2
6	$36.77	$73.53
8	$23.94	$47.88

Based on the difference, the rates effective November 1, 2020 over recover costs for commercial recycling collections.

7.2 Recycling Service Options

Based on the cost of service analysis, Burns & McDonnell has provided options for the City's consideration including alternative operational configurations for residential and commercial recycling and a compares diversion versus landfilling of recyclable materials.

7.2.1 Financial Analysis of Multiple Operational Configurations

This section summarizes the financial impacts of alternative operational configurations for residential services including reducing contamination and increasing the number of residential recycling collection routes and commercial service including expanding residential recycling collection.

7.2.1.1 Residential Services

Based on the recommendations described in Section 2.4.2, the City should consider reducing contamination through cart auditing and increasing the number of residential recycling collection routes. Reducing contamination by introducing a cart auditing program would impact behavior change at the point of generation and would require an additional FTE and vehicle to check set outs, collect data, and inform residents of improper set outs.

As discussed in Section 2.1.4.1, the City current pays approximately $221,000 to for the hauling and tipping of contamination.. Table 7-10 presents the estimated cost savings the City may realize if the level of contamination were reduced from the current 28 percent to a realistic, yet aggressive, target of 15 percent.

Table 7-10: Financial Impact of Reduced Contamination Rate

Description	Amount
Total Residential Recycling Material (FY19 Tons)	11,760
Future Contamination Rate	15.0%
Estimated Contamination (FY19 Tons)	1,764
Estimated Annual Compactors of Contamination[1]	221
Total Contamination Hauling/Processing Costs	**$117,624**
Contamination Hauling/Processing Costs per Ton	**$66.68**

1. Average capacity of a compactor is estimated at eight tons

As Table 7-10 shows, the cost per ton of hauling and processing non-recyclable material is $66.68 per ton. As provided in Section 7.2.2.3, the cost of handling material at the transfer station is $16.29 per ton and the cost of disposing it at the landfill is $21.68 per ton. If the contamination from residential material were transferred and disposed instead of being hauled and processed by FCC, the cost savings per ton would be $66.68 – ($16.29 + $21.68) = $28.71 per ton. The total decrease in tons of contamination in residential recycling if the City were to reduce the contamination rate from the current 28 percent to 15 percent is 1,555. This is calculated by subtracting the 1,746 tons of contamination at a 15 percent rate from the current 3,319 estimated tons of contamination at 28 percent. The per ton savings multiplied by the estimated 1,555 tons of contamination reduction from Table 7-10 results in a cost savings of $44,635.

Table 7-11 communicates the net effect of the direct cost impacts to reduce contamination through cart auditing on an annual and cost per household per month basis for both the recycling customers only and for all customers (i.e. including refuse customers that do not participate in the recycling program). This evaluation does not include costs for handheld data entry devices or cart tags, which are assumed to be covered by the existing education and outreach budget.

Table 7-11: Financial Impacts of Reducing Contamination Through Cart Auditing

Operational Change	Annual Cost Increase (Decrease)	Cost per Household per Month	
		Recycling Customers[1]	All Customers[2]
Add one FTE	$40,000[2]	$0.08	$0.05
Purchase ½ Ton Cab Pickup Truck	$9,135[3]	$0.02	$0.01
Reduce cost of recycling processing	($44,635)[4]	($0.09)	($0.06)
Total[5]	**$4,501**	**$0.01**	**$0.01**

1. Based on 42,439 households participating in recycling program
2. Based on 62,969 total residential customers
3. Includes estimated salary and benefits for one FTE inspector
4. Includes annual debt service, maintenance and fuel costs for inspector vehicle; assumes minimizing contamination from 28 percent to 15 percent
5. Totals may not sum exactly due to rounding

Based on this analysis, the financial impact of reducing contamination through cart auditing would provide a cost savings for recycling processing that is slightly more than the cost of hiring an employee and purchasing a vehicle to conduct cart, resulting in a negligible financial impact for all customers on a per household per month basis. As the recycling program grows, the challenges with managing and processing contamination may become more pronounced (e.g. increased hauling and tip fee, additional charges for high levels of contamination) and increased efforts to minimize contamination in the near term would provide increasing value to the City as the amount of recyclables processed continues to increase.

Table 7-12 communicates the net effect of the direct cost impacts of increasing the number of recycling routes on an annual and cost per household per month basis.

Table 7-12: Financial Impacts of Increasing Residential Recycling Routes

Operational Change	Annual Cost Increase (Decrease)	Cost per Household per Month	
		Recycling Customers[1]	All Customers[2]
Add one FTE	$60,000[3]	$0.12	$0.08
Allocate existing equipment to service route	N/A[4]	N/A[4]	N/A[4]
Eliminate Overtime Costs	($40,000)[5]	($0.08)	($0.05)
Total	**$20,000**	**$0.04**	**$0.03**

1. Based on 42,439 households participating in recycling program
2. Based on 62,969 total residential customers
3. Includes estimated salary and benefits for one FTE equipment operator
4. With a total of 10 available recycling collection vehicles, the City has enough equipment to operating an additional route without purchasing new collection equipment for front-line or backup. Assumes negligible incremental increases in maintenance and fuel costs.
5. Estimated reduction in overtime for recycling service by adding an additional route. Overtime costs would likely be eliminated based on salary and benefit costs of new FTE equipment operator.

Based on this analysis, the financial impact of adding a residential recycling route would likely eliminate overtime costs, but would have a net cost increase of $0.03 for all customers on a per household per month basis. This net cost increase would not fully offset the cost savings associated with adding an additional recycling route; however, there are still benefits to devoting resources to adding a route as described in Section 3.4.

7.2.1.1 Commercial Service

Based on the recommendations described in Section 4.4.2, the City should consider expanding its commercial recycling services. Burns & McDonnell updated the cost of service model to develop a comparison of the cost on a per collection basis to the current program.

To grow the number of customers for commercial recycling, the City could implement a WRAP and dedicate resources to marketing its commercial recycling program. Table 7-13 describes the changes associated with adjusting operations to increase commercial recycling service to fully utilize one route.

Table 7-13: Financial Impact of Increasing Commercial Recycling Service

Operational Change	Annual Cost Increase (Decrease)
Add one FTE	$40,000[1]
Allocate existing personnel and equipment to service route	N/A[2]

1. Represents salary and benefits of half an FTE to implement a WRAP and another half FTE to market recycling services totaling one FTE.
2. Existing vehicle available for operating additional route. Assumes negligible incremental increases in maintenance and fuel costs.

Burns & McDonnell estimated that the number of customers could double assuming that the route density is sufficient to maintain efficient collection operations. This increase assumes that the number of customers that require collection of six or eight CY containers once and twice per week would grow to the point where one route is fully utilized. Table 7-14 shows the estimated number of collection units that would be serviced on a per week basis.

Table 7-14: Estimated Units Serviced per Week with Fully Utilized Commercial Recycling Collection Route

Container Size	Collections per Week	
	1	2
6	102	14
8	200	48

Table 7-15 shows a side-by-side comparison of the total cost of the current cost of service for commercial recycling against the cost of service with operational changes based on the updated the cost of service model. The basis for the cost changes associated with a fully utilized route are due to changes in personnel and equipment allocations, hiring a FTE to increase the number of customers, additional education and outreach requirements, and increased recycling processing costs due to more collected tons.

Table 7-15: Cost of Commercial Recycling Comparison

Cost Center	Current Costs	Cost with Fully Utilized Route[1]
Administration	$58,953	$118,322
Commercial Front Load Recycling	$81,245	$149,494
Education and Outreach	$789	$1,719
Recycling Processing	$121,149	$236,302
Total[2]	**$262,137**	**$505,838**

1. Note the basis for the cost increases for a fully utilized route include adjustments to personnel and equipment allocations, hiring a FTE to increase the number of customers, additional education and outreach requirements, and increased recycling processing costs due to more collected tons
2. Totals may not sum exactly due to rounding

Note that the increased salary and benefits associated with hiring a FTE and allocating one driver to service commercial customers are included in the cost with a fully utilized route. Based on the adjusted collection units, Burns & McDonnell calculated the cost per collection and cost of processing per CY with a fully utilized route by dividing the total cost of commercial recycling by the total number of collections as shown in Table 7-16.

Table 7-16: Commercial Recycling Cost of Service

Category	Current Costs	Costs with Fully Utilized Route
Collection		
Annual Cost	$140,988	$269,535[1]
Annual Services	11,076	22,152
Cost per Collection	$12.73	$12.17
Processing		
Cost	$121,149	$236,302
Annual CY Serviced	81,848	163,696
Cost per CY	$1.48	$1.44

1. Collection cost increases are due, in part, to changes in allocation of equipment to service increased customers and the hiring of a FTE dedicated to commercial service

Table 7-17 shows the monthly cost of recycling based on collections per week with a fully utilized route.

Table 7-17: Monthly Recycling Cost Based on Collections per Week with Fully Utilized Route

Container Size	Collections per Week	
	1	2
6	$90.26	$180.52
8	$102.77	$205.54

Based on this analysis, increasing the number of commercial customers to fully utilize a commercial recycling route would cause the cost of the operations to increase, but the cost per collection to decrease. This reflects the inefficiencies associated with the currently partially utilized commercial route and that doubling the number of customers with six and eight cubic yard containers would make the service more cost effective. However, even with a more efficient operation, the recycling fee increase that takes effect on October 1, 2021 will cause the monthly cost for each container size to increase. Table 7-18 shows the monthly cost increase for each container size and frequency with a fully utilized commercial recycling (i.e. subtracting the values from Table 7-8 and Table 7-17).

Table 7-18: Monthly Recycling Cost Increase with Fully Utilized Route

Container Size	Collections per Week	
	1	2
6	$3.39	$6.77
8	$3.70	$7.41

Burns & McDonnell calculated the annual net revenues that the City would generate with a fully utilized and compared it to the net revenue of the current commercial recycling route. The anticipated gross revenue is calculated by multiplying the billing units for the current and fully utilized route by the rates provide in Section 7.1.6.1 for each container size and frequency. The cost of service (shown in Table 7-16) is then subtracted from the annual revenue to derive the net revenue, as shown in Table 7-19.

Table 7-19: Annual Net Revenue Comparison

Category	Current	Fully Utilized Route
Revenue	$333,328	$666,656
Cost of Service	$262,137	$505,838
Net Revenue	**$71,191**	**$160,818**

Although the cost of service increases with the fully utilized route, the net revenue increases by for a fully utilized route increases by $89,627. The cost of hiring one FTE is $40,000 including salary and benefits. Therefore, the increased revenue associated with increasing customers by hiring one FTE to increase the number of customers and fully utilize a recycling route would be an effective use of the City's resources.

7.2.2 Comparison of Diversion Versus Landfilling of Recyclable Material

The current value for recyclable materials is at historically low levels. This has increased the net cost for processing recyclable materials. The City requested that Burns & McDonnell compare the cost of their recycling processing costs to the costs of temporarily hauling the recyclable materials to the Landfill for disposal instead of to a MRF for processing.

7.2.2.1 Recycling Processing

This section outlines the types of costs and amount associated with recycling processing. The cost for collecting the recyclables from households and businesses is not included in this analysis since the cost for collection would be the same whether the material is ultimately landfilled or recycled.

Transportation

As part of the City's previous agreement with the recycling processor, the processor provides transportation services from the City's Recycling Center to the MRF. As part of this previous agreement, the transportation service includes provision of compactors and receiving units in which the City loads the recycling material. The processor had previously charged $199.41 each time a container was hauled to the MRF. Based on an average of eight tons per load, the per-ton cost for transportation had been $24.93 and will remain the same with the new contract that will take effect October 1, 2021.

Recycling Tip Fee

The recycling processor previously charged the City a tip fee of $20 per ton for processing recyclables and the City received no revenue share. The City is in the second renewal term of its recycling contract. During the initial term, the City did not pay for transportation and did not pay a recycling tip fee. During the first renewal term, the City agreed to pay for transportation, but did not pay the tip fee. The incremental increases to the costs during the renewals were meant to offset the drop in value for recycling material that occurred over the last several years. The tip fee of the new contract that will take effect October 1, 2021 increases to $41.75 per ton ($66.68 – $24.93). Combining the per-ton cost for transportation with the tip fee shows the component costs sum to the total recycling fee of $66.68.

Recycling Center Operations

Section 7.1 summarizes the cost of service analysis that Burns & McDonnell completed for the City. In that analysis, it was determined that the direct cost of operating the Recycling Center was $17.81 per ton. This cost includes equipment and personnel used to load recyclables from the floor of the Recycling Center into the compactors for transportation to the MRF. In addition, $3.48 per ton of non-departmental costs were allocated to the Recycling Center. The two costs together total $21.30 per ton.

7.2.2.2 Landfill

This section describes the costs the City would incur to haul recyclable materials to the Landfill for disposal.

Transfer Station

The City operates a transfer station for consolidating refuse and hauling it to the Landfill. The transfer station is located next to the Recycling Center, so there would be no collection cost impact for collection

vehicles to unload at the transfer station versus the Recycling Center. The following table summarizes the direct and indirect costs for the City to operate the transfer station and haul materials to the Landfill. Based on the City hauling 110,548 tons in 2019, the total cost per ton is $16.29 per ton.

Table 7-20: Transfer Station and Hauling Costs

Description	Annual Cost
Operating Costs	$1,157,429
Equipment Replacement	$392,865
G&A Allocation	$71,705
Support Services Allocation	$144,700
Self-Insurance Allocation	$33,618
LTD Allocation	$867
Total Annual Transfer Station and Hauling Costs[1]	**$1,801,186**
Annual Tons (2019)	**110,548**
Cost per Ton	**$16.29**

1. Values may not sum exactly due to rounding

Disposal Fee

In order for the City's disposal operation to recover its costs, the City's collection operation is charged a disposal fee for all tons hauled to the Landfill. The current disposal fee is $21.68 per ton.

Landfill Opportunity Cost

By sending additional City tons to the Landfill, permitted airspace is consumed at $21.68 per ton compared to higher revenues generated from outside customers. The fee charged to outside customers varies. In 2019, the average revenue per ton generated from high-volume customers with disposal contracts in place with the City was $24.21 per ton. Non-contract customers pay either $42 per ton or $57.75 per ton. The $42 per ton is for customers with self-unloading vehicles/trailers and the $57.75 per ton is for customers that must manually unload their vehicles. Therefore, the City could be getting higher revenues for the airspace than the $21.68 per ton that would be charged for the recyclables. This "opportunity cost" ranges from $2.53 per ton ($24.21 - $21.68 = $2.53) to $36.07 per ton ($57.75 - $21.68 = $36.07).

7.2.2.3 Comparison

Using the information presented in Sections 7.2.2.1 and 7.2.2.2, Table 7-21 summarizes the cost comparison of diverting the recyclable material to the MRF versus landfilling it. The "low" and "high" scenarios for the Landfill reflect the range of opportunity costs. As Table 7-21 shows, it is more

expensive for the City to continue diverting the recyclables than landfilling them. Section 7.2.2.4 shows the impact on recycling costs based on improved market conditions.

Table 7-21: Comparison of Landfilling to Recycling Processing

Description	Landfill		Recycling	Difference	
	Low	High		Low	High
Transportation	$16.29	$16.29	$24.93	$8.63	$8.63
Disposal/Recycling Tip Fee	$21.68	$21.68	$41.75	$20.07	$20.07
Recycling Center Operations					
Direct	$0.00	$0.00	$17.81	$17.81	$17.81
Allocation of Non-Departmental	$0.00	$0.00	$3.48	$3.48	$3.48
Landfill Opportunity Cost	$2.53	$36.07	$0.00	($2.53)	($36.07)
Total Cost (per Ton)[1]	$40.51	$74.04	$87.98	$47.47	$13.93
Tons	13,092	13,092	13,092	0	0
Total Cost	$530,325	$969,372	$1,151,774	$621,449	$182,401

1. Values may not sum exactly due to rounding

7.2.2.4 Impact of Recycling Market Changes

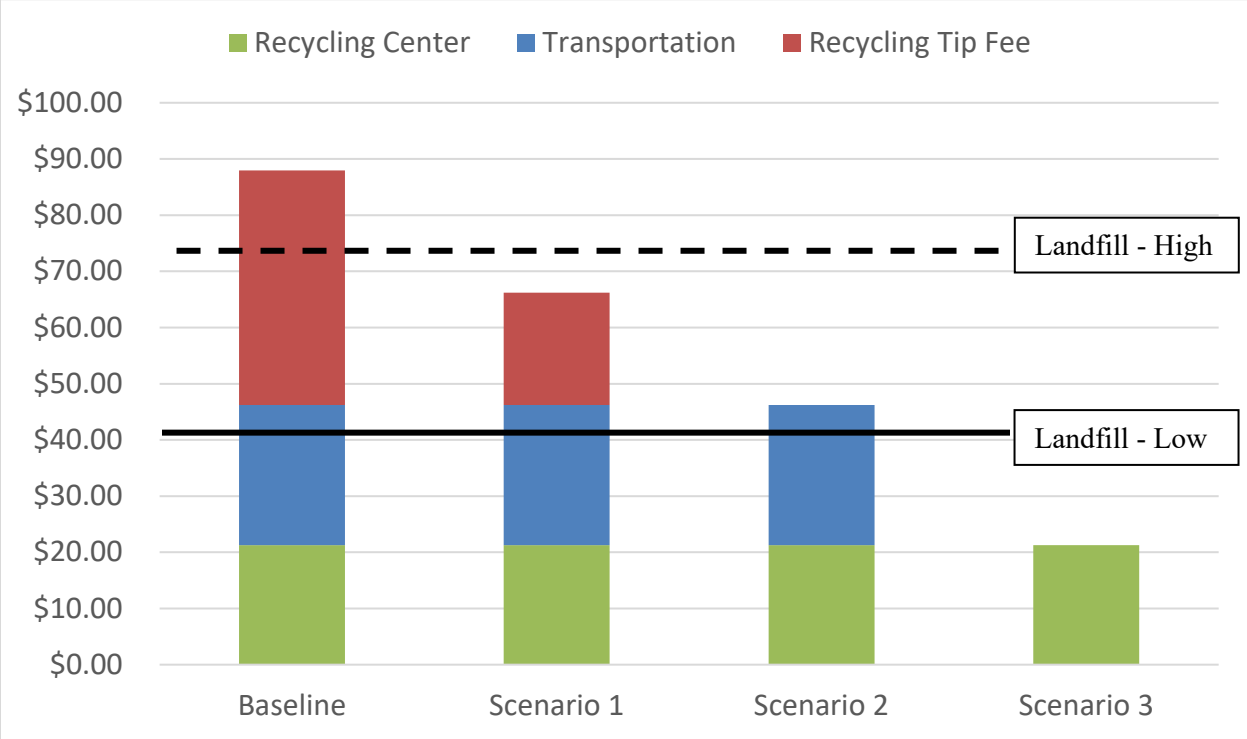
The decline in the value of recyclable material has impacted the cost to the City of diverting recyclable material from the Landfill. In addition to the current contract cost analysis presented in Table 7-21, Burns & McDonnell also evaluated changes to the recycling processing cost based on increases of the value of recyclable material. The following scenarios were evaluated:

- **Current Contract**. This is reflective of the contract that will take effect October 1, 2021, as shown in Table 7-21, with a total of $87.98 per ton.
- **Scenario 1**. This scenario assumes that improvements in the market for recyclable material improve such the recycling tip fee portion of the fee charged to the City decreases from $41.75 per ton to $20 per ton.
- **Scenario 2**. This scenario assumes that improvements in the market for recyclable material improve such the recycling tip fee portion of the fee charged to the City decreases from $41.75 per ton to $0 per ton. This was consistent with the City previous contract terms.
- **Scenario 3**. This scenario is similar to Scenario 2, but also removes the transportation cost. When the City first entered into the contract with the current recycling processor, the City did not pay for processing or transportation due to the higher value of the recovered materials.

Figure 7-1 shows how the current contract and three alternate scenarios compare to the costs to landfill recyclables from Table 7-21. If increases in the value of recyclable material were to increase and therefore allow the recycling processor to decrease the recycling tip fee from $41.75 per ton to $20 per

ton, the cost of recycling processing would be toward the high-range landfill costs. Further reductions of the recycling tip or transportation fee would result in the recycling processing costs to approach or fall below the mid-range of the landfill costs (average of low and high range). All of the scenarios include the estimated $21.30 per ton to operate the City's Recycling Center. This is a relatively high cost and Section 5.0 of this report addresses the Recycling Center operations.

Figure 7-1: Comparison of Recycling Scenarios to Landfill Costs



7.2.2.5 Other Considerations

In addition to the financial considerations, there are several non-financial considerations that the City must weigh when deciding whether to temporarily landfill recyclable material until markets improve. These considerations include:

- The City has spent years developing and growing its recycling program
- If material is not being recycled, residents would not have an incentive to separate trash and recycling
- When the value of recyclable material increases, the City would have to re-educate people about separating trash and recycling

- The City would likely see less recyclable material and more contamination in the program if it was re-started after a period of time
- The Governmental Entity Recycling Program requires governmental entities to create and maintain a recycling program for their operations as described in Section 2.2.1.1

7.3 Implementation Considerations

Based on the recycling service options, Burns & McDonnell has provided implementation considerations for including the priority, timeline, and financial impact of each option, defined as follows:

- **Priority.** Description of each option's priority as it relates to the City's solid waste management program.
- **Timeline.** Based on the priority of the option, indication if the program should be implemented in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Financial Impact.** Description of the anticipated cost increases or savings associated with the option.

Option	Priority	Timeline	Financial Impact
Adjust Operations for Residential Collection Services	Adjusting operations for residential collection is a high priority. Adding a route for residential collection is a higher priority than implementing cart auditing to minimize contamination.	Near-Term.	The financial impact of adjusting residential collection service would be a total of $56,865 annually. Although the operational adjustments result in a net cost increase to implement, there are key strategic benefits to implementing adjustments to residential service.
Adjust Operations for Commercial Collection Services	Adjusting operations for commercial recycling collection is of medium priority because fully utilizing the existing route will make the operation more cost effective.	Mid-Term.	The financial impact of increasing commercial recycling collection service would be a total annual cost increase of $243,701, but a decrease in the cost per collection by $0.56 due to fixed costs being spread over more billing units. This would result in an increased net revenue for service of $89,672.

Option	Priority	Timeline	Financial Impact
Landfill Recyclable Materials	Landfilling recyclable materials is a low priority and is not recommended at this time.	Long-Term	The financial impact depends on the opportunity cost of landfilling recyclable materials.

7.4 Key Findings and Recommendations

This section presents key findings and recommendations related to recycling services. Each recommendation is followed by a description related to implementation and summarized as part of the Implementation Plan provided in Section 8.0.

7.4.1 Key Findings

1. **The cost of service for residential recycling services is $6.93 per household per month.** This cost of service is based on the total 42,439 customers that receive recycling program.
2. **The cost of commercial recycling is $12.73 per collection, with varying disposal costs depending on the container and frequency of collection.** Commercial recycling customers receive six or eight CY containers and disposal cost per CY varies based on the size of container.
3. **Decreasing contamination rate to 15.0 percent would reduce contamination processed by 1,555 tons and provide a cost savings of $44,635 annually.** The number of trips that FCC needs to do from the Recycling Center to its MRF would be reduced, providing a cost savings to the City based on avoided hauling and tipping fees.
4. **Implementing an additional residential recycling route would increase costs $0.03 per household per month for all residential customers.** While hiring a vehicle operator to increase routes would increase the cost of service, adding a route will provide cost savings on the amount of overtime required to complete recycling routes.
5. **Implementing a cart auditing program to reduce contamination would offset the cost of hauling and processing of contamination.** Implementing a cart auditing program would require additional resources to hire an employee and provide a vehicle, but this would be offset by the cost savings of reducing contamination from 28 percent to 15 percent.
6. **Expanding commercial recycling services would decrease the cost per collection by $0.56.** While dedicating resources to implement a WRAP and provide dedicated marketing of commercial recycling service would increase the annual cost of service, the increased number of commercial recycling customers will allow the City to spread this program's fixed costs over more billing units and ultimately increase the net revenue for service by $89,672.
7. **The cost of landfilling recyclables is less expensive than the cost to recycling, varying depending on the opportunity costs associated with landfilling recyclables.** Although it may

be less expensive to dispose of material at the landfill rather than process it at the Recycling Center in certain circumstances, there are several non-financial considerations to continuing to collect curbside recycling including maintaining the customer base that the City has spent years developing, the effort to re-educate customers if the decision is made to reinstate a recycling program, and the opportunity cost of misusing valuable landfill airspace to dispose of recyclables and reduce the useful life of the landfill.

7.4.2 Recommendations

1. **Add a residential recycling route.** Increasing routes would increase cost to provide service, but help the City realize a cost savings on the amount of overtime required to complete recycling routes. Although this cost savings does not fully cover the cost of adding a route in the current program, the overtime costs of collection services will only increase as the recycling program grows. Therefore, the additional cost to add a route would be an effective use of the City's resources as a means to mitigate future challenges maintaining a cost effective residential recycling program.[**Priority:** High; **Timeline:** Near-term; **Financial Impact:** Minimal – $0.03 per household per month net cost increase for all customers]
2. **Evaluate the implementation of a WRAP and expand commercial recycling to fully utilize route.** With a fully utilized commercial recycling route, the cost of service would decrease due to the increased number of billing units. However, the cost savings on a per collection basis and increased net revenue with the fully utilized commercial recycling route support implementing a WRAP and expanding commercial recycling services. Burns & McDonnell recommends implementing a WRAP or dedicated marketing effort to expand commercial recycling to achieve an overall increase in net revenue. [**Priority:** Medium; **Timeline:** Mid-term; **Financial Impact:** Moderate – Increase in net revenue by $89,672]
3. **Evaluate the implementation of a cart auditing program to reduce contamination.** Although the cost of implementing a cart auditing program is not fully offset by the cost savings associated with a 13 percentage point decrease in contamination rate (from the current 28 percent to 15 percent), devoting resources to minimize contamination may mitigate future challenges including increased hauling and tipping costs or additional penalties introduced by the City's recycling contractor due to the sustained high contamination rate. [**Priority:** Medium; **Timeline:** Mid-term; **Financial Impact:** Low – $0.01 per household per month net cost increase for all customers]
4. **Continue diverting recycling materials**. While there is potential for some short-term cost savings by temporarily landfilling the recyclable material, the recycling industry as a whole expects the value of recycling material to increase over time. Any short-term financial gains

would likely be offset by negative impacts to the recycling program that the City has spent years developing. Burns & McDonnell recommends the City continue to send its recyclable material to the recycling processor and identify other cost-saving strategies in the operation of the Recycling Center or hauling of the recyclables to the MRF. [**Priority:** Low; **Timeline:** Long-term; **Financial Impact:** N/A]

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8.0 IMPLEMENTATION PLAN

This section provides a description of the criteria associated with the implementation of recommendations presented throughout the report. Burns & McDonnell compiled the strategies and key implementation components of each recommendation into a high-level implementation plan to provide guidance for the City's consideration. The components of the implementation plan that have been evaluated for each strategy, including priority, timing and estimated financial impact are described below:

- **Priority.** The priority indicates the urgency with which the City would implement each strategy as it relates to the City's solid waste management program.
- **Timing.** Timing gives a general indication of when the proposed strategy should be implemented. Each strategy has a timing in the near-term (one to three years), mid-term (three to five years), or long-term (five to 10 years).
- **Estimated financial impacts.** For each strategy there may be associated costs and/or financial benefits. This indicator is meant to provide the high-level understanding of the anticipated cost increases or savings associated with each option based on the detailed analysis provided in each section.

Each recommendation is intended to minimize waste and/or increase recycling as part of the City's solid waste program. Some recommendations could be implemented on a parallel track, and the impacts on waste minimization and/or recycling would change depending on the implementation order and timing. For this reason, waste minimization and/or recycling has not been quantified as part of this analysis and is not a criterion shown in the Implementation Plan.

The Implementation Plan is provided in Table 8-1 presented on a section-by-section basis.

Table 8-1: Implementation Plan

Report Section	Number	Recommendation	Priority	Timeline	Financial Impact
Recycling Metrics & Education & Outreach	**1-2**	Continue providing recycling service to customers that elect to participate in the program	Low	Near-term	N/A
	2-2	Measure recycling on a pound per household basis rather than by more traditional metrics	High	Near-term	None
	3-2	Focus education and outreach on key materials that are not well captured	High	Near-term	Minimal
	4-2	Consider developing and deploying a cart audit program to reduce contamination	High	Near-term	High
	5-2	Track recycling and refuse on a pounds per household basis to support waste minimization efforts	High	Near-term	Minimal
Recycling Collection Routing	**1-3**	Add one daily (or four weekly) recycling routes to increase the operational efficiency of recycling collections	High	Near-term	Moderate
	2-3	Maintain existing recycling collection days	Low	Long-term	N/A
	3-3	Balance routes by collection days for all residential collection services	Low	Mid-term	Minimal
Increase Commercial Recycling	**1-4**	Expand the City's commercial recycling customer base to fully utilize existing route	Medium	Long-term	Minimal
	2-4	Develop a business recognition program in conjunction with a WRAP to increase commercial recycling customers	Medium	Mid-Term	Moderate
	3-4	Explore stakeholder engagement process regarding the development of a commercial recycling ordinance	Low	Long-term	High
Recycling Center Evaluation	**1-5**	Optimize traffic flows at current or new Recycling Center	High	Near-term	N/A
	2-5	Maintain current number of equipment and staffing	Medium	Mid-term	N/A
	3-5	Ensure drivers utilize in-cab camera technology to safely execute backing maneuvers	Low	Near-term	N/A
	4-5	Develop new Recycling Center	Medium	Mid-term	High
Organics Program Development	**1-6**	Expand existing operation to process 60,000 CY annually	Medium	Near-term	High
	2-6	Assess operational needs of adjusting bulk and brush collection operation	Medium	Near-term	Moderate
Cost of Recycling Service	**1-7**	Add a residential recycling route	High	Near-term	Minimal
	2-7	Evaluate the implementation of a WRAP and expand commercial recycling to fully utilize route	Medium	Mid-term	Moderate
	3-7	Evaluate the implementation of a cart auditing program to reduce contamination	Minimal	Mid-term	Moderate
	4-7	Continue diverting recycling materials	Low	Long-term	N/A

APPENDIX A - ROUTING MODEL ASSUMPTIONS

Customer Accounts and Tonnage

Customers	FY 2019	Notes
Residential Refuse	62,696	
Residential Recycling	42,439	This represents the total households in the program. Slightly more than the total households included in the route audit located in Appendix I

Annual Tonnage	FY 2019	Notes
Residential Refuse		
Residential Recycling	11,760	
Commercial Recycling	1,332	

Time and Motion

Recycling Collection Metrics		Notes
Seconds per Set Out (loading and travel time)	29	See field observations data sheet
Seconds per Drive by	7	Assumption from AFPA Model
Extra Driving (per drive by)	3	Assumption from AFPA Model
Set Out Rate	99%	Field observations data sheet showed 78% set out rate. City recycling inventory sheet shows 98.7% set out rate

Crew/Working Hours	Status Quo	Notes
Working Hours	10	
Collection Days per Week	4	
Laborers per Crew	0	
Drivers per Crew	1	
Temporary Labor per Crew	0	

Key Routing Analysis Assumptions	Value	Notes
Households per Week	21,220	
Working Hours per Day	10	
Collection Days per Week	4	
Recycling Loading and Travel Time (seconds per set out)	29.0	
Drive by Time (seconds per drive by)	7	
Extra Driving (Avg. seconds per HH)	3	
Recycling Set Out Rate	99.0%	

Non-Collection Time	Minutes	Hours	Notes
Pre-trip Inspection	15	0.3	
Morning Meeting	15	0.3	
Time to Route	15	0.3	
Post-trip/Fueling	15	0.3	
Breaks	30	0.5	
Subtotal	**90**	**1.50**	

Recycling	Minutes	Hours	Notes
Time to Processing	15	0.3	
Tip Time	10	0.2	
Time from Processing to Route	15	0.3	
Subtotal	**105**	**1.75**	
	Trips		**Notes**
Daily Processing Trips	3		Two trips to tip at recycling center during route and one more at end of day

Total Non-Collection Time	195	3.25
Total Collection Time	405	6.75
Total Workday	600	10

Required Recycling Routes	Value	Notes
Set Out Rate	99.0%	
Extra Carts	0%	
Households	765	
Routes per Day	6.93	
Routes per Day (rounded)	7.00	

APPENDIX B – RECYCLING CONTAINER INVENTORY

Current Routes

Week 1	Tuesday	Wednesday	Thursday	Friday	Total
Rt 1	1,012	920	926	881	3,739
Rt 2	1,025	937	848	845	3,655
Rt 3	1,004	844	687	879	3,414
Rt 4	884	782	704	877	3,247
Rt 5	937	1,048	1,026	771	3,782
Rt 6	1,056	937	880	794	3,667
Rt 7	0	0	0	0	0
Daily total	**5,918**	**5,468**	**5,071**	**5,047**	**21,504**
	28%	**25%**	**24%**	**23%**	

Week 2	Tuesday	Wednesday	Thursday	Friday	Total
Rt 1	946	938	885	878	3,647
Rt 2	902	977	986	1,084	3,949
Rt 3	789	959	748	787	3,283
Rt 4	927	833	914	807	3,481
Rt 5	887	1,002	962	634	3,485
Rt 6	751	947	663	655	3,016
Rt 7	0	0	0	0	0
Daily total	**5,202**	**5,656**	**5,158**	**4,845**	**20,861**
	25%	**27%**	**25%**	**23%**	**100%**

Total	**11,120**	**11,124**	**10,229**	**9,892**	**42,365**
	26%	**26%**	**24%**	**23%**	**100%**

APPENDIX C – COST OF SERVICE SCHEDULES

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
Expenses										
Administration										
EWS - Delivery	5001	4311 Administration	Full-Time Non-Civil Salary	Personnel	$787,020	$788,533	$933,823	($13,753)	$920,070	A
EWS - Delivery	5003	4311 Administration	Part-Time Salaries	Personnel	$4,410	$14,606	$17,712		$17,712	
EWS - Delivery	5004	4311 Administration	Temp/Occasional Salaries	Personnel	$65,353	$93,079	$49,000		$49,000	
EWS - Delivery	5005	4311 Administration	Salary Charge-out	Personnel	$0	$0	$0		$0	
EWS - Delivery	5011	4311 Administration	Overtime	Personnel	$14,054	$24,613	$6,666		$6,666	
EWS - Delivery	5012	4311 Administration	Stability Pay	Personnel	$7,875	$7,725	$6,450	($95)	$6,355	A
EWS - Delivery	5021	4311 Administration	FLSA Overtime	Personnel	$5,031	$10,768	$3,333	($49)	$3,284	A
EWS - Delivery	5042	4311 Administration	Incentive Pay	Personnel	$15,300	$14,155	$35,625	($525)	$35,100	A
EWS - Delivery	5501	4311 Administration	FICA	Personnel	$62,061	$66,632	$71,743	($1,057)	$70,686	A
EWS - Delivery	5502	4311 Administration	FICA Other (Overtime, Spec Pay)	Personnel	$0	$0	$4,513	($66)	$4,447	A
EWS - Delivery	5503	4311 Administration	TMRS	Personnel	$90,144	$90,884	$105,116	($1,548)	$103,568	A
EWS - Delivery	5504	4311 Administration	TMRS Other (Overtime, Spec Pay)	Personnel	$0	$0	$3,746	($55)	$3,691	A
EWS - Delivery	5505	4311 Administration	Group Insurance	Personnel	$185,130	$160,527	$169,797	($2,501)	$167,296	A
EWS - Delivery	5510	4311 Administration	Benefits Offset	Personnel	$0	$0	$0		$0	
EWS - Delivery	6001	4311 Administration	Office Supplies	Operations	$10,962	$8,716	$14,077		$14,077	
EWS - Delivery	6003	4311 Administration	Minor Tools & Equipment	Operations	$0	$102	$0		$0	
EWS - Delivery	6005	4311 Administration	Safety Supplies & Materials	Operations	$978	$2,548	$3,370		$3,370	
EWS - Delivery	6011	4311 Administration	Minor Computer Items	Operations	$8,716	$3,445	$21,234		$21,234	
EWS - Delivery	6071	4311 Administration	Miscellaneous WAREHOUSE	Operations	$3,609	$4,370	$1,236		$1,236	
EWS - Delivery	6075	4311 Administration	Clothing	Operations	$538	$35	$0		$0	
EWS - Delivery	6079	4311 Administration	Building Maintenance Supplies	Operations	$0	$1,580	$5,000		$5,000	
EWS - Delivery	6998	4311 Administration	Purchase Card Clearing Account	Operations	$0	($111)	$0		$0	
EWS - Delivery	7003	4311 Administration	Cellular Phones	Operations	$3,765	$3,435	$4,320		$4,320	
EWS - Delivery	7013	4311 Administration	Solid Waste Collection	Operations	$5,184	$4,328	$0		$0	
EWS - Delivery	7015	4311 Administration	Wastewater	Operations	$478	$639	$3,312		$3,312	
EWS - Delivery	7017	4311 Administration	Water Service	Operations	$1,609	$2,282	$1,248		$1,248	
EWS - Delivery	7019	4311 Administration	Electric Service	Operations	$16,643	$14,837	$20,197		$20,197	
EWS - Delivery	7101	4311 Administration	Professional Services	Operations	$0	$60,010	$0		$0	
EWS - Delivery	7111	4311 Administration	Other Outside Services	Operations	$29,767	$50,818	$146,176	($100,000)	$46,176	B
EWS - Delivery	711101	4311 Administration	Misc. Other Outside Services	Operations	$30,006	$4,851	$20,000		$20,000	
EWS - Delivery	711172	4311 Administration	COVID 19 Response	Operations	$674	$0	$0		$0	
EWS - Delivery	7121	4311 Administration	Service Contracts	Operations	$0	$711	$780		$780	
EWS - Delivery	7141	4311 Administration	Postage & Mail Services	Operations	$8,607	$985	$8,380		$8,380	
EWS - Delivery	7142	4311 Administration	Printing & Photocopying	Operations	$1,971	$775	$15,410		$15,410	
EWS - Delivery	7203	4311 Administration	Rental-Equipment	Operations	$2,329	$2,263	$4,908		$4,908	
EWS - Delivery	7601	4311 Administration	Legal Notices & Publications	Operations	$0	$600	$3,200		$3,200	
EWS - Delivery	7603	4311 Administration	Dues & Memberships	Operations	$1,665	$2,199	$1,467		$1,467	
EWS - Delivery	7605	4311 Administration	Subscriptions	Operations	$83	$0	$35		$35	
EWS - Delivery	7609	4311 Administration	Personal Mileage Reimbursement	Operations	$436	$463	$400		$400	
EWS - Delivery	760901	4311 Administration	Personal Mileage Reimbursement	Operations	$6,429	$10,940	$0		$0	
EWS - Delivery	7611	4311 Administration	Professional Development	Operations	$31,649	$14,815	$9,110		$9,110	
EWS - Delivery	7613	4311 Administration	Promotional Expense	Operations	$225	$0	$0		$0	
EWS - Delivery	7641	4311 Administration	Service Awards	Operations	$1,661	$6,673	$5,780		$5,780	
EWS - Delivery	6041	4311 Administration	Fuel & Lubricants	Operating Transfers	$8,780	$4,119	$11,442		$11,442	
EWS - Delivery	6043	4311 Administration	Fuel Reimbursement	Operating Transfers	($7)	$0	$0		$0	
EWS - Delivery	6503	4311 Administration	Fleet Service Charges	Operating Transfers	$13,100	$12,964	$11,800		$11,800	
EWS - Delivery	6507	4311 Administration	Vehicle Replacement & Reserve	Operating Transfers	$2,752	$17,216	$31,090		$31,090	
Total Administration					**$1,428,987**	**$1,508,130**	**$1,751,496**	**($119,649)**	**$1,631,847**	

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
Brush Collection										
EWS - Delivery	5001	4312 Brush Collection	Full-Time Non-Civil Salary	Personnel	$1,287,096	$1,465,642	$1,500,804		$1,500,804	
EWS - Delivery	5003	4312 Brush Collection	Part-Time Salaries	Personnel	$0	$0	$0		$0	
EWS - Delivery	5004	4312 Brush Collection	Temp/Occasional Salaries	Personnel	$9,860	$29,619	$15,000		$15,000	
EWS - Delivery	5005	4312 Brush Collection	Salary Charge-out	Personnel	($172)	$0	$0		$0	
EWS - Delivery	5011	4312 Brush Collection	Overtime	Personnel	$107,434	$154,846	$46,996		$46,996	
EWS - Delivery	5012	4312 Brush Collection	Stability Pay	Personnel	$16,125	$13,500	$14,400		$14,400	
EWS - Delivery	5021	4312 Brush Collection	FLSA Overtime	Personnel	$50,184	$71,935	$23,332		$23,332	
EWS - Delivery	5042	4312 Brush Collection	Incentive Pay	Personnel	$200	$400	$0		$0	
EWS - Delivery	5501	4312 Brush Collection	FICA	Personnel	$106,894	$127,224	$115,930		$115,930	
EWS - Delivery	5502	4312 Brush Collection	FICA Other (Overtime, Spec Pay)	Personnel	$0	$0	$6,502		$6,502	
EWS - Delivery	5503	4312 Brush Collection	TMRS	Personnel	$165,218	$189,031	$169,365		$169,365	
EWS - Delivery	5504	4312 Brush Collection	TMRS Other (Overtime, Spec Pay)	Personnel	$0	$0	$7,130		$7,130	
EWS - Delivery	5505	4312 Brush Collection	Group Insurance	Personnel	$406,690	$441,267	$452,824		$452,824	
EWS - Delivery	5513	4312 Brush Collection	Unemployment Claims	Personnel	$0	$755	$0		$0	
EWS - Delivery	6003	4312 Brush Collection	Minor Tools & Equipment	Operations	$371	$815	$2,475		$2,475	
EWS - Delivery	6005	4312 Brush Collection	Safety Supplies & Materials	Operations	$4,086	$6,052	$8,029		$8,029	
EWS - Delivery	6011	4312 Brush Collection	Minor Computer Items	Operations	$0	$1,488	$3,000		$3,000	
EWS - Delivery	6051	4312 Brush Collection	Direct Materials	Operations	$689	$585	$2,000		$2,000	
EWS - Delivery	6071	4312 Brush Collection	Miscellaneous Warehouse	Operations	$3,220	$4,247	$3,169		$3,169	
EWS - Delivery	6075	4312 Brush Collection	Clothing	Operations	$10,296	$9,232	$18,300		$18,300	
EWS - Delivery	7003	4312 Brush Collection	Cellular Phones	Operations	$480	$720	$1,440		$1,440	
EWS - Delivery	7101	4312 Brush Collection	Professional Services	Operations	$0	$15,184	$0		$0	
EWS - Delivery	7111	4312 Brush Collection	Other Outside Services	Operations	$4,643	$7,854	$0		$0	
EWS - Delivery	711101	4312 Brush Collection	Misc. Other Outside Services	Operations	$240,506	$198,456	$145,080		$145,080	
EWS - Delivery	7131	4312 Brush Collection	Outside Vehicle/Equip Maint.	Operations	$2,624	$7,847	$15,000		$15,000	
EWS - Delivery	7142	4312 Brush Collection	Printing & Photocopying	Operations	$3,816	$1,424	$3,216		$3,216	
EWS - Delivery	760901	4312 Brush Collection	Personal Mileage Reimbursement	Operations	$0	$0	$5,000		$5,000	
EWS - Delivery	7611	4312 Brush Collection	Professional Development	Operations	$2,493	$2,033	$3,850		$3,850	
EWS - Delivery	6041	4312 Brush Collection	Fuel & Lubricants	Operating Transfers	$241,398	$246,606	$282,909		$282,909	
EWS - Delivery	6503	4312 Brush Collection	Fleet Service charges	Operating Transfers	$785,800	$716,843	$711,200		$711,200	
EWS - Delivery	6507	4312 Brush Collection	Vehicle Replacement & Reserve	Operating Transfers	$0	$0	$9,638		$9,638	
Total Brush Collection					**$3,449,951**	**$3,713,605**	**$3,566,589**	**$0**	**$3,566,589**	
Residential Collection										
EWS - Delivery	5001	4313 Residential Collection	Full-Time Non-Civil Salary	Personnel	$544,544	$520,830	$825,420		$825,420	
EWS - Delivery	5004	4313 Residential Collection	Occasional/Temporary	Personnel	$0	$0	$0		$0	
EWS - Delivery	5011	4313 Residential Collection	Overtime	Personnel	$36,531	$45,837	$35,996		$35,996	
EWS - Delivery	5012	4313 Residential Collection	Stability Pay	Personnel	$10,500	$10,050	$10,200		$10,200	
EWS - Delivery	5021	4313 Residential Collection	FLSA Overtime	Personnel	$17,367	$19,007	$17,998		$17,998	
EWS - Delivery	5042	4314 Residential Collection	Incentive Pay	Personnel	$200	$0	$0		$0	
EWS - Delivery	5501	4313 Residential Collection	FICA	Personnel	$44,433	$43,145	$63,938		$63,938	
EWS - Delivery	5502	4313 Residential Collection	FICA Other (Overtime, Spec Pay)	Personnel	$0	$0	$4,131		$4,131	
EWS - Delivery	5503	4313 Residential Collection	TMRS	Personnel	$68,916	$66,265	$93,405		$93,405	
EWS - Delivery	5504	4313 Residential Collection	TMRS Other (Overtime, Spec Pay)	Personnel	$0	$0	$6,016		$6,016	
EWS - Delivery	5505	4313 Residential Collection	Group Insurance	Personnel	$180,692	$169,583	$226,460		$226,460	
EWS - Delivery	6003	4313 Residential Collection	Minor Tools & Equipment	Operations	$67	$609	$2,061		$2,061	
EWS - Delivery	6005	4313 Residential Collection	Safety Supplies & Materials	Operations	$2,772	$2,963	$5,251		$5,251	
EWS - Delivery	6011	4313 Residential Collection	Minor Computer Items	Operations	$0	$1,394	$745		$745	
EWS - Delivery	6051	4313 Residential Collection	Direct Materials	Operations	$212,787	$207,940	$198,884		$198,884	
EWS - Delivery	6071	4313 Residential Collection	Miscellaneous Warehouse	Operations	$1,822	$2,043	$4,611		$4,611	
EWS - Delivery	6075	4313 Residential Collection	Clothing	Operations	$6,526	$6,144	$12,267		$12,267	
EWS - Delivery	7003	4313 Residential Collection	Cellular Phones	Operations	$1,290	$2,040	$1,440		$1,440	
EWS - Delivery	7111	4313 Residential Collection	Other Outside Services	Operations	$43,351	$43,206	$8,140		$8,140	
EWS - Delivery	7131	4313 Residential Collection	Outside Vehicle/Equip Maint.	Operations	$3,207	$38,098	$20,000		$20,000	

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
EWS - Delivery	7142	4313 Residential Collection	Printing & Photocopying	Operations	$2,541	$2,306	$4,000		$4,000	
EWS - Delivery	760901	4313 Residential Collection	Personal Mileage Reimbursement	Operations	$0	$0	$0		$0	
EWS - Delivery	7611	4313 Residential Collection	Professional Development	Operations	$1,547	$1,362	$3,490		$3,490	
EWS - Delivery	6041	4313 Residential Collection	Fuel & Lubricants	Operating Transfers	$247,197	$259,364	$290,652		$290,652	
EWS - Delivery	6503	4313 Residential Collection	Fleet Service charges	Operating Transfers	$703,400	$702,221	$699,400		$699,400	
EWS - Delivery	6507	4313 Residential Collection	Vehicle Replacement & Reserve	Operating Transfers	$7,533	$8,593	$20,247		$20,247	
Total Residential Collection					**$2,137,223**	**$2,153,000**	**$2,554,752**	**$0**	**$2,554,752**	

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
Commercial Collection										
EWS - Delivery	5001	4314 Commercial Collection	Full-Time Non-Civil Salary	Personnel	$410,591	$455,221	$553,404		$553,404	
EWS - Delivery	5004	4314 Commercial Collection	Occasional/Temporary	Personnel	$4,375	$0	$0		$0	
EWS - Delivery	5011	4314 Commercial Collection	Overtime	Personnel	$46,617	$104,939	$29,997		$29,997	
EWS - Delivery	5012	4314 Commercial Collection	Stability Pay	Personnel	$7,650	$7,875	$6,375		$6,375	
EWS - Delivery	5021	4314 Commercial Collection	FLSA Overtime	Personnel	$21,168	$49,748	$14,998		$14,998	
EWS - Delivery	5501	4314 Commercial Collection	FICA	Personnel	$35,796	$45,569	$42,835		$42,835	
EWS - Delivery	5502	4314 Commercial Collection	FICA Other (Overtime, Spec Pay)	Personnel	$0	$0	$3,442		$3,442	
EWS - Delivery	5503	4314 Commercial Collection	TMRS	Personnel	$54,758	$68,670	$62,565		$62,565	
EWS - Delivery	5504	4314 Commercial Collection	TMRS Other (Overtime, Spec Pay)	Personnel	$0	$0	$5,013		$5,013	
EWS - Delivery	5505	4314 Commercial Collection	Group Insurance	Personnel	$135,512	$135,712	$147,199		$147,199	
EWS - Delivery	5513	4314 Commercial Collection	Unemployment Claims	Personnel	$0	$124	$0		$0	
EWS - Delivery	6003	4314 Commercial Collection	Minor Tools & Equipment	Operations	816	$522	$2,160		$2,160	
EWS - Delivery	6005	4314 Commercial Collection	Safety Supplies & Materials	Operations	$1,779	$4,539	$4,397		$4,397	
EWS - Delivery	6011	4314 Commercial Collection	Minor Computer Items	Operations	$0	$1,039	$900		$900	
EWS - Delivery	6051	4314 Commercial Collection	Direct Materials	Operations	$74,900	$94,584	$138,510		$138,510	
EWS - Delivery	6071	4314 Commercial Collection	Miscellaneous Warehouse	Operations	$1,244	$909	$3,579		$3,579	
EWS - Delivery	6075	4314 Commercial Collection	Clothing	Operations	$4,189	$3,854	$8,541		$8,541	
EWS - Delivery	6091	4314 Commercial Collection	Miscellaneous Supplies	Operations	$12,810	$17,543	$11,105		$11,105	
EWS - Delivery	7003	4314 Commercial Collection	Cellular Phones	Operations	$1,320	$1,740	$1,440		$1,440	
EWS - Delivery	7101	4314 Commercial Collection	Professional Services	Operations	$0	$7,592	$4,950	($4,950)	$0	C
EWS - Delivery	7111	4314 Commercial Collection	Other Outside Services	Operations	$4,251	$7,720	$6,290		$6,290	
EWS - Delivery	7131	4314 Commercial Collection	Outside Vehicle/Equip Maint.	Operations	$71,208	$54,732	$20,000		$20,000	
EWS - Delivery	7141	4314 Commercial Collection	Postage & Mail Services	Operations	$0	$24	$2,376		$2,376	
EWS - Delivery	7142	4314 Commercial Collection	Printing & Photocopying	Operations	$5,459	$3,656	$5,305		$5,305	
EWS - Delivery	7203	4314 Commercial Collection	Rental-Equipment	Operations	$17,600	$0	$0		$0	
EWS - Delivery	7603	4314 Commercial Collection	Dues & Memberships	Operations	$778	$130	$350		$350	
EWS - Delivery	7605	4314 Commercial Collection	Subscriptions	Operations	$0	$0	$0		$0	
EWS - Delivery	760901	4314 Commercial Collection	Personal Mileage Reimbursement	Operations	$0	$0	$2,500		$2,500	
EWS - Delivery	7611	4314 Commercial Collection	Professional Development	Operations	$1,963	$3,036	$2,965		$2,965	
EWS - Delivery	7613	4314 Commercial Collection	Promotional Expense	Operations	$6,423	$6,218	$11,911		$11,911	
EWS - Delivery	6041	4314 Commercial Collection	Fuel & Lubricants	Operating Transfers	$162,403	$178,974	$192,000		$192,000	
EWS - Delivery	6503	4314 Commercial Collection	Fleet Service charges	Operating Transfers	$499,900	$511,200	$511,200		$511,200	
Total Commercial Collection					**$1,583,510**	**$1,765,870**	**$1,796,307**	**($4,950)**	**$1,791,357**	

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
Recycling Services										
EWS - Delivery	5001	4315 Recycling Services	Full-Time Non-Civil Salary	Personnel	$381,181	$366,194	$527,520		$527,520	
EWS - Delivery	5004	4315 Recycling Services	Occasional/Temporary	Personnel	$0	$0	$0		$0	
EWS - Delivery	5005	4315 Recycling Services	Salary Charge-out	Personnel	($28,259)	($30,965)	($31,411)	$31,411	$0	D
EWS - Delivery	5011	4315 Recycling Services	Overtime	Personnel	$42,356	$43,299	$19,198		$19,198	
EWS - Delivery	5012	4315 Recycling Services	Stability Pay	Personnel	$8,025	$8,625	$7,800		$7,800	
EWS - Delivery	5021	4315 Recycling Services	FLSA Overtime	Personnel	$20,477	$19,923	$5,382		$5,382	
EWS - Delivery	5501	4315 Recycling Services	FICA	Personnel	$32,468	$31,855	$40,953		$40,953	
EWS - Delivery	5502	4315 Recycling Services	FICA Other (Overtime, Spec Pay)	Personnel	$0	$0	$2,358		$2,358	
EWS - Delivery	5503	4315 Recycling Services	TMRS	Personnel	$51,050	$48,977	$59,831		$59,831	
EWS - Delivery	5504	4315 Recycling Services	TMRS Other (Overtime, Spec Pay)	Personnel	$0	$0	$1,807		$1,807	
EWS - Delivery	5505	4315 Recycling Services	Group Insurance	Personnel	$112,967	$113,090	$135,876		$135,876	
EWS - Delivery	6003	4315 Recycling Services	Minor Tools & Equipment	Operations	723	$555	$778		$778	
EWS - Delivery	6005	4315 Recycling Services	Safety Supplies & Materials	Operations	$1,990	$3,027	$2,898		$2,898	
EWS - Delivery	6011	4315 Recycling Services	Minor Computer Items	Operations	$228	$418	$745		$745	
EWS - Delivery	6051	4315 Recycling Services	Direct Materials	Operations	$3,280	$40,629	$117,614	($65,614)	$52,000	E
EWS - Delivery	6071	4315 Recycling Services	Miscellaneous Warehouse	Operations	$869	$842	$1,528		$1,528	
EWS - Delivery	6075	4315 Recycling Services	Clothing	Operations	$3,896	$3,216	$5,988		$5,988	
EWS - Delivery	7003	4315 Recycling Services	Cellular Phones	Operations	$360	$600	$720		$720	
EWS - Delivery	7101	4315 Recycling Services	Professional Services	Operations	$0	$15,790	$0		$0	
EWS - Delivery	7111	4315 Recycling Services	Other Outside Services	Operations	$98,956	$161,211	$597,795	$275,178	$872,973	F
EWS - Delivery	711101	4315 Recycling Services	Misc. Other Outside Services	Operations	$25,657	$10,951	$0		$0	
EWS - Delivery	7131	4315 Recycling Services	Outside Vehicle/Equip Maint.	Operations	$19,971	$22,372	$20,000		$20,000	
EWS - Delivery	7142	4315 Recycling Services	Printing & Photocopying	Operations	$36,542	$19,148	$26,711		$26,711	
EWS - Delivery	7203	4315 Recycling Services	Rental-Equipment	Operations	$0	$0	$6,000		$6,000	
EWS - Delivery	7603	4315 Recycling Services	Dues & Memberships	Operations	$75	$225	$200		$200	
EWS - Delivery	760901	4315 Recycling Services	Personal Mileage Reimbursement	Operations	$0	$0	$2,500		$2,500	
EWS - Delivery	7611	4315 Recycling Services	Professional Development	Operations	$5,792	$7,912	$4,140		$4,140	
EWS - Delivery	7613	4315 Recycling Services	Promotional Expense	Operations	$2,330	$15,863	$30,662	($15,000)	$15,662	G
EWS - Delivery	6041	4315 Recycling Services	Fuel & Lubricants	Operating Transfers	$105,731	$108,273	$123,816		$123,816	
EWS - Delivery	6503	4315 Recycling Services	Fleet Service charges	Operating Transfers	$202,000	$256,200	$256,200		$256,200	
Total Recycling Services					**$1,128,665**	**$1,268,230**	**$1,967,609**	**$225,975**	**$2,193,584**	
Miscellaneous Non-Departmental										
EWS - Delivery	5001	7777 Misc Non-Departmental	Full-Time Non-Civil Svc Salary	Personnel	$0	$0	$115,409		$115,409	
EWS - Delivery	5513	7778 Misc Non-Departmental	Unemployment Claims	Personnel	$2,399	$0	$8,497		$8,497	
EWS - Delivery	7101	7779 Misc Non-Departmental	Professional Services	Operations	$2,367	$2,204	$2,160		$2,160	
EWS - Delivery	7505	7780 Misc Non-Departmental	Contribution to OPEB	Operations	$124,286	$124,286	$124,286		$124,286	
EWS - Delivery	7631	7781 Misc Non-Departmental	Payment of Principal-CO	Operations	$2,630,000	$3,060,000	$2,625,000		$2,625,000	
EWS - Delivery	7632	7782 Misc Non-Departmental	Payment of Interest-GO Bonds	Operations	$650	$650	$650		$650	
EWS - Delivery	7632	7783 Misc Non-Departmental	Payment of Interest-COs	Operations	$412,014	$446,257	$443,209		$443,209	
EWS - Delivery	7915	7784 Misc Non-Departmental	Residential Disposal Fees	Operations	$2,059,982	$2,185,710	$2,745,327		$2,745,327	
EWS - Delivery	7916	7785 Misc Non-Departmental	Commercial Disposal Fees	Operations	$1,025,688	$1,031,123	$829,682	$361,573	$1,191,255	H
EWS - Delivery	8003	7786 Misc Non-Departmental	General & Administrative	Operations	$777,472	$806,106	$815,899		$815,899	
EWS - Delivery	8005	7787 Misc Non-Departmental	In Lieu of Ad Valorem Tax	Operations	$96,963	$104,323	$121,129		$121,129	
EWS - Delivery	8006	7788 Misc Non-Departmental	In Lieu of Franchise Fee Tax	Operations	$784,518	$785,970	$1,044,035		$1,044,035	
EWS - Delivery	8017	7789 Misc Non-Departmental	Self Insurance Transfer	Operations	$304,623	$293,062	$296,176		$296,176	
EWS - Delivery	8018	7790 Misc Non-Departmental	City Contrib Retiree Health	Operations	$183,499	$186,684	$184,670		$184,670	
EWS - Delivery	8029	7791 Misc Non-Departmental	In Long Term Disability Transfer	Operations	$12,845	$13,021	$12,883		$12,883	
EWS - Delivery	8031	7792 Misc Non-Departmental	Other Interfund Transfers Out	Operations	$513,579	$166,527	$322,177		$322,177	
Total Misc Non-Departmental					**$8,930,885**	**$9,205,923**	**$9,691,189**	**$361,573**	**$10,052,762**	

Account	Budget Code	Service	Account Description	Class	2017-2018 Actual	2018-2019 Actual	2019-2020 Budget	Adjustments	Test Year	Notes
Support Services										
EWS - Delivery	8025	7779 Support Services	Support Svc-Facilities Mgmt	Operations	$111,011	$123,363	$135,824		$135,824	
EWS - Delivery	8026	7780 Support Services	Support Svc-Mgmt Info Svcs	Operations	$902,674	$846,456	$749,544		$749,544	
EWS - Delivery	8027	7781 Support Services	Support Svc-Warehouse	Operations	$14,644	$12,971	$17,859		$17,859	
EWS - Delivery	8028	7782 Support Services	Support Svc-Customer Service	Operations	$297,417	$207,072	$201,499		$201,499	
Total Support Services					**$1,325,746**	**$1,189,862**	**$1,104,726**	**$0**	**$1,104,726**	
Total Expenses					**$19,984,967**	**$20,804,620**	**$22,432,668**	**$462,949**	**$22,895,617**	
Revenue Offsets										
			Residential Collection		($14,684,073)	($14,708,953)	($15,498,827)	$15,498,827	$0	I
			Commercial Collection		($3,194,967)	($3,299,547)	($3,725,991)	$3,725,991	$0	I
			Roll-Off Containers		($762,872)	($796,029)	($848,009)	$848,009	$0	I
			Premium Brush Collection		($5,790)	($6,910)	($7,658)	$7,658	$0	I
			Recycling		($143,775)	($135,055)	($133,029)	$133,029	$0	I
			Intra-City Collection		($132,787)	($125,671)	($125,671)	$125,671	$0	I
			Penalty Charges		($133,915)	($140,000)	($142,000)		($142,000)	
			Extra Containers		($1,024,532)	($1,025,686)	($1,025,678)		($1,025,678)	
			Bad Debt		$39,978	$81,464	$82,051		$82,051	
			Miscellaneous		($75,386)	($88,978)	($24,000)		($24,000)	
			Auction Revenue		($53)	($209,300)	($20,000)		($20,000)	
			Interest		($38,698)	($55,000)	($46,910)		($46,910)	
									$0	
			Total Revenue Offsets		**($20,156,870)**	**($20,509,665)**	**($21,515,722)**	**$20,339,185**	**($1,176,537)**	
			Total Revenue Requirement		**($171,903)**	**$294,955**	**$916,946**		**$21,719,080**	

Notes:

A. Adjusted by subtracting anticipated staff vacancies (e.g. retirement) and adding salaries paid out of Disposal account. Benefits line items adjusted proportionally to Budget Item 5001

B. Represents one-time cost for EWS business plan. Adjusted down to reflect typical annual cost

C. Will be included in Budget Item 7111

D. One partial salary paid by water dept. Included this cost in total salary for employee no. 4017

E. Budget department rolled over $65,614 for expenditures that took place late in FY18/19

F. Updated based on new FCC contract rate of $66.68 per ton (inclusive of transportation fee). Test year cost calculcated by multiplying $66.68 * 13,092 annual FY 2019 tons

G. Adjusted down to reflect anticipated cost of recycling education and outreach

H. Adjusted up to reflect anticipated disposal fee for commercial services

I. Offset for purposes of calculating revenue requirement

Cost Center	FY 2020
Administration	$4,858,384
Residential Curbside Recycling	$1,655,225
Commercial FL Recycling	$81,245
Recycling Events	$26,823
Drop Off	$0
Education and Outreach	$120,451
Recycling Processing	$1,190,878
Residential Refuse Collection	$3,065,622
Brush/Bulk Collection	$4,558,547
Transfer/Disposal	$3,936,582
Commercial FL Refuse	$1,739,624
Commercial Roll Off Refuse	$485,699

Total Revenue Requirement	$21,719,080

Cost Center	FY 2020
Administration	$703,054
Residential Curbside Recycling	$1,655,225
Recycling Events	$26,823
Education and Outreach	$76,399
Recycling Processing	$1,069,729

Residential Recycling Revenue Requirement	$3,531,230
Total Households	62,969
Total Cost/Household/Month	$4.67

Cost Center	Cost per Household per Month (Total Households)
Administration	$0.93
Residential Curbside Recycling	$2.19
Recycling Events	$0.04
Education and Outreach	$0.10
Recycling Processing	$1.42

Residential Recycling Revenue Requirement	$3,531,230
Total Households (with recycling carts)	42,439
Total Cost/Household/Month	$6.93

Cost Center	Cost per Household per Month (Total Households with Recycling Carts)
Administration	$1.38
Residential Curbside Recycling	$3.25
Recycling Events	$0.05
Education and Outreach	$0.15
Recycling Processing	$2.10

Cost Center	FY 2020
Administration	$58,953
Commercial FL Recycling	$81,245
Education and Outreach	$789
Recycling Processing	$121,149

Collection Cost	$140,988
Processing Cost	$121,149
Total Commercial Recycling Revenue Requirement	**$262,137**

Annual Collections	11,076
Cost per Collection	$12.73

Annual CY Collected	81,848
Cost of Processing per CY	$1.48

Collections per Week	Monthly Recycling Cost Based on Collections per Week	
Container Size	**1**	**2**
6	$93.64	$187.29
8	$106.47	$212.94

Collections per Week	Current Rate Based on Collections per Week	
Container Size	**1**	**2**
6	$130.41	$260.82
8	$130.41	$260.82

Collections per Week	Difference Based on Collections per Week	
Container Size	**1**	**2**
6	$36.77	$73.53
8	$23.94	$47.88