REPORT

September 2024

ORGANICS FEASIBILITY STUDY

Prepared for

Hamilton County ReSource

September 2024

GT ENVIRONMENTAL, INC. 614-794-3570 2400 Corporate Exchange Drive, Suite 150, Columbus, OH 43231

Study Prepared By

GT Environmental, Inc. - Columbus, OH

Economic Environmental Solutions International – Cincinnati, OH

Coker Composting and Consulting - Troutville, VA

BioCycle Connect, LLC - Emmaus, PA

Amplify for Change - Arlington, VA

Acknowledgments

This study would not have been possible to complete without the assistance of Hamilton County ReSource staff. The project team would like to recognize the invaluable assistance of Michelle Balz, Solid Waste Manager, Hamilton County ReSource.

TABLE OF CONTENTS

Table of Contents

GLOSSARY

Biofilter – An engineered bed of soil, compost, and/or woodchips covering a distribution system of perforated pipes. Contaminated air is blown into the perforated pipes and biologically "scrubbed" of odor-causing compounds as it diffuses up through the filtration media.

Bulking Agent – A material that increases porosity and improves the structure of a compost pile, such as wood chips.

Commercial Solid Waste – Refers to solid waste generated at non-residential buildings, non-industrial businesses, and institutions. This category includes businesses such as shopping centers, retail stores, grocery stores, theaters, gas stations, business offices, hotels, restaurants, and similar service establishments. Institutions include government and non-profit offices, schools, prisons, churches, parks, and similar organizations.

Composting – As defined in Ohio Administrative Code Rule 3734-27-01(C)(3), the process of biological decomposition of solid wastes under controlled conditions resulting in compost. Controlled conditions include but are not limited to grinding, shredding, piling, physical turning, aerating, adding moisture, or other processing of solid wastes.

Composting Facility – As defined in Ohio Administrative Code Rule 3734-27-01(C)(4), a site, location, tract of land, installation, or building used for composting of solid waste in accordance with Chapter 3734 of the Revised Code and rules adopted thereunder.

There are four types of regulated compost facilities:

- Class I Compost Facilities – These facilities can be used to compost the greatest variety of solid wastes including mixed solid waste (glass, food, plastics, pesticides, household cleaners, etc.), food waste, yard waste and other industrial wastes. Class I facilities must have a permit, license and financial assurance.
- Class II Compost Facilities – These facilities can be used to compost only source-separated yard waste, food scraps, animal wastes, specified agricultural wastes, authorized bulking agents and additives, and other alternative materials. Alternative materials (feed stocks, bulking agents and additives) may be used in the compost process only if prior approval is obtained from the Director. Except in limited circumstances, Class II facilities must have a license, financial assurance and registration.
- Class III Compost Facilities – These facilities can be used to compost only source-separated yard waste, animal wastes, specified agricultural wastes, authorized bulking agents and additives. Class III facilities must be registered with Ohio EPA.
- Class IV Compost Facilities – These facilities can be used to compost only source-separated yard waste, authorized bulking agents, and the following additives: urea and bacteria or fungal inoculum. Class IV facilities must be registered with Ohio EPA.

Curing – Maturation period required for compost to become stable and nontoxic to plant life.

Feedstocks – Raw material inputs for the composting process.

Inoculants – Dominant microorganisms which may be added to a compost pile.

Lignin – Is a class of complex organic polymers that form key structural materials in the support tissues of most plants. Lignins are particularly important in the formation of cell walls, especially in wood and bark, because they lend rigidity and do not rot easily.

Porosity – Is the percentage of void space in a compost pile. It is defined as the ratio of the volume of the voids or pore space divided by the total volume. It is written as either a decimal fraction between 0 and 1 or as a percentage.

Processing Capacity – For purposes of this document, processing capacity refers to the design capacity of the facility (or the maximum amount of materials which could be processed), and not the actual amount of materials processed during a given time period.

Residential Solid Wastes – Solid wastes generated at residential dwellings, such as single-family homes, apartment complexes, condominiums, mobile homes. Domiciles such as nursing homes, campgrounds, and other types of group quarters and institutions are considered to generate commercial waste.

Screening – The sifting of compost through a screen to remove large particles and improve consistency and quality of the end product.

Windrow – An elongated pile into which organic materials are formed during the composting process.

INTRODUCTION

Hamilton County ReSource (ReSource) aims to divert residential and commercial food scraps, yard trimmings, and compostable fiber from the landfill. The Hamilton County Solid Waste Management Plan 2024-2038 (2024 Solid Waste Plan) identified organics, in particular food scraps, as a target material with potential for an increase in diversion. Because Southwest Ohio lacks strong infrastructure for processing food scraps, Hamilton County worked with GT Environmental and a team of consultants to lay the groundwork to establish better organics processing infrastructure in the region with a focus on food scraps.

Hamilton County set an aspirational goal of increasing residential diversion from 18% to 27% and commercial diversion from 43% to 50%. Adding food scrap processing infrastructure is one strategy and program to increase diversion, moving Hamilton County towards meeting the goal.

One of the limiting factors preventing more widespread food scrap recovery is the lack of composting (or processing) facilities in Hamilton County or adjacent counties to process food scraps. Despite this, Hamilton County has continued to expand food scrap diversion through several initiatives, including supporting food rescue efforts, educating residents about backyard composting, and establishing food scrap drop-off sites.

The intent of this feasibility study is to produce a report so Hamilton County ReSource can assess opportunities to further divert organic waste from the landfill and evaluate whether a public-private partnership (PPP) is feasible to develop organic processing. A key priority for Hamilton County is developing a multi-faceted approach to organics management and processing that is mutually beneficial to all stakeholders. The solution needs to be viable and built on a solid foundation that will move Hamilton County forward to reduce reliance on landfills. Equally important, the solution must benefit the community and have their buy-in and support.

At the project launch, this study brought together stakeholders to assess interest in collaborative solutions for organics recovery. Consultants also engaged with composters in the region to better identify existing initiatives, gather available data, and understand the appetite for increasing organics recovery; especially, food scraps. This study arrives at solutions through an incremental, transparent process that leveraged stakeholder input and broader-scale coordination and opportunities.

Food scrap feedstock for consideration includes residential and a select basis of commercial businesses. It does not consider industrial generators nor commercial businesses such as groceries that are committed to other diversion methods. A goal of this study was to not compete with the existing and planned private and public diversion infrastructure. Assumptions used in this analysis combine data provided from Hamilton County ReSource, interviews, surveys, calculations developed using a North American Industry Classification System (NAICS) code-based estimate of potential quantities generated, and national and state databases.

The organics portion of the solid waste stream encompasses a wide range of materials, including vegetative and non-vegetative (meat, dairy, bones, etc.) food scraps, leaves, grass, garden trimmings, brush, and house plants (collectively yard trimmings). Organic waste such as kitty litter, dog waste, and diapers were not considered as viable divertible streams with this study. Relative to organics diversion,

soiled and otherwise unrecyclable paper (i.e., used paper towels and other food-soiled paper) and BPI certified compostable products can be successfully handled at many organics processing facilities. For purposes of estimating organic waste that could be diverted into a food scrap recycling program, targeted organics include all food scraps, soiled/compostable paper, and BPI certified compostable products. Throughout this report these materials are referred to as source-separated organics (SSO). Yard trimmings is also targeted in the organic waste stream.

The outcome of this study provides a recommendation for developing food scrap processing. The recommended path complements food scrap processing initiatives already in place and encourages continued growth and expansion.

EXECUTIVE SUMMARY

The Challenge

One of the limiting factors preventing more widespread food scrap recovery in the region is the limited availability of source-separated food scrap collection and processing facilities in Hamilton County or adjacent counties to recover food scraps. Because Southwest Ohio lacks strong infrastructure to divert food scraps from landfill disposal, Hamilton County ReSource worked with GT Environmental and a team of consultants to improve regional organics recovery with a focus on food scraps. Therefore, the GT Project Team conducted a feasibility study to assess opportunities to further divert organic waste from the landfill and evaluate whether a public-private partnership (PPP) is viable to develop this infrastructure. A key priority for Hamilton County is developing a multi-faceted approach to organics management and processing that is mutually beneficial to various stakeholders.

Food Scraps Landfilled Annually

~138,050
Tons Landfilled

Residential
~ 42,650 Tons
Commercial Establishments
~ 95,400 Tons

The Proposed Solutions

This study focuses on residential and commercial sectors excluding generators such as the manufacturing industry and grocers that plan to send materials to anaerobic digesters already being developed. A goal of this study was to not compete with the existing and planned private and public diversion facilities thus, focusing on household and select commercial feedstock sources.

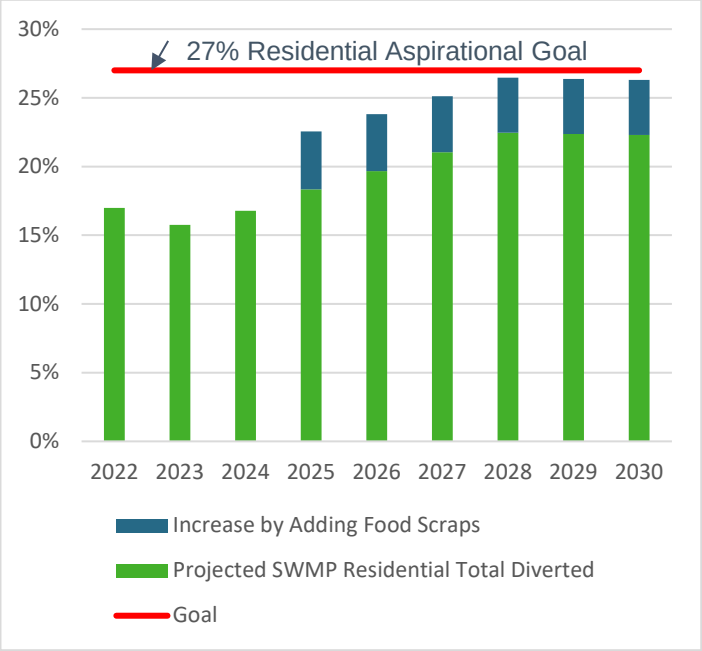
The first consideration was to estimate the amount of organic material that the system could capture, which frequently corresponds with collection convenience. For example, curbside recycling systems typically recover more materials on a per capita basis than drop-off sites. Steered by case study research, the GT Project Team based residential collection modeling on systems where access was available to all residential generators or “universal collection.” The GT Project Team evaluated four different universal residential collection scenarios:

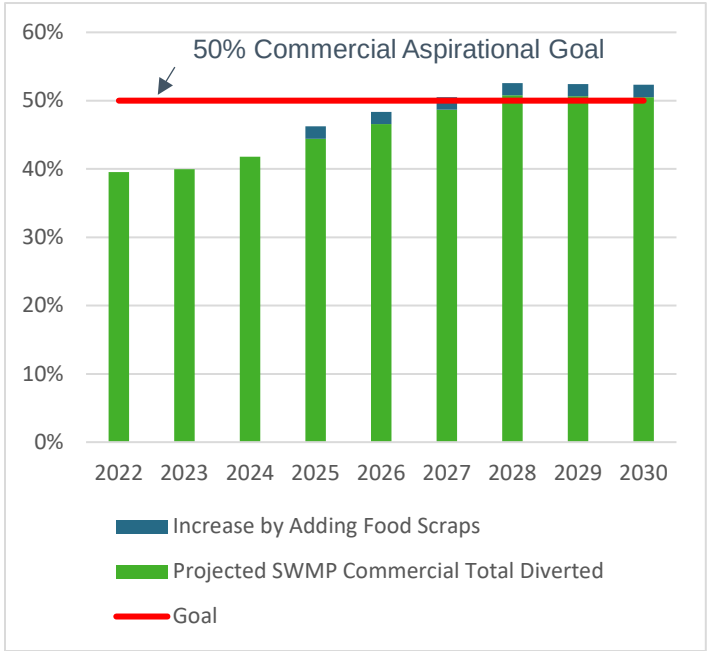
- **Scenario 1 – Non-Subscription:** where all households receive service regardless of whether they participate. The jurisdiction includes the service fee on property tax or solid waste bill, thus all households pay for the program.

- **Scenario 2 – Contract/Franchise and Subsidized Subscription:** where jurisdictions contract with a single hauler or award franchises to multiple haulers to provide service to households and subsidize service costs.
- **Scenario 3 – Subscription:** where households opt in for service and directly contract with the hauler.
- **Scenario 4 – Drop-Off Sites:** that are available 24/7 but households must register to use them.

For the commercial sector, GT modeled generation estimates using the New York State Pollution Prevention Institute and the Rochester Institute of Technology Food Waste Estimator Tool where participation was refined with anecdotal information gathered from targeted Hamilton County commercial business interviews and audits.

Hamilton County set an aspirational goal to increase residential diversion from 18% to 27% and commercial diversion from 43% to 50%. If Hamilton County achieves the modeled diversion of food scraps, the 27% residential aspirational diversion goal is almost reached by year 2028 and the commercial aspirational diversion goal of 50% will be reached by 2027.





There are several approaches to composting and each approach and technology have different land area requirements, feedstock considerations, processing times, benefits, and costs. Hamilton County is relatively urban/suburban with dense housing and businesses, and the generation of odors and storm water runoff could be an issue. Aerated static pile (ASP) composting limits potential odors and would mitigate these concerns, thus is considered a suitable composting technology for Hamilton County. ASP composting involves introducing forced aeration into a compost pile, either by pushing it up from under the pile (positive aeration) or pulling it down into the pile (negative

aeration). ASP systems are often constructed of concrete for longevity and to provide "push walls" for materials handling equipment.

Photo Source: Onondaga Resource Recovery Authority, Syracuse NY (9,600 tons/year food scraps and 48,000 cubic yards/year yard trimmings)

The available tonnage in Hamilton County would support a large-scale processing facility. However, there are options for processing that could range small to large-scale processors. Small, medium, and large processing options each have their advantages, and they can be combined. Small-scale organics processing options can be a starting point which can be added onto or expanded to increase processing capacity. Small-scale operations can be designed to work in concert with larger, large-scale facilities or as standalone operations. A large-scale facility requires more land and thus, may be more challenging to locate. A large-scale facility could provide advantages in terms of economies of scale and can provide cost effective solutions for communities. The GT Project Team evaluated four potential processing alternatives:

- One large-scale facility
- Two large-scale facilities
- Three medium-scale facilities
- Multiple small-scale community composting

To determine the solution path for processing development, the GT Project Team engaged with internal and external stakeholders and designed weighting and scoring criteria. This process identified the three, medium-scale decentralized facilities as the most appropriate for Hamilton County.

Medium-scale facilities require a smaller footprint and can complement the existing small-scale community composters in Hamilton County. Medium-scale facilities using the ASP technology can break down the same more difficult feedstocks such as meat and dairy that larger facilities can process. Additionally, medium-scale facilities can be located close to the point of organic waste material generation, can help create local collection-to-

processing loops, reduce truck traffic, and could help increase nutritional value of food grown at the community level.

This study identified a few small-scale composters with acreage that could expand if there is interest in a public/private partnership with Hamilton County.

Highlights

Medium-scale composting could be ideal for designing a phased approach. The smaller-footprint configuration could expand as the program grows and matures. If each site is designed to annually handle 18,000 tons of food scraps, yard trimmings, and supplemental materials, such as wood chips. Three medium-scale composting facilities would be able to process the modeled volume of residential and commercial organics for Hamilton County.

Feedstock receipt, pre-processing, and contaminant removal would all take place under roof to minimize formation of contact water. Other compost manufacturing activities would occur outside. The infrastructure of site office, parking, equipment maintenance, vehicle movement space, and vegetated buffer would be similar to the larger alternatives modeled.

Hamilton County should plan on a 6 to 8-acre site to accommodate storm water management, weigh scales/scale house and other associated infrastructure.

Acreage (processing only)	Acreage (including other infrastructure)
6	8

Keys to Success

Site Exploration – Conduct a property search using ArgGIS, Hamilton County's CAGIS system, and known small scale processors who expressed interest in scaling into larger operations.

Narrow Sites – Use Ohio EPA regulations and objective criteria beyond regulations to find a list of potential properties that may be suitable for food scrap composting operations. Use criteria weighting to identify at least three potential sites to further explore. Develop high-level cost range of capital and operational costs.

Site Specific Development Costs – Estimate site development, capital and operational costs, and revenue from product sales for the three potential sites.

Define County Role – Define Hamilton County's role for collection, design, and operations of the organic recovery infrastructure. The most common PPP model for developing food scrap recovery systems is some version of a service agreement. There is no standard definition of PPP, and it can accommodate a range of types of agreements between the public and private sectors.

Engage Community – Public education will play a crucial role in progressing food scrap

recovery and demonstrating the benefits that a local organics recovery facility could bring to a community. Public education lays the groundwork for an open and transparent process of siting a food scraps facility. It creates a base of educated, engaged, and supportive community members and provides a platform to receive public input.

Compost Market Assessment – No matter the arrangement for design, construction, and operation of the composting facility, Hamilton County has an opportunity to enhance the sales of the product with education and outreach to County residents and businesses, with potential policies that facilitate an internal “structural demand” for the product amongst County agencies.

CHAPTER 1 Current Landscape

Baseline

In 2022, Hamilton County ReSource reported 889,880 tons of waste disposed in total from the residential and commercial sectors.

Total Waste Landfilled in 2022

~889,880
Tons Landfilled

Residential
~ 253,865 Tons

Commercial Establishments
~ 636,015 Tons

The commercial/institutional (commercial establishments) sector landfills the greatest percentage of the waste in Hamilton County. This sector, which includes private businesses, not-for-profit organizations, institutions, and government offices, disposed approximately 71% of all waste disposed in 2022. This included an estimated 20,857 commercial establishments in Hamilton County with an approximate employment of 400,000 people[i] in 2022.

According to Hamilton County's 2024 Solid Waste Plan, food scraps represent a significant percentage of Hamilton County's overall disposed solid waste stream. Hamilton County residents and commercial establishments annually landfill an estimated 138,051 tons of food scraps. Of this amount, it is estimated that commercial establishments annually dispose of roughly 95,400 tons of food scraps, followed by approximately 42,650 tons annually landfilled by the residential sector. (See Chapter 3 for food scrap disposal projections through 2041.

Food Scraps Landfilled Annually

~138,050
Tons Landfilled

Residential
~ 42,650 Tons

Commercial Establishments
~ 95,400 Tons

A review of businesses from the U.S. EPA Excess Food Waste Map in food retail, hospitality, education facilities, restaurants, and healthcare facilities found 2,818 businesses in Hamilton County that have the potential to generate significant quantities of food scraps.

In 2022, Hamilton County communities, commercial establishments, and programs recovered 44,817 tons of yard trimmings. However, an estimated 17,500 tons of yard trimmings in Hamilton County ends up in the landfill. The 2024 Residential Waste Characterization Study found 6.9% of the landfilled material was yard trimmings (see Chapter 3).

Yard Trimmings Landfilled
~17,500
Tons

There are 14 registered Class IV (yard trimmings) composting facilities located in Hamilton County. Three landscapers, two private, and nine jurisdictions in the area have a Class IV registration for composting yard trimmings:

- Bzak Landscaping
- Evans Landscaping
- H. Hafner & Sons, Inc.
- Granny's Garden School
- NPK Compost Facility
- Amberley Village
- City of Springdale
- City of Wyoming
- Columbia Township
- Village of Fairfax
- Village of Glendale
- City of Reading
- Sycamore Township
- Village of Greenhills

Mulching operations, those that grind or shred yard trimmings to produce mulch, are not required to register with Ohio EPA. Compost operations that process yard trimmings into compost are required to register.

Landscaper operations that are registered with Ohio EPA report the yard trimmings managed. This study identifies landscaper materials composted as "other sources" (see Chapter 3 for tonnage estimates and projections).

State and Regional Food Scrap Processing

Hamilton County

Hamilton County has one permitted food scrap compost facility and several small-scale composters. The composters listed below**,** except for Findlay Market, are small-scale composters (under 500 square feet in size). Operations using less than 500 square feet at a non-residential location are not subject to Ohio's composting regulations. Each composter and its current operations are briefly described:

- **Findlay Market** is a registered Class II processing facility in Ohio. This registration was established for the purpose of composting food scraps generated at the market and consists of three sealed plastic in-vessel composting units and an area for storage of finished compost. Each unit has a capacity of three cubic yards and occupies an area of 57 square feet[ii]. The storage area is 100 square feet with a capacity of one cubic yard. This was the region's first in-vessel food scrap composting system and was supported by funding from Hamilton County ReSource and a grant from the USDA. Installed to manage commercial food scraps, it has expanded to accept residential food scraps for a subscription fee ($10/month). They are

investigating selling their own compost and may be a possible market for future “boutique” bagged compost.

Findlay Market does not have much room to expand outside of its current capacity. They are in a densely urban setting. Findlay Market is transitioning away from on-site composting to contracting with a food scrap hauler to compost food scraps off-site.

- **Civic Garden Center** is a non-profit that teaches people how to grow food and care for gardens. Through their network and mapping, they identified 60 community gardens they support. They partnered with Queen City Commons, a local food scrap collection service, to install Johnson-Su Bioreactors at Hauck Botanic Garden[iii], a 10-acre public park. They also have traditional compost bins and an in-vessel units. They could not expand much beyond small-scale community garden level composting.

  They have a residential backyard composting demonstration area and could act as an outlet for finished compost in their retail area.

- **Common Orchard Project** operates a small-scale composting site located at Camp Washington Perennial Farm. A community-based orchard development program working to establish 100+ orchards across Greater Cincinnati, Common Orchard Project is incubated by Cincinnati’s Regional Climate Collaborative, Green Umbrella. They implement a no-turn, aerated composting system in bays and Johnson-Su Reactors. At full capacity, the compost program at Camp Washington Perennial Farm can take in up to 6,000 pounds of food scraps per week, producing 600 yards per year.[iv] In 2021, the City of Cincinnati received a USDA Community Composting grant, with the goal of building infrastructure for composting food scraps at community sites across Cincinnati. The USDA grant and an Ohio EPA grant supported the beginning of this small-scale operation. In addition to the community orchard materials, food scraps collected from Queen City Commons are composted. Compost is used in community projects and bagged and sold.

  This site, although small, has a lot of potential for developing medium-scale composting. It is owned by Hamilton County and is part of the River City Correctional property. They want to apply for a Class II permit.

- **Tikkun Farm** is a nonprofit farm operating small-scale composting. Any food from the farm unable to be eaten is fed to chickens, worms, and black solider flies. Using vermiculture (worm) composting produces compost for use in soil and gardens on the farm. Soldier fly larvae consume food scraps; the larvae can be fed to the farm’s chickens, ducks, and turkeys.[v] More recently, the compost operation expanded to allow households to drop off their food scraps. With a grant from Hamilton County ReSource, Tikkun Farm was able to expand its current operation (see video) by adding equipment that enables them to accept more food scraps.

  This site has a lot of potential for medium-scale composting, although a challenge is that the farm is located in a residential area.

- **Carriage House Farms** is a working farm and event venue. They are a small-scale composter currently accepting a small volume of food scraps from Queen City Commons. It’s under 500-

square foot site consists of a turned windrow pile covered with shredded carbon feedstock.

A USDA grant in partnership with Hamilton County and Clermont County will provide funding for a concrete pad and other equipment. They want to apply for a Class II permit. The property size is more than 100 acres, with the potential for developing large-scale composting**.**

- **The Heights Movement/Jackson Street Farm**. The Heights Movement is a non-profit committed to engaging, inspiring, and empowering Lincoln Heights residents. The gardening/composting branch of The Heights Movement is Jackson Street Farms. They operate four community gardens in the Village of Lincoln Heights with a small-scale (under 500 square foot) composting operation on one of the sites.

  Jackson Street Farms partnered with Lincoln Heights Missionary Baptist to use a separate property with about 15 acres in a mostly industrial zone to build a composting site that is currently under development. Jackson Street Farms is part of the Hamilton County and Clermont County USDA grant and will receive funding and training to grow a composting site. It wants to become a Class II facility.

- **Other Community Composting.** There are several community gardens practicing composting at a small scale. Three community gardens use Johnson-Su Bioreactors: Carthage Community Garden, Walnut Hills Community Garden, and Hauck Botanic Garden.

Neighboring Clermont County has one small-scale composter.

- **Valley View Foundation** is a non-profit working farm. It currently composts in several static piles placed around the farm consisting of mostly residential leaves, residential food scraps, and a small amount of commercial food scraps. It is also part of the Hamilton County and Clermont County USDA grant to purchase equipment and expand operations. Valley View wants to be a Class II facility.

  This site also has a lot of potential for large scale composting as it sits on 190 acres.

Neighboring Counties

Hamilton County is situated in the southwest corner of Ohio and shares borders with counties in Indiana and Kentucky. Envisioning the region includes an outlook that crosses state boundaries. There are eight immediate surrounding counties, and depending on the Hamilton County geographic location, most of each neighboring county falls within a 75-mile radius.

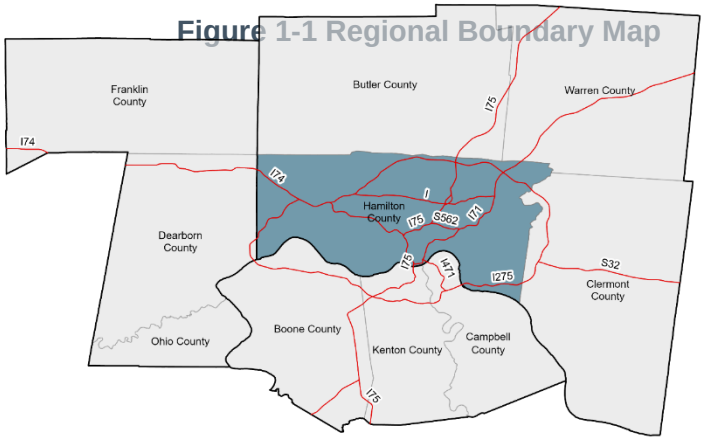


Figure 1-1 Regional Boundary Map

Surrounding counties could be a source of viable locations for food scrap processing. The highway system in Hamilton County and neighboring counties improves accessibility to a potential regional site or sites. Siting processing operations close to

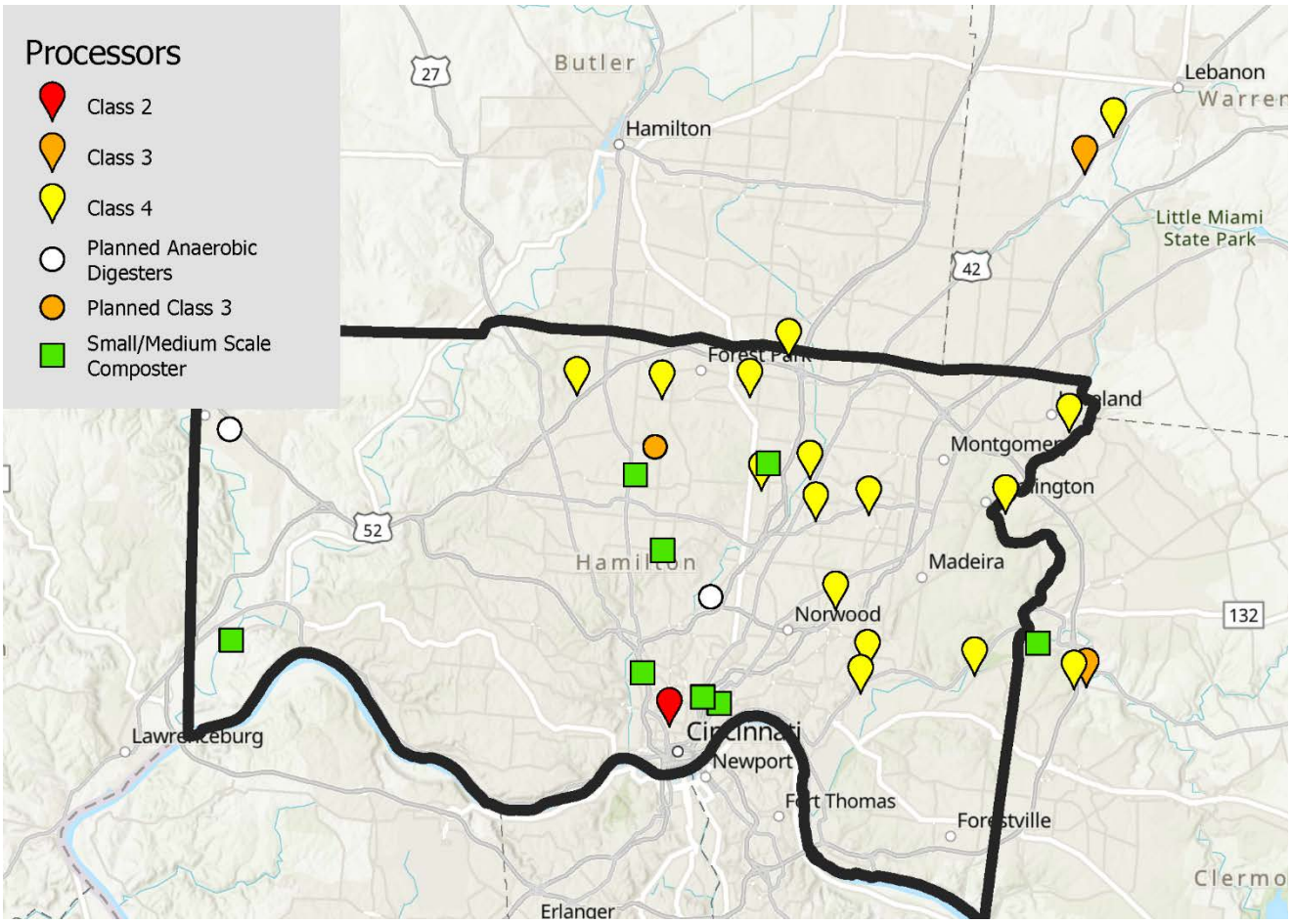
the feedstock source will minimize transportation costs for both hauling the materials and distributing finished compost. Additionally, some neighboring counties are not as urban as Hamilton County.

Expanding a wider radius beyond the neighboring counties finds additional processors that can accept food scraps but the distance to these already permitted processers is 49 miles or greater (see Appendix A Table A-1 for a list of these processors).

Neighboring Warren County has one registered Class II processor.

- **Brausch Farms** is a working farm with an area of the farm registered as a Class II processing facility in Ohio. Brausch Farms accepts yard trimmings, agricultural plant materials, and animal waste. Food scraps were accepted but odor complaints and permit violations resulted in discontinued composting of food scraps.

Figure 1-2. Organic Processing Infrastructure Map



There is a food scrap processing gap in the state and the region, which is not uncommon in the U.S. An article written and published in BioCycle in 2023, "BioCycle Nationwide Survey: Full-Scale Food Waste Composting Infrastructure in the U.S.," identified only around 200 facilities across the country that process up to 4% of the food waste generated by Americans each year.

There are a handful of small-scale composters looking to grow their facilities larger, presenting potential opportunity. Currently, these small-scale composters collectively do not provide enough capacity to divert the desired quantity of material targeted for diversion. Though, current processing infrastructure will play a role in achieving Hamilton County ReSource's goals, but additional capacity needs to come on-line.

ReSource and Hamilton County Jurisdiction Programs

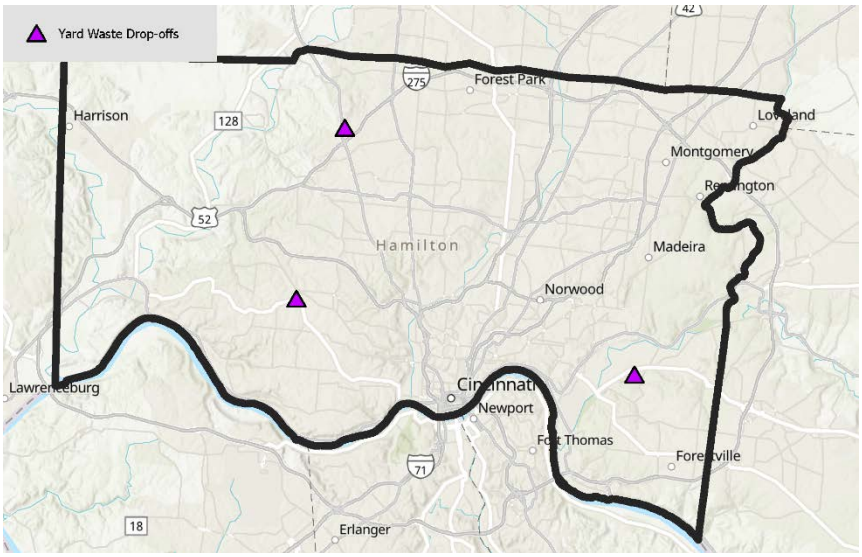
Yard Trimmings

Hamilton County ReSource purchases compost bins in bulk to offer a discounted sale price to households for backyard composting, writes a composting blog, and offers free backyard composting seminars to encourage residents to compost yard trimmings and food scraps in their backyards, and offers grant funds to offset start-up costs for communities interested in starting a yard trimmings program.

Specific yard trimming activities are at the discretion of the local political jurisdiction. As of 2023, 31 of the 48 jurisdictions in Hamilton County collect yard trimmings either seasonally or mostly year-round at the curb with only nine jurisdictions offering no program for diversion. Jurisdictions either manage the yard trimmings with their own compost or mulching operations or contract to a composter for processing. (See Appendix A, Table A-2 for a list of the yard trimming programs provided by each jurisdiction.)

65% of Jurisdictions have **Curbside** Yard Trimming Pick up

Figure 1-3 Yard Trimming Drop-Offs



Hamilton County ReSource offers an annual Yard Trimmings Drop-Off program through contracts with private partners. This service began in the early 1990s. The sites open in March and close in December, with two days in January for Christmas tree drop-off. Contractors are required to compost or mulch received materials. Weather and large storms impact drop-off site participation and tonnage. ReSource intentionally located the three drop-off sites to provide convenient access to residents in Hamilton County's northern, western, and eastern areas (see **Figure 1-3**) where residents have less access to curbside yard trimmings collection.

Food Scraps

Hamilton County ReSource has integrated food scrap diversion into several commercial programs that

provide technical assistance and supplies to Hamilton County businesses. ReSource encourages businesses to donate excess food and decrease the amount of excess food generated. Hamilton County ReSource staff provides technical assistance to help businesses implement composting of food scraps and offers waste audits at no charge to help commercial establishments recover food scraps. Hamilton County ReSource maintains a working list of commercial businesses (schools included) with compost programs or who source separates food scraps for collection and processing.

Hamilton County has many organizations that rescue edible food to feed hungry people. ReSource supports these organizations through grants and professional development opportunities.

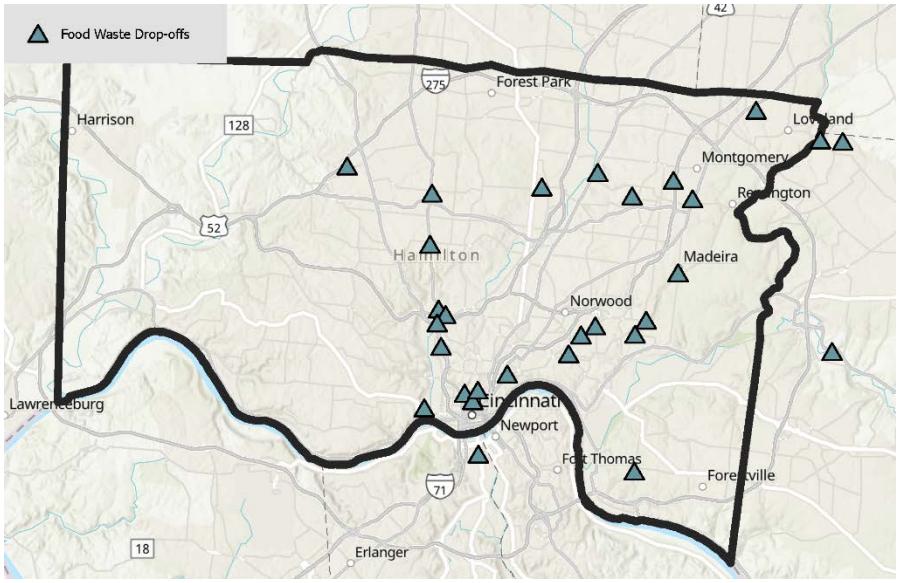
The residential Hamilton County-wide food reduction campaign, Wasted Food Stops With Us, has received national recognition.

Hamilton County ReSource conducts an annual seminar series titled “Get the Dirt on Backyard Composting” to promote residential backyard composting of yard trimmings and food scraps. Participants receive a free kitchen collector and a "Simple Guide to Composting in Your Backyard" booklet.

Food Scrap Drop-offs

ReSource promotes food scrap drop-off locations on its website. In 2023, three identified haulers/couriers offered collection of food scraps through residential drop-offs: GoZero, Queen City Commons, and CompostNow. When surveyed, not all provided customer counts leaving gaps and inability to reliably estimate the number of households and commercial businesses using curbside service. Only one indicated the drop-off sites service approximately 300 household customers.

Figure 1-4 Food Scrap Drop-Offs



Food scrap drop-offs serve as part of the collection infrastructure. There are 29 locations in Hamilton County where households may drop off food scraps. Some drop-off locations are open to the public, and others are solely for residents in a specific community to use. It varies whether the households subscribe to use the drop-off and the subscription cost.

Each food scrap drop-off site is managed by a different organization and made available by the community, business, or entity listed in **Table 1-1.**

Table 1-1 Food Scrap Drop-Off Sites

Drop-Off Site	Hauler/Courier Servicing Site
Camp Washington Perennial Farm	Common Orchard Project
Cincinnati Recycling & Reuse Hub	Queen City Commons
City of Wyoming	City of Wyoming contract with GoZero
Colerain Township	Colerain Twp contract with GoZero
College Hill – Fern	Queen City Commons
College Hill	Queen City Commons
Covington – Redden Gardens	Queen City Commons
Findlay Market	Findlay Market
Hyde Park Farmers' Market	Compost Now
Hartwell/ Wyoming – Unity Christian Church	Queen City Commons
Hyde Park – Church of the Redeemer	Queen City Commons
Lower Price Hill – Cincinnati Recycling and Reuse Hub	Queen City Commons
Mad Llama Coffee	GoZero
Madeira Farmers Market	Queen City Commons
Madeira – Redden Fine Meats and Seafood	Queen City Commons
Melink	GoZero
Mt. Auburn – Flatiron Café	Queen City Commons
Northside – Growing Trade	Queen City Commons
Northside – Lierer's Market	Queen City Commons
Northside – The Village Green	Queen City Commons
Northside Farmers Market	Queen City Commons
OTR – Northern Row Park	Queen City Commons
Rooted Juicery + Kitchen of Oakley	GoZero
Sycamore Community Schools: Blue Ash Elementary	GoZero
Sycamore Community Schools: Maple Dale Elementary	GoZero
Sycamore Community Schools: Symmes Elementary	GoZero
Trinity Lutheran Church	Tikkun Farm
Walls of Wellness	Compost Now
Walnut Hills – Taft Garden	Queen City Commons

Source: Hamilton County ReSource Food Drop-off Map
The list may not be comprehensive.

The exact flow of food scraps to the destination processor is not mapped, however, three hauler/courier providers transport food scraps from drop-off locations to composters. Active food scrap haulers include:

- **GoZero** transports material from Hamilton County to processors outside of Hamilton County. GoZero was hauling to London Correctional Institution however, the contamination was a higher level than London Correctional Institution was able to handle, and the agreement came to an end. GoZero currently hauls to Andre Farms in northern Ohio for processing.
- **CompostNow** transports materials out of Hamilton County, using GoZero as a conduit to processing.
- **Queen City Commons** transports materials to small-scale composters in Hamilton County.

On The Horizon Food Scrap Processing

The current landscape will change as two large-scale anaerobic digesters (AD) in the planning/design/construction phase will have the ability to process significant volumes of food scraps generated in Hamilton County. AD is a biological process where microorganisms break down organic materials, such as food scraps, in the absence of oxygen. AD recovers energy and nutrients, both of which have environmental and economic value. These facilities will target industrial and pre-consumer food scraps, fats, oils, and grease.

One facility is expected to be complete by end of year 2024 in Cincinnati (Synthica Energy, LLC). Synthica Energy, LLC is not currently collecting or processing organics. When the facility comes online, the developer anticipates having 190,000 tons per year of capacity of which 30,000 tons is reserved for "spot" material or not under contract[vi]. Liquid waste streams from industry is the target but a large volume of packaged food products from grocery/warehouse/refrigerated storage will be accepted. The only interested feedstock at this facility is pre-consumer materials.

Another AD facility (Divert) is planned in Harrison Township. Expected processing capacity is 100,000 tons per year[vii]. Divert will focus primarily on grocery store food scraps and will use artificial intelligence (AI) technology to help the grocery stores reduce their wasted food.

With the introduction of the Synthica and Divert AD plants, there should be sufficient capacity to process pre-consumer commercial food scraps. ReSource is monitoring the expansion of these opportunities as it continues its efforts to plan for food scrap recycling in Hamilton County.

There is a lot of potential for decentralized community food scrap composting in Hamilton County. In 2022, the Institute for Local Self-Reliance (ILSR) conducted a national census of community composters (ILSR, 2022) and found community composting operations are on the rise and can result in myriad of co-benefits such as community engagement, youth education, and local use of compost. Hamilton County now has at least five small-scale food scrap composters demonstrating these community benefits.

Throughout Hamilton County, several community gardens and parks could potentially host small-scale composting systems. In addition to this potential to add new small-scale composters, capacity at some existing facilities could increase. Hamilton County ReSource is already working with a few small-scale composters and will apply the recently received USDA grant (2024) to support medium-scale composting sites.

Expansion projects on the horizon, through the USDA grant include:

- Jackson Street Farms (Village of Lincoln Heights)
- Valley View Foundation (City of Milford)
- Carriage House Farms (Miami Township)

Processor Interest in Adding Food Scraps

Accepting food scraps can be challenging and costly, as different permits are required, new equipment

may be needed, and properties may need to be rezoned. State permitting is crucial for yard trimming processors to transition to accept food scraps. The Composting Consortium, Coker Composting & Consulting, and BioCycle analyzed current permitting requirements and costs to retrofit composting facilities to accept food scraps across all 50 states[viii]. After evaluating each of the 50 states' permitting requirements, the study found the State of Ohio to be among the more favorable for converting yard trimmings infrastructure to accept food scraps.

A number of larger yard trimming processors are located in Hamilton County and the region. To understand interest in adding food scraps to their current processing operations, the GT Project Team surveyed 37 processors in Hamilton County and the region. Registered Class II, III, and IV processors (Class III and IV do not take food scraps), small-scale, as well as anaerobic and aerobic digester businesses were contacted via an online survey and phone interviews. The goal of the survey was to ascertain if Class IV composters would be willing to add food scraps or if new or existing food scrap processors would be willing to expand. Accepting food scraps would require changing to a Class II facility.

Tables 1-2 and **1-3** show the survey results. In total, the survey returned a 45% response rate, though as shown in **Table 1-2** very few existing Class III or IV processors are interested in adding food scraps to their operation.

Table 1-2 Survey Results for Processors Interest in Adding Food Scraps

Facility Name	Compost Facility Class	Interest in Adding Food Scraps (Y/N)	Property Size	2023 Distribution Tons
Located in Hamilton County				
Amberley Village	IV	N	Unknown	400
H. Hafner & Sons Inc.	IV	N	66.5 acres	965
City of Wyoming	IV	Y	1 acre	1,272
Columbia Township Composting Facility	IV	Did Not Respond	2.4 acres	114
Village of Fairfax	IV	Did Not Respond	Unknown	0
Glendale Composting Facility	IV	Did Not Respond	10 acres	181
Village of Greenhills	IV	Did Not Respond	14 acres	75
Irvine Wood Recovery	IV	Did Not Respond	Unknown	0
NPK Composting Facility	IV	Did Not Respond	3.03 acres/ 132,000 sq ft	8,082
Reading	IV	Did Not Respond	Unknown	355

Facility Name	Compost Facility Class	Interest in Adding Food Scraps (Y/N)	Property Size	2023 Distribution Tons
City of Springdale Compost Site	IV	Did Not Respond	1 acre	221
Sycamore Township Compost	IV	Did Not Respond	Unknown	1,782
Evans Landscaping	IV	Was not Surveyed	2-3 acres	106
Great Parks Hamilton County	Applying for Class III	Did Not Respond	Unknown	Unknown
Carbon Harvest	Pilot with biochar and animal waste	Did Not Respond	Pilot Test	Unknown
Located in the Region				
Bzak Landscaping (Clermont County, Ohio)	III	Did Not Respond	2,611 sq ft	13
Bzak Landscaping (Clermont County, Ohio)	IV	Did Not Respond	17.3 acres	39,480
City of Oxford – Collins Run Compost Facility (Butler County, Ohio)	IV	Did Not Respond but reached out to relay they have 40 acres and would like to compost	Unknown	444

Source:
Survey conducted July 2023.
If the survey recipient did not provide size and capacity data and the facility is registered with Ohio EPA, permits were reviewed.
2023 Distribution tons provided by Ohio EPA.

Six respondents indicated they have the potential to expand their current or future yard trimming processing capacity. Several Class IV facilities have considerable acreage that could be ideal for a Class II facility, though only one showed interest. Responders' barriers to adding food scraps include:

- Financial costs associated with scaling up operations
- Managing odors that could result from food scrap processing
- Controlling vermin that may be attracted to organic waste
- Addressing the general "yuck" factor

Table 1-3 Survey Results for Processors to Scale Larger

Facility Name	Processor Facility Class or Type	Interest in Scaling Larger or Developing	Compost Property Size	Throughput Capacity (Per Year)
Located in Hamilton County				
Findlay Market In-Vessel	II	No capacity	147 square feet	100 tons (134 cubic yards)
Civic Garden Center	Small-scale composter	No capacity	<500 sq ft	Less than 1 ton

Facility Name	Processor Facility Class or Type	Interest in Scaling Larger or Developing	Compost Property Size	Throughput Capacity (Per Year)
CompostNow	Collection Service	Potential Public Private Partnership (PPP) but low tipping fees of solid waste present challenging economics.	Not a local processor	
Divert	Anaerobic Digester	Unable to share percent under contract. Open to reserving capacity to support Hamilton County. Not yet operational.	Unknown	100,000 tons
GoZero	Collection Service	Would be interested in local processing and being operator	Varies, uses processors around state	Varies, uses processors around state
Queen City Commons	Collection Service	No capacity	Not a processor	
SMART Center – Upland Road	Mixed-Stream MRF	Not operational in Hamilton County would like to be. Would like to accept 2,000 tons per day mixed municipal solid waste	No Facility	Not SSO
Synthica	Anaerobic Digester	Would like to take pre-consumer food scraps. Not yet operational.	Unknown	190,000 tons
The Common Orchard Project	Small-scale composter	Increasing capacity and footprint to become a Class II	500 sq ft increasing size unknown	~ 110 tons (150 cubic yards)
Jackson Street Farm	Small-scale composter	Interest in developing a compost operation and become a Class II.	500 sq ft	Did not specify
Carriage House Farm *	Small-scale composter	Increasing capacity and footprint to become a Class II	500 sq ft	Did not specify
Tikkun Farm	Small-scale composter	No indication	500 sq ft or less	~ 3 tons (4 cubic yards)
Valley View Foundation	Small-scale composter	Y	500 sq ft or less	Did not specify
Walnut Hills Redevelopment	Small-scale composter	Y	500 sq ft or less	~ 7 tons (10 cubic yards)
Located in the Region				
London Correctional Institution	II	Did Not Respond	Unknown	Unknown
Earth Peak Organics	Aerobic Digester	Y	Located in Columbus and would be interested in a local facility	

Source:
Survey conducted July 2024.
If the survey recipient did not provide size and capacity data and the facility is registered with Ohio EPA, permits were reviewed.

Some of the small-scale composters showed interest in becoming larger and seeking a Class II permit.

There is significant opportunity for growth in local processing. The survey and subsequent phone interviews highlighted interest in food scraps but also reservations. Feedback gathered from food scrap haulers/couriers showed much interest in local processing capacity for food scraps, as some are currently hauling great distances to provide service to interested clients.

Shared Thoughts of Processor Survey

Stakeholders responding to the survey expressed a strong preference for keeping food sourcing local. They emphasized the benefits of buying from regional sources instead of relying on mass shipping from across the globe. This approach not only supports local economies but also reduces the environmental impact associated with long-distance transportation. Similarly, regarding food scraps diversion, stakeholders believe that efforts should be concentrated at a smaller, regional level. They argue that large-scale facilities may be less effective or sustainable than smaller regional composting operations. This localized approach may be more manageable and better suited to community needs.

A localized approach may be more manageable and better suited to community needs

Seven stakeholders responded they had additional thoughts, ideas, or concerns to share over a virtual or phone interview. The Project Team contacted all seven directly via phone and email. Meetings varied based on each participant's thoughts and perspectives; however, a commonality among follow-up interviews was the increasing demand for food diversion. Interestingly, two interviewees brought up the legal definition of a compost operation. Both respondents reported challenges with the current definition by Ohio law. As it stands, the Ohio EPA defines any compost operation as a solid waste disposal facility. Both stakeholders dislike the current definition and would be in favor of classifying a compost operation as a resource recovery method rather than a disposal method.

Interviewees report facing challenges in getting buy-in and participating in diverting food scraps because of the definition of compost. Whether at a macro level with a municipality or even a micro level with individual participants, the term “solid waste disposal” immediately raises red flags for those unaware of the composting process. Reportedly, residents commonly express concerns about composting operations and the smell or sight of a “waste disposal facility” that prevents participation or desire to divert food scraps. Respondents believe changing the classification of waste disposal facility will help break the stigma surrounding composting and increase participation with proper education, outreach, and policy change.

There is a shared sentiment that getting this changed to more accurately reflect the nature of composting will help residents (or customers) understand a compost operation is not a landfill and increase participation in food scrap diversion programs. This legal definition also becomes a barrier for new facilities. Because of Ohio’s robust laws and regulations surrounding solid waste, there are many criteria that must be met for any solid waste facility to be sited. Given that compost facilities are labeled as solid waste disposal, the regulations prevent some facilities from expanding capacity. Those interviewed stated that regulations are necessary to protect environmental and public health. One summarized it as regulations being “the floor” rather than “the ceiling” but that the current definition, and by association regulations, make composting much more difficult than it should be.

Composting is a business, one where a company receives waste, processes it, and creates a valuable and beneficial commodity for use. It is a recycling activity that very rarely disposes of the waste it receives. There is a proven business model that has been established where companies can profit while providing a valuable landfill diversion service. One interviewee believes there is a lot of room to expand on the infrastructure within the region, but certain hurdles are in the way, chief among them being the legal definition of a compost facility and the Ohio EPA's policies regarding compost operations. This stretches into the policy realm of composting in the State of Ohio as a whole and is not something Hamilton County is realistically able to effect on a macro scale. However, it is important to be aware of these perceived challenges and through public education and awareness, help disseminate the differences between a traditional disposal facility and a compost facility to residents. One interviewee believes any financial issues in their business model are in fact broader policy and legal definition issues, pointing to the lack of potential participation stemming directly from these issues, which leads to less revenue and less ability to expand operations. This sentiment was shared between other interviewees, though not as direct.

Decentralized systems are favored

Another common theme between interviews was the favor of a "decentralized" system, where multiple smaller facilities manage the compostable materials. There is a common belief that a "democratic" system where many companies work independently towards the same goal would be the most effective method for Hamilton County. Stakeholders fear that a large Class II facility moving into Hamilton County will wipe out the existing stakeholder companies by either monopolizing the market and/or charging low tip fees that force companies to close. However, under the right conditions, responders stated they would like to see a Class II facility in the greater Cincinnati area. A Class II facility could help existing infrastructure, and companies increase their capacity and add to their acceptable materials.

30 – 50 miles

is viewed as the sweet spot for maximum distance between collection and processing

Respondents frequently cited location and regional presence as important factors in the success of food scrap diversion. A 30 to 50-mile distance is considered the sweet spot for the maximum distance between collection and processing. Interviewees agree that keeping things local is the best way to implement food scrap processing programs. One respondent described the collection process as costing money and/or resources whenever the material gets touched. Whether it's collection, transportation, or processing, the more complicated the process, the more expensive it gets and decreases the environmental benefits.

The final topic of note was the challenge of finding reliable carbon sources. Participants described this as one of the more challenging puzzle pieces to solve. For the composting process to work, both nitrogen sources (food) and carbon sources (woody materials) are needed. One participant stated that partnering with local arborists or landscaping companies to provide a carbon source is a significant opportunity to pursue in the region. Stakeholders requested that the partnership remain, regardless of the path Hamilton County takes in its efforts to recover food scraps.

The independent food scrap diversion community

highly values Hamilton County ReSource's role in supporting them

Chapter 2 Stakeholder Engagement

Hamilton County ReSource's commitment to public awareness about organics diversion is evidenced in its many outreach events, and its well-defined public messaging to reduce food waste and compost food scraps. These efforts reflect Hamilton County ReSource's acknowledgment of the public's significant role in the success of organics diversion initiatives. From these previous efforts, Hamilton County ReSource knows that community engagement must lead the way during this project.

Research demonstrates that engaging community stakeholders in early-stage planning for a public-private project not only helps minimize the risks of stopping the project before it begins but can also foster community support and buy-in. The Project Team focused on several key initiatives in this phase of the project:

- **Regional Stakeholder Engagement:** A collaborative visioning session meeting involving county/district level materials management professionals in Ohio, as well as neighboring counties in Indiana and Kentucky. Primary objectives aimed to bring together and inform stakeholders about the organics feasibility study, assess interest in collaborative solutions for organics recovery, and gather data on current local initiatives.

  Hosted by Hamilton County ReSource and facilitated by GT Environmental, a visioning session on February 26, 2024, saw participation from representatives of six counties in Ohio: Hamilton, Brown, Butler, Clermont, Montgomery, and Warren, as well as one county in Kentucky: Campbell, and the City of Covington.

  Representatives from each county/district shared information about their organization, solid waste management planning/data collection processes, existing food scrap and yard trimmings recovery programs and facilities, as well as food recovery education and outreach efforts. Representatives were led through an open-ended activity brainstorming where they want food recovery to be in the short, mid and long-term timeframes. Thoughts were captured on sticky-note honeycombs and later grouped into common themes.

- **Progressing Organics Recovery Stakeholder Engagement**: Stakeholder outreach included a pre-survey and workshop. Target audience for this informative outreach involved high interest and high influence stakeholders exploring roles in food scrap diversion. Primary objectives aimed to inform stakeholders about the study, provide an overview of public private partnerships, and obtain thoughts and ideas on progressing food scrap diversion in Hamilton County.

  A pre-survey consisting of three questions was delivered using an online tool. Questions were framed to gather ideas to build more infrastructure, challenges and/or barriers, and how stakeholders could help. The survey was followed with a virtual session on March 14, 2024, and saw participation from 30 stakeholders representing Ohio EPA, haulers and processors, interested businesses and non-profits, Hamilton County ReSource staff, political jurisdictions, and planning departments.

  Attendees heard about ongoing food scrap initiatives in Hamilton County and objectives of the

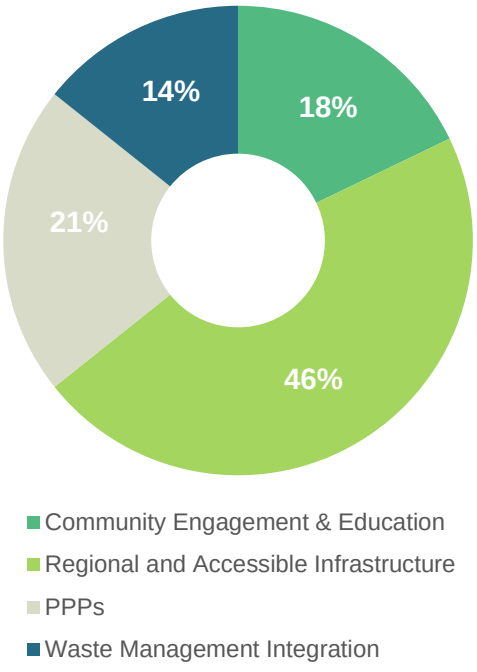
organics feasibility study, and participated in breakout rooms where ideas and feedback was gathered on where and how food scrap diversion could progress further in the region. During the stakeholder engagement, attendees identified key challenges or barriers (e.g., cost concerns, environmental friendliness), and the need for convenient and accessible composting facilities.

- **Processor Stakeholder Engagement**: Stakeholder outreach to processors in the region to understand willingness to process food scraps. The Project Team conducted an online survey and phone interviews to gather information. The efforts and results are expanded upon in Chapter 1.

Summary of Engagement

This section presents the synthesized conclusions from across the engagement sessions.

Stakeholders Vision for Southwest Ohio's Infrastructure



Regional and Accessible Infrastructure
Emphasis of a regional approach to composting infrastructure with locations across counties along with convenient facilities to boost participation from residents and businesses.

Public/Private Partnerships
Facilitating composting infrastructure development through public private partnerships and socially minded organizations.

Community Engagement and Education
Promoting composting practices through community engagement and education.

Waste Management Integration
Integrating composting facilities with existing waste management infrastructure and co-locating organics processing sites to support capacity.

~ 46% Suggest regional facilities and multiple compost sites across counties

Barriers to Envisioned Future

Community Resistance	Financial Support	Regulations & Licensing
		
Resistance from neighbors and local communities: NIMBY (Not In My Backyard), odor, public nuisance ordinances, etc.	Cost of property, funding initial construction, and ensuring long-term financial viability	Zoning and permitting restrictions, obtaining necessary licenses, and managing odor control, ensuring clean waste streams, and transportation logistics

How Can We Make This Infrastructure a Reality?

1) **Visioning and Collaboration:**
   Many respondents expressed willingness to be involved in the visioning process and collaborate on the development of composting infrastructure, even if monetary assistance wasn't feasible.

2) **Resource Provision:**
   Contributions such as providing carbon-rich material, offering land for composting facilities, and sharing data and survey results were mentioned as ways to support infrastructure development. Suggestions for utilizing existing land owned by entities like the Ohio Department of Transportation were also made.

3) **Technical Assistance and Financing Partnerships:**
   Several respondents suggested collaboration with local officials, and assistance from agencies like the Ohio EPA to facilitate the process through technical guidance, and potential funding through market development grants from organizations like Green Umbrella and the Climate Pollution Reduction Grant.

4) **Public Education**
   Engaging the community through education, public engagement sessions, sharing success stories from other regions and supporting community-based composting locations were suggested as ways to help.

5) **Policy and Partnerships**
   Advocating for supportive zoning policies and operations and partnering with other organizations was mentioned by a few respondents.

If we remove all the challenges and barriers, where do you want to be in food scrap recovery?

1) **Short Term: 1 to 5 years**
   - Increase accessibility of backyard composting
   - Rescue all food from grocers and commercial restaurants

- Expand food scrap drop-off locations throughout county
- Improve/support small-scale composting
- Engage haulers for collection
- Site and begin operations of medium scale composting facilities
- Focus and increase education efforts
- Form regionally connected networks
- Create policy

2) **Mid Term: 6 to 10 years**
   - Support and provide access to curbside collection for households
   - Advance small, decentralized processing options for food scraps
   - Enhance and expand upon existing processing infrastructure to accept food scraps
   - Introduce policy for commercial restaurants
   - Require mandatory diversion policies
3) **Long Term: 11 to 20 years**
   - Establish national/state regulation
   - Introduce organics landfill ban

Stakeholders feel there are some unique opportunities in the region to leverage existing relationships. Thoughts shared felt creating a regional coalition could help move the needle with collaboration of resources, education, planning, etc. Messaging is important to ensure constructed facilities are good neighbors and not public nuisances.

Building a resilient network and one that supports marginalized community members were ideas shared for how to progress an integrated food scrap recovery system. Stakeholders also supported decentralized composting of food scraps using current small-scale composting opportunities and backyard composting. Thoughts to uplift small scale composters and keep materials local were captured. Emphasis was also placed on developing regional and accessible infrastructure.

This study embraced these thoughts and ideas in executing each phase and task. The feasibility study lays out in this report a strategy for Hamilton County to develop food scrap processing infrastructure that addresses the thoughts and ideas from stakeholders and will propel towards Hamilton County's goals.

CHAPTER 3 SSO Feedstock

Estimating the tons of available source-separated organics (SSO) and the potential to recover them is fundamental for estimating processing facility size/footprint, site development, and landfill diversion rates. SSO is defined as food scraps and other compostables, such as paper, and BPI compostable products.

The GT Project Team modeled quantities of Hamilton County's households' SSO and five employer categories of commercial establishments' SSO that an organics recovery facility could receive from 2025 through 2041. Any developed processing facility will depend on collecting food scraps and other needed organics for feedstock. The first consideration was to estimate the amount of organic material that the system could capture, which frequently corresponds with collection convenience. For example, curbside recycling systems typically recover more materials on a per capita basis than drop-off sites. This chapter models four collection scenarios to quantify the amount of household organics that could be recovered. For the five employer categories a combination of national averages and Hamilton County-specific data was used to estimate tonnages. This base shows estimated recovery tonnage modeled in four "what if" collection scenarios. Most of the data focuses on Hamilton County with a broader look at regional data at the end of this chapter.

Background

An effective composting process requires four basic elements: nitrogen, carbon, water, and air. Nitrogen and carbon are mixed following a specific ratio to achieve the desired moisture content and then air provides oxygen to create the conditions. All these elements are used by microorganisms as food which speeds up the process of organic material decay. In the composting process, nitrogen often comes from "greens" such as grass clippings, plant cuttings, and fruit/vegetable scraps. Carbon often comes from "brown" or woody materials such as leaves, wood chips, sawdust, and even paper. Typically, a ratio of 3:1 browns to greens by volume is sufficient.

Generators often discard these materials, and they end up being landfilled. The challenge for some compost operations is not the generation of compostable materials but acquiring said materials to use as "feedstock" for the composting process. Common compostable feedstock sources are household yard trimmings, household food scraps and soiled paper, and commercial organics (such as restaurant plate scrapings and grocery store culled vegetables). Manufacturing industries can also provide feedstock, particularly food processing industries.

This study focuses on residential and commercial establishments excluding sectors such as industry and grocers sending materials to anaerobic digesters. A goal of this study was to not compete with the existing and planned private and public diversion infrastructure thus, focusing on household and select commercial establishment feedstock sources.

Residential Sector

Estimate from Landfill Stream

Wherever possible, the Project Team used quantitative data directly from Hamilton County. Hamilton County completed its most recent 2024 Solid Waste Plan in 2023 establishing 2024 as the first planning year. In the 2024 Solid Waste Plan, total waste generation is projected through 2038. These projections were used as the base for projecting waste generation growth from which the SSO stream is estimated. Projections beyond 2038 were predicted using the same rate of growth.

The estimate of how much household organics landfilled with diversion potential is based on the two-season residential waste characterization conducted in Fall 2023 and Spring 2024[ix] (2024 residential waste characterization study). The 2024 waste characterization study sorted the landfill stream into eight macro material categories, each subdivided further for a total of 52 different material categories. The "compostable" fraction of waste is estimated to be approximately 31.6%[1]. This includes yard trimmings, food scraps, brush/leaves, and compostable paper. The 31.6% compostable fraction is consistent with the 2018 Residential Waste Characterization study which found 33% compostable material. **Table 3-1** shows the aggregated seasons residential waste sort results and compostable fraction.

Table 3-1 Hamilton County Residential Aggregated Waste Audit

Material Category	Mean	Compostable
Paper	22.8%	
Corrugated Cardboard	2.9%	
Newspaper	0.2%	
Aseptic & Gable Top Cartons	0.2%	
Mixed Recyclable Paper	5.6%	
Compostable Paper	9.8%	Yes
Remainder/Composite Paper	4.1%	
Plastic	18.0%	
Metal	3.8%	
Glass	2.7%	

Material Category	Mean	Compostable
Food Waste Organics	16.8%	
Vegetative Food Waste	11.6%	Yes
Non-Vegetative Food Waste	3.9%	Yes
Other Organics	1.3%	
Yard Waste Organics	6.9%	
Grass	1.5%	Yes
Leaves	2.1%	Yes
Brush	2.0%	Yes
Wood	0.6%	
Other Yard Waste	0.7%	Yes
Electronics	2.6%	
Other	26.4%	

Applying the residential "compostable" value of materials identified in **Table 3-1** to the residential waste disposal projections estimates potential residential organics in the landfill disposal waste stream. **Table 3-2** shows the estimated SSO feedstock that could be diverted.

[1] Rounding results in a 0.3% difference in Table 3-1 from 2023 Fall and 2024 Spring Season Residential waste audit.

Table 3-2 Estimated Residential Organics in Landfill Waste

Year	Waste Landfilled (Tons)	Estimate of Yard Trimmings in Landfill Waste (Tons)	Estimate of Food Scraps in Landfilled Waste (Tons)	Estimate of Other Compostables in Landfilled Waste (Tons)
2022	253,865	17,517	42,649	24,879
2023	280,905	19,382	47,192	27,529
2024	282,310	19,479	47,428	27,666
2025	283,722	19,577	47,665	27,805
2026	285,140	19,675	47,904	27,944
2027	286,566	19,773	48,143	28,083
2028	287,999	19,872	48,384	28,224
2029	289,439	19,971	48,626	28,365
2030	290,886	20,071	48,869	28,507
2031	292,340	20,171	49,113	28,649
2032	293,802	20,272	49,359	28,793
2033	295,271	20,374	49,606	28,937
2034	296,747	20,476	49,854	29,081
2035	298,231	20,578	50,103	29,227
2036	299,722	20,681	50,353	29,373
2037	301,221	20,784	50,605	29,520
2038	302,727	20,888	50,858	29,667
2039	304,144	20,986	51,096	29,806
2040	305,665	21,091	51,352	29,955
2041	305,665	21,091	51,352	29,955

Estimate of Diverted Yard Trimmings

Programs and commercial establishments already operating will not necessarily provide readily available feedstock for any organics processing facility in Hamilton County. As identified in Chapter 1, there are several SSO small to medium-scale composters diverting food scraps. In addition, there are several yard trimmings programs as well as private businesses managing yard trimmings in Hamilton County. **Table 3-3** projects the sources of material already being diverted and estimates which feedstocks may be accessible.

Table 3-3 Projected Diverted Residential Yard Trimmings

Year	Potential Feedstock		Other Sources (Tons)	Total (Tons)
	Hamilton County ReSource Drop-off (Tons)	Community Programs (Tons)		
2022	2,269	15,854	26,694	**44,817**
2023	3,099	17,283	26,038	**46,420**
2024	3,153	17,583	26,491	**47,226**
2025	3,229	18,009	27,133	**48,371**
2026	3,299	18,399	27,720	**49,418**
2027	3,373	18,813	28,344	**50,530**
2028	3,452	19,253	29,007	**51,713**
2029	3,466	19,328	29,120	**51,913**
2030	3,479	19,403	29,233	**52,115**
2031	3,493	19,478	29,346	**52,317**
2032	3,506	19,554	29,461	**52,521**
2033	3,520	19,630	29,575	**52,725**
2034	3,534	19,707	29,691	**52,931**
2035	3,547	19,784	29,806	**53,137**
2036	3,561	19,861	29,923	**53,345**
2037	3,575	19,939	30,040	**53,554**
2038	3,589	20,017	30,158	**53,763**
2039	3,602	20,090	30,268	**53,961**
2040	3,617	20,169	30,387	**54,172**
2041	3,617	20,169	30,387	**54,172**

Note: Other Sources are reported from private businesses and landscapers. It is assumed this feedstock would not be available to provide the “brown” carbon source needed for composting.

While the projections in Table 3-3 could potentially be feedstock, Hamilton County ReSource only contracts and controls the drop-off program. Hamilton County ReSource would have to implement other steps such as contracts, competitive pricing, partnerships, etc. to secure tonnages from community programs, private businesses, and landscapers. The most recent residential waste audit found that Hamilton County residents currently landfill over 17,000 tons of yard trimmings every year. ReSource already supports communities to increase diversion of yard trimmings in Hamilton County through the Residential Recycling Incentive program.

All programs and commercial establishments combined reported diverting over 46,000 tons of yard trimmings in 2023. To project annual tonnages, the same growth rate as predicted from the 2024 Solid Waste Plan for the generation and waste disposal was applied.

Projected SSO

There are currently about 400 municipally supported residential SSO collection programs in the U.S. serving about 14.9 million households (Goldstein, 2023)[x]. Of these, 230 are curbside collection only, 139 are drop-off stations only, and 31 are a combination of both. The majority of these programs are voluntary sign-up programs although some states, like California, now mandate SSO diversion. This programmatic information was used to model potential tonnages based on various collection systems. Case studies found in Chapter 4 support the low, medium, and high participation rates modeled for each collection system.

The projected tonnages to be collected annually were calculated using these participation estimates. It is assumed that each household generates 8.7 pounds per week[xi] of SSO. This assumed value is an industry-standard that is consistent with the Project Team's research.

The Hamilton County Auditor's Office provided data on the number of single-family households in Hamilton County per political jurisdiction[xii]. Using this information, the Project Team assumed each single-family household has 2.26 persons per the U.S. Census[xiii]. The Project Team applied the growth factor found in the 2024 Solid Waste Plan to the population projections.

Estimates of future SSO diversion was prepared for several different scenarios.

- *Scenario 1 – Universal Availability Non-Subscription*

  SSO collection is available to all households. All households in a service area have access to the program but may need to request a SSO curbside container. Depending on the program, households may receive one container for SSO only or commingled with yard trimmings. Participation is not mandatory, but the jurisdiction includes the service fee on property tax or solid waste bill, thus all households pay for the program.

- *Scenario 2 – Universal Availability Contract/Franchise and Subsidized Subscription*

  Jurisdictions contract with a single hauler or award franchises to multiple haulers to provide service to households. Similar to Scenario 1, all households have access and there may be one or two containment systems. Households pay the hauler directly for collection. However, jurisdictions subsidize the cost of generators participating through paying fees to the contractor or franchisee.

- *Scenario 3 – Universal Availability Subscription*

  SSO collection is available to households, and they can opt-in to receive a curbside container. The homeowner participating directly pays for the collection service. Unless the jurisdiction adopts a policy, haulers would not be required to provide this service.

- *Scenario 4 – Drop-Offs*

  This collection model represents participation levels at drop-off locations for SSO. Residents may have 24/7 access to the stations throughout the year. In this scenario, it is assumed that users must register to be able to use these sites.

The quantities of food scraps projected to be available for each scenario modeled are shown below in

Tables 3-4 through **3-7**.

Table 3-4 Projected Residential Quantities of SSO – Scenario 1

	Universal Availability Non-Subscription		
Year	**Low (Tons)**	**Medium (Tons)**	**High (Tons)**
Percent of Households Participating	**5%**	**20%**	**35%**
2025	2,440	9,759	17,078
2026	2,452	9,807	17,163
2027	2,464	9,856	17,249
2028	2,476	9,906	17,335
2029	2,489	9,955	17,422
2030	2,501	10,005	17,509
2031	2,514	10,055	17,596
2032	2,526	10,105	17,684
2033	2,539	10,156	17,773
2034	2,552	10,207	17,862
2035	2,564	10,258	17,951
2036	2,577	10,309	18,041
2037	2,590	10,360	18,131
2038	2,603	10,412	18,221
2039	2,616	10,464	18,313
2040	2,629	10,517	18,404
2041	2,642	10,569	18,496

Table 3-5 Projected Residential Quantities of SSO – Scenario 2

	Universal Availability Franchise / Subsidized Subscription		
Year	**Low (Tons)**	**Medium (Tons)**	**High (Tons)**
Percent of Households Participating	**15%**	**30%**	**45%**
2025	7,319	14,638	21,957
2026	7,356	14,711	22,067
2027	7,392	14,785	22,177
2028	7,429	14,859	22,288
2029	7,466	14,933	22,399
2030	7,504	15,008	22,511
2031	7,541	15,083	22,624
2032	7,579	15,158	22,737
2033	7,617	15,234	22,851
2034	7,655	15,310	22,965

	Universal Availability Franchise / Subsidized Subscription		
Year	Low (Tons)	Medium (Tons)	High (Tons)
2035	7,693	15,386	23,080
2036	7,732	15,463	23,195
2037	7,770	15,541	23,311
2038	7,809	15,618	23,428
2039	7,848	15,697	23,545
2040	7,887	15,775	23,662
2041	7,927	15,854	23,781

Table 3-6 Projected Residential Quantities of SSO – Scenario 3

	Universal Availability Subscription		
Year	Low (Tons)	Medium (Tons)	High (Tons)
Percent of Households Participating	1%	10%	20%
2025	488	4,879	9,759
2026	490	4,904	9,807
2027	493	4,928	9,856
2028	495	4,953	9,906
2029	498	4,978	9,955
2030	500	5,003	10,005
2031	503	5,028	10,055
2032	505	5,053	10,105
2033	508	5,078	10,156
2034	510	5,103	10,207
2035	513	5,129	10,258
2036	515	5,154	10,309
2037	518	5,180	10,360
2038	521	5,206	10,412
2039	523	5,232	10,464
2040	526	5,258	10,517
2041	528	5,285	10,569

Table 3-7 Projected Residential Quantities of SSO – Drop-Offs

	Food Scrap Drop-Offs		
Year	Low (Tons)	Medium (Tons)	High (Tons)
Percent of Households Participating	1%	3%	5%
2025	488	1,464	2,440
2026	490	1,471	2,452
2027	493	1,478	2,464
2028	495	1,486	2,476
2029	498	1,493	2,489
2030	500	1,501	2,501
2031	503	1,508	2,514
2032	505	1,516	2,526
2033	508	1,523	2,539
2034	510	1,531	2,552
2035	513	1,539	2,564
2036	515	1,546	2,577
2037	518	1,554	2,590
2038	521	1,562	2,603
2039	523	1,570	2,616
2040	526	1,577	2,629
2041	528	1,585	2,642

Notes:
All projected tonnage growth is based on the waste disposal calculations and its expected growth rate in the 2024 Solid Waste Plan. It is assumed that each household disposes of 8.7 pounds per week of SSO.
All projected household growth is based on the population calculations and the expected growth rate in the 2024 Solid Waste Plan Update. It is assumed per the U.S. Census there are 2.26 persons per single-family household.

Commercial Sector

Estimate from Landfill Stream

The estimate of food scraps and compostable paper landfilled with diversion potential in the commercial stream is based on the values estimated in the 2024 Solid Waste Plan. Projections of landfill tonnage growth were used as the base for projecting the growth of the commercial establishment food scraps and compostable paper stream. The 2024 Solid Waste Plan also stated commercial “compostable” in the stream comprises food scraps (15%) and compostable paper (8%). No estimates of yard trimmings sourced from the commercial sector were estimated in the landfill stream. **Table 3-8** shows the estimated commercial food scraps and compostable paper in the landfill stream for potential diversion.

Table 3-8 Estimated Commercial SSO in Landfill Waste

Year	Waste Landfilled (Tons)	Estimate of Food Scraps in Landfilled Waste (Tons)	Estimate of Compostable Paper in Landfilled Waste (Tons)
2022	636,015	95,402	50,881
2023	654,104	98,116	52,328
2024	657,375	98,606	52,590
2025	660,661	99,099	52,853
2026	663,965	99,595	53,117
2027	667,285	100,093	53,383
2028	670,621	100,593	53,650
2029	673,974	101,096	53,918
2030	677,344	101,602	54,188
2031	680,731	102,110	54,458
2032	684,134	102,620	54,731
2033	687,555	103,133	55,004
2034	690,993	103,649	55,279
2035	694,448	104,167	55,556
2036	697,920	104,688	55,834
2037	701,410	105,211	56,113
2038	704,917	105,738	56,393
2039	708,217	106,233	56,657
2040	711,758	106,764	56,941
2041	711,758	106,764	56,941

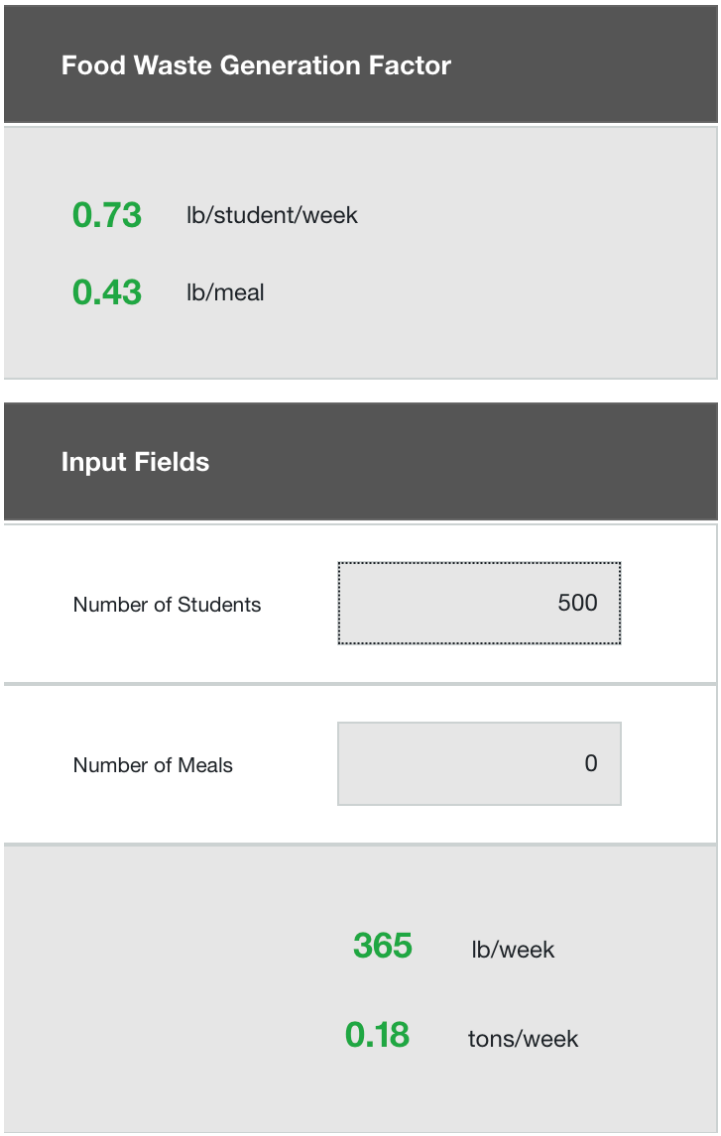
Concurrent to this study, Hamilton County ReSource is conducting a different study on commercial waste characterization involving a desktop analysis of existing commercial waste characterizations followed by sorts at targeted organics-heavy sectors. That study and data results were not completed for use in this report, thus generation was estimated using New York State Pollution Prevention Institute and the Rochester Institute of Technology Food Waste Estimator Tool. The participation was refined with anecdotal information gathered from targeted Hamilton County commercial business interviews and audits.

Collaborating with Hamilton County ReSource to complement its other commercial waste characterization study, five employer categories with the most potential to participate in an organics recovery program were selected.

- Education
- Hospitality
- Healthcare
- Restaurant

- Food retail

Figure 3-1 Food Waste Estimator Tool



The New York State Pollution Prevention Institute and the Rochester Institute of Technology[xiv] Food Waste Estimator Tool provides estimates for a variety of specific commercial establishment generators including colleges, primary schools, restaurants, hospitals, and more. Each generator category includes a food waste generation factor with an estimated amount of food waste generated in pounds. The tool provides estimates based on a pounds per unit basis, with varying units for respective sources. Units include students, employees, and beds depending on the type of commercial establishment source. To use the tool for Hamilton County, research was gathered from various sources to identify the number of each type of business and employee, student and / or bed count in Hamilton County.

Education

The Ohio Department of Education (DOE) was consulted for available data on public and private schools located in Hamilton County. The project team utilized the DOE's database to determine the number of schools and enrollment numbers for each school district, public and private, located in Hamilton County. Data is representative of the 2023 – 2024 school year. For all Pre-K through 12th grade school data, the following assumptions were made:

- Early childhood schools: pre-K – 2,
- Elementary grades: 3 – 6
- Middle schools grade: 7 – 8
- High school: grades: 9 – 12

The early childhood schools were excluded from the Educational Institutions model due to there being no available food waste estimates from the Food Waste Estimator tool. For all higher education schools, the Project Team worked with the Ohio Department of Higher Education for publicly available data on enrollments for public higher education. For private higher education, desktop research was conducted for enrollment numbers.

Once enrollment numbers were determined, enrollment was multiplied by the generation factor from the Food Waste Estimator tool to determine the pounds per student per week which was the identified unit. This number was then converted to tons per year for each educational subsect.

Sample Calculation:
Elementary School Annual Tons = ((# of students * generation factor) * # of school weeks) / 2,000
4,118 = (40,478 * 1.13 lbs/elementary student/week) * 36) / 2,000

Healthcare

For healthcare facilities, the Project Team contacted the Ohio Department of Health (DOH). Using DOH's database, the number of beds in each targeted healthcare facility type was determined. These included hospitals, nursing homes, assisted living facilities, and retirement communities. Where missing, internet research was used to supplement this dataset.

Once the licensed beds and the total number of facilities were quantified, the Project Team multiplied this information by the generation factor from the Food Waste Estimator tool, then multiplied by the total beds per facility to determine the pounds per bed generated per week. This number was then converted to tons per year for each healthcare subsect.

Sample Calculation:
Hospital Annual Tons = ((# of beds * generation factor) * # of weeks) / 2,000
3,109 = (4,995 * 23.94 lbs/bed/week) * 52) / 2,000

Food Retail Locations and Restaurants

The Project Team worked with the Ohio Department of Jobs & Family Service to determine the number of establishments and average employment numbers per relevant NAICS code for all food retail and restaurants located in Hamilton County. Once employees and the total number of establishments were determined, this was multiplied by the generation factor from the Food Waste Estimator tool, then multiplied by total employees to determine the pounds per employee generated per week. This number was then converted to tons per year for each food subsect.

Sample Calculation:
Grocery Store Annual Tons = ((# of employees * generation factor) * # of weeks) / 2,000
10,807 = (7,205 * 57.69 lbs/employee/week) * 52) / 2,000

Hospitality Locations

The Project Team worked with the Ohio Department of Jobs & Family Service to determine the number of establishments and average employment numbers for accommodations located in Hamilton County. Once employees and the total number of facilities were determined, this was multiplied by the generation factor from the Food Waste Estimator tool, then multiplied by the total employees to determine the pounds per employee generated per week. This number was then converted to tons per year.

Sample Calculation:
Hospitality Annual Tons = ((# of employees * generation factor) * # of weeks) / 2,000
2,528 = (2,250* 38.13 lbs/employee/week) * 52) / 2,000

Using the Food Waste Estimator Tool and the data gathered specifically for Hamilton County, the Project

Team estimated the amount of organics generated in the commercial sector for the five generator categories. **Table 3-9** below presents the number of establishments and the estimated tons per year.

Table 3-9 Commercial Feedstock Projections

Commercial Feedstock Source Category - Commercial Establishments			
Establishment Type	**# of Establishments**	**Tons/Year**	**Tons/Establishment/Year**
Educational Institutes	411	4,118	10
Healthcare Facilities	94	5,603	60
Restaurants	1655	49,940	30
Food Retail Locations	551	44,504	81
Hospitality Locations	107	2,528	24
Total	**2,818**	**106,693**	**38**

Commercial Projections

If a business or institution wishes to divert SSO, it must independently contract with a private service provider to do so. To determine how many commercial businesses in each sector would participate, businesses and institutions were interviewed from:

- Nursing homes
- Entertainment venues
- Wholesale produce/restaurant suppliers
- Schools/churches
- Landscapers/nurseries

The Project Team worked with Hamilton County ReSource to develop this subset of the five employer categories. Based on interviews, the assessment of the opportunity to capture is as follows.

- **Nursing Homes** – The five nursing homes in Hamilton County with the largest number of beds were contacted. Preliminary thoughts felt these facilities might prepare food on-site and have dedicated kitchen and custodial managers. After speaking with these staff, there appeared to be a general perspective that it would be challenging to establish a SSO program due to the constant challenge to retain, hire, and train staff and employees aren't willing to do anything beyond their basic job description.

- **Entertainment Venues** – The Project Team called private and university arenas, music/wedding venues, and the two casinos. The only entity that returned calls was the university arena and they are highly interested in diverting food scraps. Based on previous projects, most of the food served is prepared by off-site contractors.

- **Wholesale Produce/Restaurant Suppliers** – The Project Team spoke with entities, such as Sysco, to assess their desire to establish a food scrap recovery system. Respondents said they generate very little food scraps as that would decrease their profits. One said they are a “box in/box out” establishment where they receive large quantities of food from national suppliers, such as Tyson. Then they break it down and distribute the food to their customers. If something is damaged but still edible, they donate it to the foodbank.

- **Schools/Churches** – The Project Team contacted schools with churches thinking they might host weddings and events in addition to serving student lunches. While the schools/churches do have event venues, they do not cater the food unless it is something like an internal spaghetti dinner. The individuals who rent the space outsource catering. Concerning lunches, schools are moving toward a heat and serve model where they contract with a private company for meal preparation. Of those contacted, one company said they generate very little food scraps because food quantities are based on the number of students in the school. From the school perspective they don’t want to pay for more meals than they serve. The school will notify the company if they know a large number of students will be absent because of activities, such as field trips, to reduce the meal count.

- **Landscapers/Nurseries** – These establishments don’t produce food scraps, but could be a source of yard trimmings and a potential compost off-taker. The larger ones, especially the ones that grow their own plants, compost on their property. The stores that are smaller and strictly retail could be a possible source of green material and compost end users, depending on the proximity of the compost facility and price.

The interviews and audits determined the willingness to participate and potential capture rate of organics for each commercial business type identified.

The food scrap estimator tool was used to project food scraps generated. While it does not include compostable paper, the estimator provides a basis for potential generation of food scraps. Without a commercial waste characterization study, it would be a guess as to the generation of compostable paper for the targeted businesses. The commercial food scraps estimated, and potential capture provide a conservative estimate for projecting diversion and was used for calculating projected diversion tonnages.

The quantities of food scraps projected to be available for each commercial business type explored are shown below in **Tables 3-10** and **3-11.**

Table 3-10 Projected Commercial Quantities of Food Scraps

	Food Scraps				
Year	Education (Tons)	Hospitality (Tons)	HealthCare (Tons)	Restaurant (Tons)	Food Retail (Tons)
Baseline (2023)	4,118	2,528	5,603	49,940	44,504
2025	4,494	2,759	6,114	54,497	48,565
2026	4,697	2,884	6,392	56,968	50,767
2027	4,916	3,018	6,688	59,613	53,124
2028	5,150	3,161	7,007	62,449	55,652
2029	5,162	3,169	7,024	62,603	55,789
2030	5,175	3,177	7,041	62,757	55,926
2031	5,188	3,185	7,059	62,913	56,065
2032	5,201	3,193	7,076	63,069	56,204
2033	5,214	3,201	7,094	63,226	56,343
2034	5,227	3,208	7,111	63,383	56,484
2035	5,240	3,217	7,129	63,541	56,625
2036	5,253	3,225	7,147	63,701	56,767
2037	5,266	3,233	7,165	63,861	56,909
2038	5,279	3,241	7,183	64,021	57,053
2039	5,292	3,248	7,200	64,173	57,187
2040	5,305	3,257	7,218	64,335	57,332
2041	5,305	3,257	7,218	64,335	57,332

Note: Projected tonnage growth is based on the waste disposal calculations and its expected growth rate in the Hamilton County Solid Waste Management Plan Update.

Table 3-11 Projected Capture for Commercial Quantities of Food Scraps

	Food Scraps				
Year	Education (Tons)	Hospitality (Tons)	HealthCare (Tons)	Restaurant (Tons)	Food Retail (Tons)
Capture Rate	5%	15%	1%	20%	20%
Baseline (2023)	225	414	61	10,899	9,713
2025	235	433	64	11,394	10,153
2026	246	453	67	11,923	10,625
2027	257	474	70	12,490	11,130
2028	258	475	70	12,521	11,158
2029	259	477	70	12,551	11,185
2030	259	478	71	12,583	11,213
2031	260	479	71	12,614	11,241
2032	261	480	71	12,645	11,269

	Food Scraps				
Year	Education (Tons)	Hospitality (Tons)	HealthCare (Tons)	Restaurant (Tons)	Food Retail (Tons)
2033	261	481	71	12,677	11,297
2034	262	482	71	12,708	11,325
2035	263	484	71	12,740	11,353
2036	263	485	72	12,772	11,382
2037	264	486	72	12,804	11,411
2038	265	487	72	12,835	11,437
2039	265	489	72	12,867	11,466
2040	265	489	72	12,867	11,466
2041	225	414	61	10,899	9,713

Note: Projected tonnage was calculated by applying the capture rate assumption to the tonnage numbers above in Table 3-10.

Combined Projections

Tables 3-12 through **3-14** below present the combined projections detailed above for the residential and commercial sectors and includes the estimate of yard trimmings expected to be diverted through the Hamilton County ReSource drop-off sites and community yard trimming programs. Yard trimmings from other sources (businesses/landscapers) were excluded. The private sector is managing that material and is assumed to continue. For SSO recovery the medium estimate is used.

Table 3-12 Projected Combined Quantities of SSO – Scenario 1 Medium

	Universal Availability Non-Subscription + Commercial				
Year	Residential (Tons)	Commercial (Tons)	ReSource Drop-off Yard Trimmings (Tons)	Community Yard Trimmings (Tons)	TOTAL (Tons)
2025	9,759	21,312	3,229	18,009	52,309
2026	9,807	22,278	3,299	18,399	53,784
2027	9,856	23,313	3,373	18,813	55,355
2028	9,906	24,422	3,452	19,253	57,033
2029	9,955	24,482	3,466	19,328	57,231
2030	10,005	24,542	3,479	19,403	57,429
2031	10,055	24,603	3,493	19,478	57,629
2032	10,105	24,664	3,506	19,554	57,830
2033	10,156	24,725	3,520	19,630	58,031
2034	10,207	24,787	3,534	19,707	58,234
2035	10,258	24,849	3,547	19,784	58,438
2036	10,309	24,911	3,561	19,861	58,642
2037	10,360	24,974	3,575	19,939	58,848
2038	10,412	25,037	3,589	20,017	59,055
2039	10,464	25,096	3,602	20,090	59,253

	Universal Availability Non-Subscription + Commercial				
Year	Residential (Tons)	Commercial (Tons)	ReSource Drop-off Yard Trimmings (Tons)	Community Yard Trimmings (Tons)	TOTAL (Tons)
2040	10,517	25,159	3,617	20,169	59,461
2041	10,569	25,159	3,617	20,169	59,514

Table 3-13 Projected Combined Quantities of SSO – Scenario 2 Medium

	Universal Availability Franchise / Subsidized Subscription + Commercial				
Year	Residential (Tons)	Commercial (Tons)	ReSource Drop-off Yard Trimmings (Tons)	Community Yard Trimmings (Tons)	TOTAL (Tons)
2025	14,638	21,312	3,229	18,009	57,188
2026	14,711	22,278	3,299	18,399	58,687
2027	14,785	23,313	3,373	18,813	60,283
2028	14,859	24,422	3,452	19,253	61,986
2029	14,933	24,482	3,466	19,328	62,208
2030	15,008	24,542	3,479	19,403	62,432
2031	15,083	24,603	3,493	19,478	62,657
2032	15,158	24,664	3,506	19,554	62,882
2033	15,234	24,725	3,520	19,630	63,109
2034	15,310	24,787	3,534	19,707	63,337
2035	15,386	24,849	3,547	19,784	63,567
2036	15,463	24,911	3,561	19,861	63,797
2037	15,541	24,974	3,575	19,939	64,028
2038	15,618	25,037	3,589	20,017	64,261
2039	15,697	25,096	3,602	20,090	64,485
2040	15,775	25,159	3,617	20,169	64,720
2041	15,854	25,159	3,617	20,169	64,799

Table 3-14 Projected Combined Quantities of SSO – Scenario 3 Medium

	Universal Availability Subscription + Commercial				
Year	Residential (Tons)	Commercial (Tons)	ReSource Drop-off Yard Trimmings (Tons)	Community Yard Trimmings (Tons)	TOTAL (Tons)
2025	4,879	21,312	3,229	18,009	47,430
2026	4,904	22,278	3,299	18,399	48,880
2027	4,928	23,313	3,373	18,813	50,427
2028	4,953	24,422	3,452	19,253	52,080
2029	4,978	24,482	3,466	19,328	52,253

	Universal Availability Subscription + Commercial				
Year	Residential (Tons)	Commercial (Tons)	ReSource Drop-off Yard Trimmings (Tons)	Community Yard Trimmings (Tons)	TOTAL (Tons)
2030	5,003	24,542	3,479	19,403	52,427
2031	5,028	24,603	3,493	19,478	52,602
2032	5,053	24,664	3,506	19,554	52,777
2033	5,078	24,725	3,520	19,630	52,953
2034	5,103	24,787	3,534	19,707	53,131
2035	5,129	24,849	3,547	19,784	53,309
2036	5,154	24,911	3,561	19,861	53,488
2037	5,180	24,974	3,575	19,939	53,668
2038	5,206	25,037	3,589	20,017	53,849
2039	5,232	25,096	3,602	20,090	54,020
2040	5,258	25,159	3,617	20,169	54,203
2041	5,285	25,159	3,617	20,169	54,229

Table 3-15 Projected Combined Quantities of SSO – Scenario 4 Drop-Off Medium

	Food Scrap Drop-off Sites		
Year	Drop-off Sites (Tons)	ReSource Drop-off Yard Trimmings (Tons)	TOTAL (Tons)
2025	1,464	3,229	4,693
2026	1,471	3,299	4,770
2027	1,478	3,373	4,852
2028	1,486	3,452	4,938
2029	1,493	3,466	4,959
2030	1,501	3,479	4,980
2031	1,508	3,493	5,001
2032	1,516	3,506	5,022
2033	1,523	3,520	5,043
2034	1,531	3,534	5,065
2035	1,539	3,547	5,086
2036	1,546	3,561	5,108
2037	1,554	3,575	5,129
2038	1,562	3,589	5,151
2039	1,570	3,602	5,172
2040	1,577	3,617	5,194
2041	1,585	3,617	5,202

Note: Scenario 4 does not add commercial estimates to the combined projections because any food scraps drop-off station would not be open to commercial businesses in Hamilton County.

Note: All projected tonnage growth is based on the waste disposal calculations and its expected growth rate in the Hamilton County Solid Waste Management Plan Update. It is assumed that each household disposes of 8.7 lbs. per week of SSO.

Note: All projected household growth is based on the population calculations and the expected growth rate in the Hamilton County Solid Waste Management Plan Update. It is assumed per the U.S. Census there are 2.26 persons per household.

Hamilton County expects to dispose of nearly 1 million tons of residential/commercial solid waste annually from 2025 – 2041. Using the data from the 2024 residential waste characterization study and the 2024 Solid Waste Plan for commercial disposal composition, roughly 32% of all residential waste landfilled is compostable and roughly 23% of all commercial waste landfilled is compostable. This means that on average, about 230,000 tons of compostable waste will be landfilled each year through 2041.

Hamilton County set an aspirational goal to increase residential diversion from 18% to 27% and commercial diversion from 43% to 50%. As shown in **Figure 3-2**, if Hamilton County achieves the modeled diversion of food scraps in Scenario 2 the 27% residential aspirational diversion goal is almost reached by year 2028. **Figure 3-3** shows the commercial aspirational diversion goal of 50% will be reached by 2027. Both gap projections assume the 2024 Solid Waste Plan diversion projections are achieved. If not, then the gap to reach the 27% residential and 50% commercial diversion goals becomes greater.

Figure 3-2 Residential Aspirational Goal Gap Projection

As shown in the projections, quantities projected to be captured for recycling from households are heavily dependent on collection and the number of participating households. It is recommended Hamilton County ReSource consider facilitating collection of SSO through grants, franchises, contracts, etc. With a strong collection program, Hamilton County ReSource can expect a food scrap capture rate will ramp up over time. Likewise, the quantities from businesses are dependent on the number of participating businesses and potential capture rate.

Figure 3-3 Commercial Aspirational Goal Gap Projection

Regional Outlook

Regional SSO data is sparse. The permitted facilities in Ohio report SSO and yard trimming diversion however, residential and commercial sources are combined. Indiana and Kentucky data was not readily available on a county-specific basis. Without a good base, the best approach was to estimate a multiplier assuming Hamilton County participation estimates. An approach used here estimated a multiplier for the region and applied the multiplier to the projected diversion tonnages for Hamilton County. **Table 3-16** shows the population for each regional county and the calculated multiplier. Hamilton County's population is roughly 65% of the region's population.

Table 3-16 Regional Population

County	State	Population
Butler	Ohio	390,357
Clermont	Ohio	242,337
Warren	Ohio	208,601
Franklin	Indiana	23,096
Dearborn	Indiana	51,215
Ohio	Indiana	6,004
Campbell	Kentucky	93,702
Kenton	Kentucky	171,321
Boone	Kentucky	140,496
TOTAL		1,327,129

Source: US Census 2023 estimate

County	State	Population
Hamilton	Ohio	860,639

Ratio of Regional Population to Hamilton County	1.5

Tables 3-17 through 3-20 exclude Hamilton County data.

Table 3-17 Regional Projected Residential Quantities of SSO – Scenario 1

Universal Availability Non-Subscription	% of HHs	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
LOW	5%	3,762	3,781	3,800	3,819	3,838	3,857	3,876	3,896	3,915	3,935	3,954	3,974	3,994	4,014	4,034	4,054	4,075
MEDIUM	20%	15,048	15,123	15,199	15,275	15,351	15,428	15,505	15,583	15,661	15,739	15,818	15,897	15,976	16,056	16,136	16,217	16,298
HIGH	35%	26,334	26,466	26,598	26,731	26,865	26,999	27,134	27,270	27,406	27,543	27,681	27,819	27,958	28,098	28,239	28,380	28,522

Table 3-18 Regional Projected Residential Quantities of SSO – Scenario 2

Universal Availability Franchise / Subsidized Subscription	% of HHs	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
LOW	15%	11,286	11,342	11,399	11,456	11,513	11,571	11,629	11,687	11,745	11,804	11,863	11,922	11,982	12,042	12,102	12,163	12,224
MEDIUM	30%	22,572	22,685	22,798	22,912	23,027	23,142	23,258	23,374	23,491	23,608	23,726	23,845	23,964	24,084	24,204	24,325	24,447
HIGH	45%	33,858	34,027	34,197	34,368	34,540	34,713	34,887	35,061	35,236	35,412	35,590	35,767	35,946	36,126	36,307	36,488	36,671

Table 3-19 Regional Projected Residential Quantities of SSO – Scenario 3

Universal Availability Subscription	% of HHs	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
LOW	1%	752	756	760	764	768	771	775	779	783	787	791	795	799	803	807	811	815
MEDIUM	10%	7,524	7,562	7,599	7,637	7,676	7,714	7,753	7,791	7,830	7,869	7,909	7,948	7,988	8,028	8,068	8,108	8,149
HIGH	20%	15,048	15,123	15,199	15,275	15,351	15,428	15,505	15,583	15,661	15,739	15,818	15,897	15,976	16,056	16,136	16,217	16,298

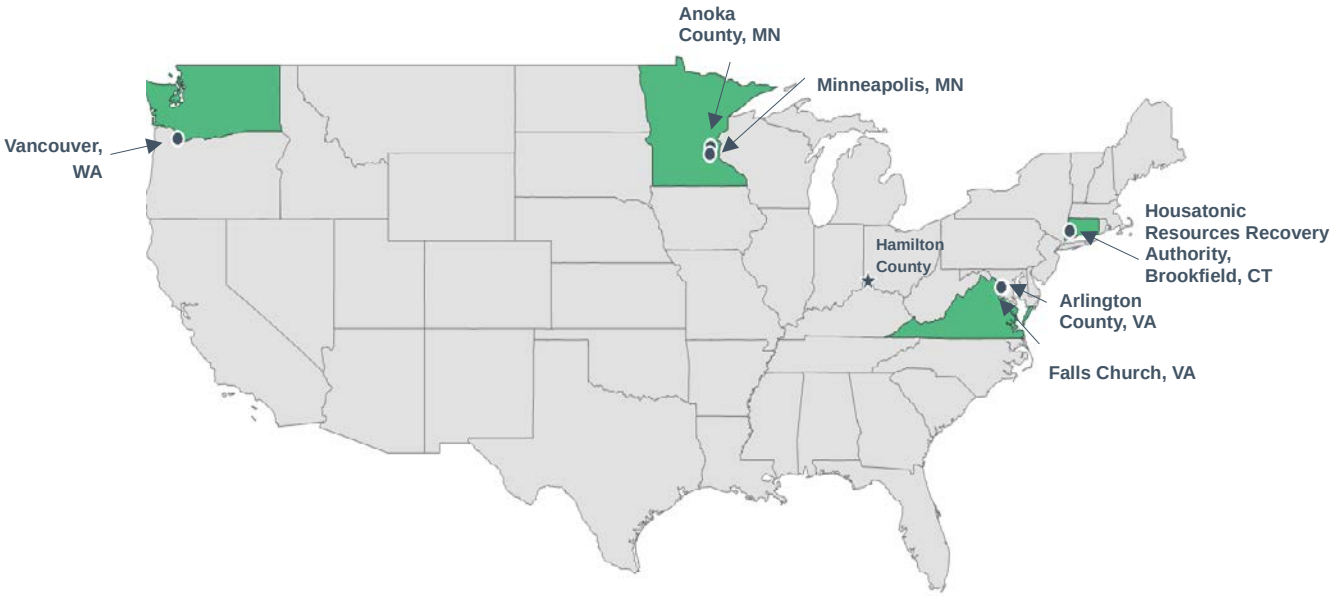
Table 3-20 Regional Projected Residential Quantities of SSO – Scenario 4 Drop-Offs

Food Scrap Drop-Offs	% of HHs	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
LOW	1%	752	756	760	764	768	771	775	779	783	787	791	795	799	803	807	811	815
MEDIUM	3%	2,257	2,268	2,280	2,291	2,303	2,314	2,326	2,337	2,349	2,361	2,373	2,384	2,396	2,408	2,420	2,433	2,445
HIGH	5%	3,762	3,781	3,800	3,819	3,838	3,857	3,876	3,896	3,915	3,935	3,954	3,974	3,994	4,014	4,034	4,054	4,075

CHAPTER 4 Case Studies Key Findings

As part of this feasibility study, the GT Project Team collaborated with Hamilton County to select six organics recovery systems as case studies to serve as models for surrounding communities looking to implement food scrap collection programs for their residents. The selected locations include low, medium, and high-functioning diversion estimates and have established systems with multiple years of data and performance metrics. The case studies demonstrate residential curbside and drop-off food scrap collection programs in the following communities:

1. Arlington County, Virginia
2. Falls Church, Virginia
3. Minneapolis, Minnesota
4. Vancouver, Washington
5. Anoka County, Minnesota
6. Housatonic Resources Recovery Authority (HRRA) in Brookfield, CT



Two communities surveyed offer both drop-off locations and curbside collection services as part of their organics' programs: Minneapolis, MN and Falls Church, VA. The remaining four communities either provide drop-off locations or curbside collection.

The GT Project Team interviewed program operators to obtain data on financials, collection infrastructure, accepted materials, household participation, education/outreach programs, enforcement, and organics capture rate. The interviewees were asked conversation-style and open-ended questions about their food scrap programs' key learnings and challenges. These structured interviews allowed for participants to communicate extended meanings or interpretations about particular aspects of their programs.

This chapter contains a summary of the findings and key diversion sensitivity takeaways. Appendix B provides the full descriptions of the case studies.

Curbside Food Scrap Collection

The GT Project Team benchmarked two types of curbside program structures.

1. **Universal Availability Non-Subscription**

   Food scrap collection is available to all households eligible for municipal solid waste collection service. This is typically single-family households and, in some cases, dwellings with up to a specified number of units. Households in the service area receive a food scrap only cart or commingled food scrap and yard trimmings cart. Participation is not mandatory, but jurisdiction includes the service fee on property tax or solid waste bill, thus all households pay for the program.

2. **Universal Availability Franchise/Subsidized Subscription**

   Food scrap collection is available to all households eligible for municipal solid waste collection service. This is typically single-family households and, in some cases, dwellings with up to a specified number of units. Jurisdictions contract with a hauler to provide service to households. Households request service and pay the hauler directly for food scrap collection. The government awards franchise agreements and subsidizes the cost of households participating.

Current food scrap collection taking place in Hamilton County is a subscription-based model where the homeowner subscribes (opts in) with a private hauler to receive a curbside container to collect food scraps. The homeowner participating directly pays the hauler for the collection service. Estimated diversion for this collection structure is included in Chapter 3 but was not benchmarked as a case study in this chapter. These case studies focus on non-subscription and franchise/subsidized subscription models to learn more about diversion, participation, sensitivities, highlights, and takeaways.

Table 4-1 summarizes key characteristics of the curbside collection program structures in the benchmarked communities.

Table 4-1 Curbside Collection Program Characteristics

Jurisdiction	Arlington County, VA	Minneapolis, MN	Falls Church, VA	Vancouver, WA
Program Structure	Universal Availability Non-Subscription	Universal Availability Non-Subscription	Universal Availability Franchise/Subsidized Subscription	Universal Availability Franchise/Subsidized Subscription
Food Scrap Only Diversion Per Eligible Households (Pounds/HH/Year)	109*	98	107	74***
Eligible refers all households in the jurisdiction that are eligible to sign up or receive the service.				
Food Scrap Only Diversion Per Participating	545*	185	547**	122***

Jurisdiction	Arlington County, VA	Minneapolis, MN	Falls Church, VA	Vancouver, WA
Households (Pounds/HH/Year)				
Participating refers to only those households known or estimated to be participating in the service.				
% of Households Participating	10-20%	53%	~20%	61%
Program Drivers	– County zero waste goal – Households pay whether or not they use the service	– County adopted ordinance requiring availability of curbside organics – Pay-as-you-throw	– City subsidizes collection	– Households required to maintain a minimum service – Pay-as-you-throw
Cart or Container Size	Choice of 32 or 64-gallon	32-gallon	Choice of 7 or 12-gallon buckets	Choice of 20, 32, 64 or 96-gallon
Program Start	2021	2015	2017	2019
Collection	Co-collection with yard trimmings	Food scraps only	Food scraps only	Co-collection with yard trimmings
Materials Accepted	Fruits Vegetables Coffee grounds, filters and tea bags Breads, grains and pasta Meat and seafood (including bones) Food soiled paper Pizza boxes Certified compostable liner bags	Fruits Vegetables Coffee grounds, filters and tea bags Breads, grains and pasta Meat and seafood (including bones) Food soiled paper Pizza boxes Certified compostable liner bags Compostable foodservice ware (e.g., cups, utensils)	Fruits Vegetables Coffee grounds, filters and tea bags Breads, grains and pasta Meat and seafood (including bones) Food soiled paper Certified compostable liner bags Compostable foodservice ware (e.g., cups, utensils) Uncoated paper plates and bags	Fruits Vegetables Coffee grounds, filters and tea bags Breads, grains and pasta Meat and seafood (including bones) Food soiled paper Pizza boxes Uncoated paper plates and bags

Notes:
*Diversion does not include yard trimmings. Program co-collects yard trimmings and food scraps. An estimated 20% is food scraps.
** Diversion does not include yard trimmings. Participation is estimated at 20%.
*** Diversion does not include yard trimmings. Program co-collects yard trimmings and food scraps. An estimate of 12-15% is food scraps.

Calculating diversion and participating households is based on estimations in three of these benchmarked communities. While estimating is not exact it provides value. **Table 4-2** identifies the estimations used.

Table 4-2 Curbside Collection Program Estimations

Estimations	Diversion	Participating Households
Arlington County, VA	Food scrap diversion is estimated because collection is commingled with yard trimmings. City of Arlington estimates approximately 20% is food scraps.	Cart set out rates are not measured on an ongoing basis. City of Arlington estimates approximately 10-20% of households participate in the food scrap program.
Minneapolis, MN	None*	None**
Falls Church, VA	None*	City of Falls Church estimates approximately 600 households participate which is roughly 20%.
Vancouver, WA	Food scrap diversion is estimated because collection is commingled with yard trimmings. Vancouver estimates approximately 12-15% is food scraps.	None***

Notes:
*Weights cannot be measured because food scraps are not commingled with yard trimmings
**Curbside service offered to single-family and multi-family housing (with 4 units or less). Households pay for the service but must opt-in (curbside) to receive a cart for food scraps collection.
***Households must subscribe directly with franchised hauler to receive organics collection so city knows number of households with organics collection service.

Costs to households vary across the communities as shown in **Table 4-4**. The household cost represents the cost each household pays monthly for food scrap collection at the curb. The subsidy covered by Falls Church's results in higher jurisdiction costs than the other case studies.

Table 4-4 Curbside Collection Program Costs

Jurisdiction	Arlington County, VA	Minneapolis, MN	Falls Church, VA	Vancouver, WA
Jurisdiction Total Cost ($/household/year)	$15-20	~$36	$139	$16
Household Cost	$12/year	$30/mo.	7-gal - $8/mo. 12-gal -$15/mo.	20-gal - $5.53/mo. 32-gal - $6.78/mo. 64-gal - $8.03/mo. 96-gal - $9.28/mo.

Notes:
*Jurisdiction costs are bundled services. A rough estimate for the organics (which includes yard trimmings) is $16.

Key Takeaways: Curbside Collection

The case studies of the four benchmarked communities' qualitative conditions found trends that impact recovery. When asked about pain points, communities shared lower participation rates and lower tonnages captured are the most common challenges cited with a curbside program. Other challenges included rental property turnover, inadequate funding for ongoing outreach and education, and tipping

fees.

Factors that could impact program success include policy drivers, incentives to reduce the cost for households to participate in a food scraps collection program, and collection method. Examples from the four benchmarked communities, and how these factors may impact a program in Hamilton County, include:

- **County Requires Jurisdictions to Provide Residential Food Scraps Collection Service**

  Hennepin County (MN), where Minneapolis is located, passed an ordinance in 2020 that required jurisdictions in the county with >10,000 in population to provide food scraps collection. Minneapolis had existing residential food scraps drop-off sites and curbside food scraps collection service for all single-family households and dwellings up to four units when the ordinance became effective in January 2022. The ordinance helped validate the City's decision to offer food scraps collection. Other county jurisdictions followed suit to comply with the ordinance. Earlier in 2024, the Minnesota Pollution Control Agency passed a regulation requiring that all counties in the Minneapolis-St. Paul 7-county metro area establish residential food scraps collection in all jurisdictions with population >5,000. Program design is at the discretion of individual jurisdictions and includes requiring franchised haulers to offer residential collection to households for an additional fee.

  Takeaway for Hamilton County: A policy that requires households have access to food scraps collection could provide a baseline for jurisdictions — perhaps with financial assistance in the form of grants — to establish a program such as drop-off locations and/or require franchised haulers to offer the service.

- **Incentivize Household Participation with a Pay-As-You-Throw Rate Structure**

  Minneapolis and Vancouver offer pay-as-you-throw pricing incentives. Minneapolis has reduced monthly rates for smaller trash cart sizes; Vancouver has reduced rates for both the trash and organics carts, as well as the collection frequency — every week or every-other-week. The franchised hauler offers the variable rates to the households it services.

  Takeaway for Hamilton County: Two jurisdictions in the County — Madeira and Forest Park — have established variable rates for household solid waste services. Quantifying the impact of a pay-as-you-throw structure in these communities, which represent 8% of the County's household count, could provide data to evaluate the impact on increased landfill diversion and reduced cost to households for solid waste collection.

- **Imbed fee for Food Scraps Collection into Residential Monthly/Annual Solid Waste Services Fee**

  Arlington County and Minneapolis imbed the costs for food scraps collection into the rate households pay for all solid waste collection services. Participation in the program is voluntary, but the fact that households are paying either way may incentivizes participation. This cause-and-effect is evident in Minneapolis, where 53% of eligible households have opted in to receive a food scraps cart. To date, it does not appear to be a significant driver in Arlington County, where

participation is between 10% and 20%.

Takeaway for Hamilton County: Because jurisdictions in the County separately contract for solid waste services, use of this pricing structure must be determined by each city or township.

- **Subsidizing Food Scraps Collection Fee for Collection by Private Subscription Service**

  Falls Church subsidizes the fee households pay to have their food scraps collected by a private service. The fee of $8/month is significantly less than if the household subscribed directly for a fee of $32/month. Despite the subsidy, only 17-20% of households eligible for the service subscribe. Reluctance to participate includes concern about odors and vectors, and lack of space for the cart.

  Takeaway for Hamilton County: Subsidizing the cost to participate in a private food scraps collection service may not be enough of an incentive for households to participate.

- **Collection Method Impact on Program Participation**

  Falls Church and Minneapolis collect food scraps separately from yard trimmings, and households are allowed to use a certified compostable liner bag for the food scraps. Arlington County and Vancouver collect food scraps commingled with yard trimmings in the same cart. Arlington County allows use of certified compostable liner bags; Vancouver does not as the composting facility servicing the program does not accept them. In jurisdictions where yard trimmings are not generated year-round, some households may be disincentivized to set out a cart with only 1-2 small bags of food scraps and no yard trimmings. In Vancouver, households may be disincentivized to put uncontained food scraps in the cart with yard trimmings as it makes the cart messy and potentially odorous. Collecting food scraps only makes it easier to quantify the tons of food scraps diverted.

  Takeaway for Hamilton County: Allowing use of certified compostable liner bags helps address the ick factor associated with source separating food scraps and may be a factor in increasing program participation. Collecting food scraps only also facilitates measuring capture rates.

Drop-Off Food Scrap Collection

Interest in residential food scrap diversion has grown in the US. In 2023, BioCycle conducted a nationwide survey on residential food scraps collection access and identified 400 programs serving 710 communities (Goldstein, 2023). Of these, 141 are drop-offs only. Increasingly, political jurisdictions are offering food scrap drop-off collection programs. The GT Project Team researched four drop-off programs and wrote case studies to share with Hamilton County ReSource. These case studies focus on models to learn more about diversion, participation, sensitivities, highlights, and takeaways.

Participation is voluntary and program costs are either covered through a general solid waste fund or in some cases, residents pay an annual fee to use the drop-off site.

Table 4-6 summarizes key characteristics of the drop-off program structures in the benchmarked

communities.

Table 4-6 Drop-Off Program Characteristics

Jurisdiction	Anoka County, MN	Falls Church, VA	HRRA, CT	Minneapolis, MN
Program Structure	Households need to register	No registration needed	Have sign-ups though it is not required	Households need to register
Diversion Per Eligible Households (Pounds/HH)	3.5	19.9	n/a	1.9
Eligible refers all households in the jurisdiction that are eligible to sign up or receive the service.				
Diversion Per Participating Households (Pounds/HH)	70	518	n/a	37
Participating refers to only those households known or estimated to be participating in the service.				
% Households Participating	5%	0.4%	12-17%	5%
Program Start	2017	2017	2014	2014
Number of Sites	3 provided by County 10 provided by local jurisdictions	1 provided by Falls Church	9 member towns provide sites	19 provided by City 1 provided by a church

When asked about their pain points, the drop-off communities shared that start-up costs, lower participation rates, and lower tonnages captured are the most common challenges cited with a drop-off location program.

Table 4-7 Challenge and Pain Points of Drop-Off Programs

Jurisdiction	Anoka County, MN	Falls Church, VA	HRRA (Brookfield, CT)	Minneapolis, MN
Low Participation	X			X
Not Mandatory		X	X	
Low Tonnages Captured	X		X	X
Implementation Cost			X	
Rural Site Locations	X		X	

Jurisdiction	Anoka County, MN	Falls Church, VA	HRRA (Brookfield, CT)	Minneapolis, MN
Other	Two county drop-off sites are at staffed facilities, which limits contamination.	None	Noticed participation is higher in affluent towns Would develop small scale composting at each rural transfer station if could start over because of convenience, avoided hauling and processing facility tip fee savings	Perceived lack of convenience e.g., 6 blocks from household is too far; challenging to identify ideal drop-off site locations in City. Currently, all are at city parks.

Costs to provide the drop-off programs vary across the jurisdictions as shown in **Table 4-8**. Falls Church and Anoka County provide the drop-off at no direct charge to the households. The City of Minneapolis includes the costs in the monthly fees and jurisdictions in HRRA vary for how the cost to the household is charged, if one is charged (two of the nine do not charge fees).

Table 4-8 Food Scrap Drop-Off Program Costs

Jurisdiction	Anoka County, MN	Falls Church, VA	HRRA	Minneapolis, MN
Jurisdiction Total Annual Cost	$90,000 per site (includes yard trimming costs)	$15,000 per site	Media and staff time costs only	$1,500 per site
Notes	Receive annual funding from State	None	Finds funding to establish sites; 7 of 9 jurisdictions with drop-off charge a fee to access the site	Charge to household included in solid waste services monthly fee

Key Takeaways: Drop-Off

The case studies of the four benchmarked communities' qualitative conditions found trends that impact recovery. Listed below are highlights and key takeaways for the drop-off program.

- User sign-up helps track program participation and contamination-related feedback to households.
- Drop-offs provide access for multi-family households as well as single-family.
- Drop-off sites co-located with small-scale composting operation provide savings from avoided hauling and tip fees.
- Drop-offs need to be monitored periodically.

CHAPTER 5 Composting Technologies and Options

Hamilton County is seeking the best processes and infrastructure for managing organics. There are several approaches to composting and each approach and technology have different land area requirements, feedstock considerations, processing times, benefits, and costs. This chapter describes technologies available for SSO recovery and describes the SSO processing options for developing Hamilton County infrastructure.

Compost Technologies

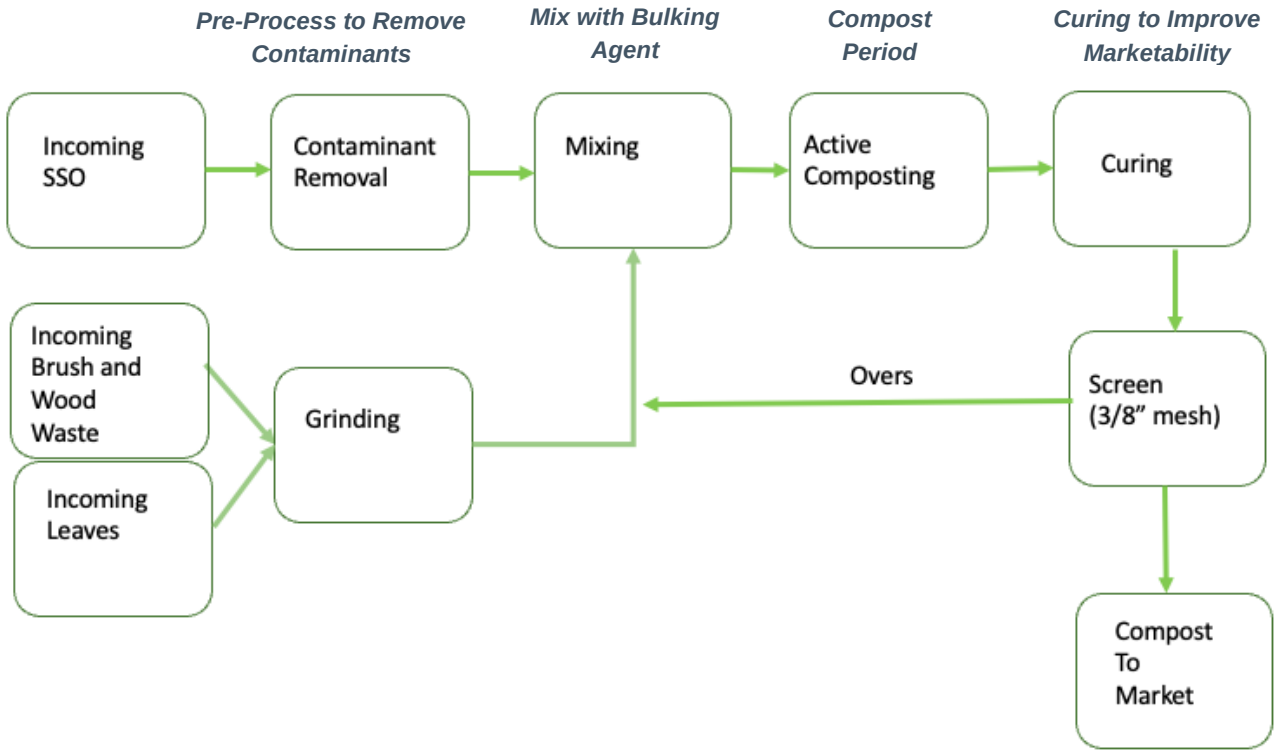
Composting is a well-proven approach to recycling organic materials; there are between 3,000 and 4,000 operating composting facilities in the U.S. and 231 Class IV, 51 Class III, and 22 Class II (food scrap) composting facilities operate in Ohio[xv]. Composting is the controlled aerobic (with oxygen) decomposition of SSO materials, or feedstocks, such as food scraps, sewage sludge, yard trimmings, water treatment residuals, animal manures and mortalities, and certain industrial solid wastes. It is a self-heating process that destroys pathogens and weed seeds and produces a material similar to soil humus. The biological activity of decomposition produces heat and temperatures rise to thermophilic levels (115º F. – 160º F.). This heating kills pathogenic microbes like fecal coliform and *Salmonella sp.* Well-stabilized and mature compost can be stored indefinitely and has a wide variety of product markets in residential and commercial landscaping, sediment and erosion control, agriculture, non-point source water quality management systems, disturbed lands remediation, and commercial horticultural applications.

Composting, at any scale, is a biological manufacturing process, where the inputs to the process are feedstocks, air, and water, and the outputs are compost, heat, water vapor, and biogenic carbon dioxide. Compost production requires a medium dry enough to provide pore spaces with adequate air, but wet enough to sustain biological activity (around 50% to 55% moisture). Porosity of around 35% to 50% typically is provided by mixing organic wastes with a bulking agent or amendment, such as wood chips. The addition of woody materials as amendments also serves to raise the carbon: nitrogen ratio of the organic waste materials into the preferred range of 25:1 to 30:1 (on a mass basis). Composting is a relatively simple process that can be performed outdoors in most climates. Because of a desire to operate the process more efficiently, control odors, and minimize the effects of weather, some facilities are constructed under structures, in fully enclosed buildings, or in entirely mechanized facilities (and combinations thereto).

Figure 5-1 illustrates a hypothetical process flow diagram for a composting system in Hamilton County. Incoming SSO materials would be pre-processed by removing contaminants. Contaminant removal is often done manually or with a “picking line” where the SSO moves along a conveyor. SSO diversion programs benefit from a vigorous public education and outreach program to keep contamination out of the SSO stream. SSO is then mixed with bulking agent which comes from incoming yard trimmings and overs from the finished screening process. Incoming yard trimmings are usually ground or shredded to a consistent 2” minus particle size creating a bulking agent for mixing with the SSO. Operators combine this yard trimmings bulking agent with the SSO. It is common practice to recycle partially composted

bulking agent that is screened out from the finished compost, known as overs, for use in the starting composting mix (used as a microbial inoculum).

Figure 5-1 Composting Process Flow Diagram



After a 30-to-60-day period (faster in some enclosed and in-vessel systems), the compost is moved to a curing area, where it ages to improve marketability. Curing will take 60 to 90 days, depending on weather conditions (less if done indoors). Following curing, the compost is screened to a 3/8" or 1/2" particle size and shipped to market as wholesale bulk or bagged distribution.

The majority of composting operations in the U.S. today are open-air turned windrow facilities. Turned windrows are not always advisable for SSO composting due to the potential for attracting vectors (flies, birds, small mammals) and for the need for continual housekeeping (**Figure 5-2**) as the windrow turning action rolls round fruits and vegetables out of the pile. Hamilton County is relatively urban/suburban with dense housing and businesses, and the generation of odors and storm water runoff could be an issue. Due to this potential to attract vermin and generate odors, turned windrow composting of food scraps was not considered further in this study.

The other primary methods of composting SSO currently used in the U.S. are:

- Aerated static pile (ASP),
- Aerated tunnel reactors,

- Aerated agitated bays, and
- Rotary drums.

Table 5-1 summarizes the features of these technologies.

Figure 5-2 Windrow Housekeeping with Food Scraps

Photo Source: Black Bear Composting, Crimora, VA - Coker Composting & Consulting

Table 5-1 Composting Technologies

	Aerated Static Pile	Tunnel Reactors	Agitated Bay	Rotary Drum (also known as in-vessel systems)
General Description	Forced aeration system which utilizes at-grade (low tech) or in-ground (high tech) piping to provide positive, negative, or reversing aeration to mixed organic waste piles.	Forced aeration system with compost processed in a fully enclosed structure, typically a long, narrow, cast-in-place concrete enclosure resembling a tunnel. Positive aeration via an in-ground aeration system and/or process air can be exhausted from the headspace of the tunnel.	Equipped with forced aeration like ASP and enclosed (in-vessel) systems, agitated bays utilize large beds of material placed at depths up to 10 ft. enclosed within perimeter walls. Material mechanically turned in individual bays every 1–3 days. Mechanical agitation can be achieved with an auger suspended from a bridge crane spanning across the bay floor, which can reach all areas of the bay.	Rotating drum systems utilize mechanical agitation to achieve material aeration, rotating organic material in large-scale drums at 0.5–5 revolutions per minute, moving material down the drum in a corkscrew pattern. Air is typically injected into drums to meet process air requirements. Typically, the retention time in the drum is relatively short so further composting is needed.
Land Area Requirements	Low to Moderate - Controlled aeration supply allows construction of large piles (e.g., 30 ft. W × 100 ft. L × 10 ft. H), with ASP requiring less land than windrow composting. Configurations for ASP can be standalone piles, in-bunker, or extended aeration, with processing density increasing for each and decreasing land area. Low difficulty to add piles but requires cost of additional aeration equipment.	Low to Moderate - Land area requirement like ASP bunker facility configurations. Can be installed in indoor and outdoor settings.	Low - Effective use of land area; space requirements per ton of capacity are low.	Low to Moderate - Vessels can vary in size and capacity; however, they generally require significantly less land area than windrow composting. Large-scale systems typically consist of a steel drum with diameter up to 16 ft. and length between 100 and 250 ft., positioned on an incline less than 5%.
Feedstock Considerations	1,000 to >100,000 TPY – Appropriate for large volumes of SSO, yard trimmings and manure.	25,000 to >100,000 TPY - Composting of residential and commercial SSO and yard trimmings, digestate from anaerobic digestion, biosolids from wastewater treatment	50,000 to >100,000 TPY - Appropriate for SSO and yard trimmings. While facilities can process smaller volumes, the technology is well suited for handling large volumes of	1,000 to 100,000 TPY - Can accommodate virtually any type of organic waste (e.g., meat, animal manure, biosolids, food scraps).

	Aerated Static Pile	Tunnel Reactors	Agitated Bay	Rotary Drum (also known as in-vessel systems)
		and manure. While facilities can process smaller volumes, the higher capital costs for tunnel construction lend use of this technology to facilities processing higher volumes of organics.	material.	
Processing Timelines	2-6 months -Total Pre-Treatment Material grinding/mixing and decontamination prior to placement in piles. Active Composting Fan aeration. No mechanical agitation required. Depending on facility configuration and level of technology, material handling can be ***Low*** (no pile turning during active composting), ***Medium*** (one pile rebuild), or ***High*** (use of fabric pile covers). Typically, 2–8 weeks for primary composting Post-Processing Secondary curing/maturation.	2-4 months Total Pre-Treatment Material grinding/ mixing and decontamination prior to placement in enclosed system. Active Composting Fan aeration. No mechanical agitation required. Depending on the facility processing approach, material handling can be ***Low*** (no pile turning during active composting) or ***Medium*** (one pile rebuild). Typically, 2–4 weeks. Post-Processing Secondary curing.	2-4 months Total Pre-Treatment Material grinding. Preparation of feedstocks and amendments critical. Additional mechanical mixing during active composting. Active Composting High degree of automation requires ***Low*** material handling. Front-end loaders or conveyors are used to place material at bay receiving ends. Material moved across bays and discharged on floor or conveyor belt after processing. Typically, 3–4 weeks. Post-Processing Secondary curing.	1-3 months Total Pre-Treatment Material grinding and decontamination. Drums provide effective mixing and agitation of feedstocks and amendments. Active Composting ***Low*** material handling. Drum loading/unloading introduces mechanical complexity in comparison to other enclosed or in-vessel composting. Typically, 7–10 days. Additional active composting may be required. Post-Processing Secondary curing.
Public Benefits	Greater processing density (tons/day/SF of processing area) as compared to turned windrows. Reduced volatile organic compound (VOC) emissions compared to turned windrows.	Greater processing density Reduced VOC emissions compared to turned windrows.	Greater processing density Reduced VOC emissions compared to turned windrows.	Reduced processing footprint but secondary treatment of raw compost is needed.
Public	Odor – Requires process	Odor – High degree of	Odor – Agitated bays are	Odor – Process air

	Aerated Static Pile	Tunnel Reactors	Agitated Bay	Rotary Drum (also known as in-vessel systems)
Concerns	design and attentive management of moisture and temperature throughout process. Can also be optimized through use of aeration regime, pile covers, and biofilters.	process air containment minimizes odor concerns. Worker Health and Safety – Tunnel systems may require management as confined spaces with appropriate personal protective equipment.	typically installed within buildings, allowing a higher degree of odor control.	containment minimizes odor concerns but odor treatment recommended.
Relative Costs	Moderate - Significant cost and technical assistance to purchase, install, and maintain aeration equipment (e.g. blowers, piping, and ductwork, process controls).	Moderate to High - Cast-in-place concrete for tunnel systems increases construction costs. Significant cost and technical assistance to purchase, install, and maintain complex aeration equipment and process controls.	High - High use of automation requires high capital cost.	Moderate to High - High cost of equipment and technical expertise may be required to support operations.

Aerated Static Pile

ASP composting involves introducing forced aeration into a compost pile, either by pushing it up from under the pile (positive aeration) or pulling it down into the pile (negative aeration). ASP systems are often constructed of concrete for longevity (**Figure 5-3**) and to provide "push walls" for materials handling equipment (e.g., front-end loaders). In addition to limiting vermin, ASP reduces stormwater runoff.

Figure 5-3 ASP Composting

Photo Source: Onondaga Resource Recovery Authority, Syracuse NY

The ASP bunkers can be out in the open (as shown in **Figure 5-3**) with an 8-inch to 10-inch layer of compost (a "biolayer") over the mixed feedstocks to serve as an *in-situ* biofilter for positive aeration ASPs. Some ASP systems are reversible between positive and negative aeration, with a biofilter treating the exhaust air from negative aeration. These systems are inherently scalable, in that additional bunkers can be built if volumes increase over time.

Aerated Tunnel Reactor and Agitated Bays

There are two other variations on ASP composting used for SSO and yard trimmings: tunnel bioreactors and agitated bays. Tunnel bioreactors are another form of actively aerated composting systems. These systems consist of long narrow cast-in-place concrete walls and floors (**Figure 5-4**). A 35-foot wide by 80-foot long tunnel bioreactor will hold about 800 CY or 250 tons of mixed feedstocks.

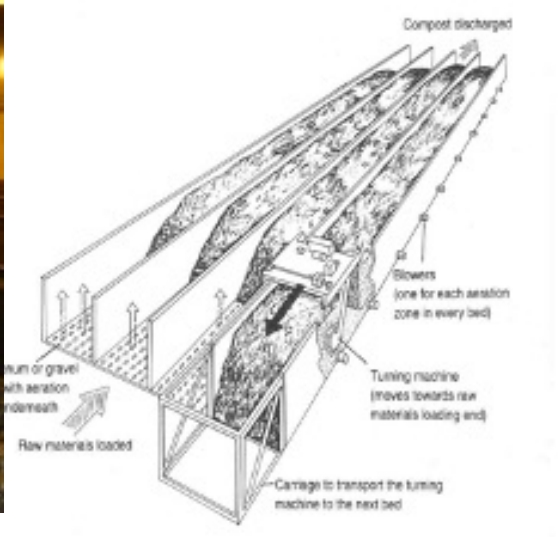
The positive aeration system is in the floor. Air is fed from a central blower system through pipes hung off the back walls of the reactors. They are designed to be filled and emptied with rubber-tired front-end loaders. The airtight door systems that close each tunnel after filling are either hinged at the top and open with hydraulic lifters or hung on tracks and slide to one side (like a barn door). Composting times are 2 to 4 weeks, and some are configured to allow material to be removed and remixed during the

process. During operation, process air is exhausted from the headspace above the composting mass and routed to a biofilter for treatment.

Figure 5-4 Tunnel Bioreactors

Photo Source: Engineered Compost Systems, Seattle WA

Figure 5-5 Agitated Bay Composting



Graphic from On-Farm Composting Handbook - NRAES-54.
Photo courtesy of Coker Composting and Consulting

Equipped with forced aeration, agitated bays utilize large bays of material placed at depths up to 10 feet, enclosed within perimeter walls in long narrow bays. Material is mechanically turned and moved along the axis of the bay in individual bays every 1 to 3 days, with mechanical agitation achieved via an auger riding on perimeter wall rails or suspended from a bridge crane that can reach all areas the bay (**Figure 5-5**). Agitated bay systems are an effective use of land area, as space requirements per ton of capacity are lower than windrows and ASPs. In addition, agitated bays are typically installed within buildings, allowing a higher degree of odor control. The high use of automation in agitated bay systems does require high capital cost but reduces the labor effort necessary.

Processing by agitated bay system is appropriate for SSO and yard trimmings, and is well suited for handling larger volumes of material. While material grinding is required prior to processing and additional agitation is provided during active composting, the preparation of feedstocks and amendments prior to active composting is critical. Due to the high degree of automation, material handling requirements during the active composting phase are low. Front-end loaders or conveyors are typically used to place material at the receiving end of an agitated bay, with material moved along bays by the turning auger throughout active composting. Augured compost is discharged onto the bay floor or a conveyor belt for further processing at the completion of the active composting phase. Agitated bay composting typically produces compost within 2 to 4 months including active composting and secondary curing. Due to mechanical agitation, the active composting phase typically lasts 3 to 4 weeks. Additional secondary curing is typically required (although some facilities are sized to accommodate the curing phase in the bays).

Rotary Drums (also known as in-vessel systems)

In rotating drum composting, the composting process starts quickly, and the highly degradable, oxygen-demanding materials are decomposed. Further decomposition of the material is necessary and is accomplished through a second stage of composting, usually in windrows or aerated static piles. The primary advantage of rotary drum composting is it usually achieves the requisite pathogen kill time-temperature relationship (>55^{o} C for three days), and it can reduce potential odor problems due to rapid decomposition of highly degradable organics. Air is supplied through the discharge end and is incorporated into the material as it tumbles. The air moves in the opposite direction to the material. The compost near the discharge is cooled by the fresh air. In the middle, it receives the warmed air, which encourages the process; and the newly loaded material receives the warmest air to initiate the process. Rotating drum systems are generally smaller (e.g., 7-foot diameter, 40-feet long) but larger drums are available, like the 12-foot diameter by 185-foot long rotary drums used at the Sevier Solid Waste Authority in Pigeon Forge, TN, which uses six (6) drums to process 450 tons/day of feedstocks. **Figure 5-6** illustrates one of these larger drums.

Figure 5-6 Larger Rotary Drum Composter

Photo Source: ANDAR Holdings Ltd.

One drawback to rotary drum composting is that they have limited residence times in the drums as they were developed in the 1980s for the in-vessel composting of sewage sludges, which only requires a pathogen kill time-temperature regime of 3 days at 131º F. or greater, so what comes out of a rotary drum is not stable compost, requiring additional treatment.

Community-Scale Decentralized Composting

Another concept to consider is to help smaller-scale composting facilities get started and for them to grow and expand as SSO diversion in the region becomes more mainstream. These small-scale composting sites (often referred to as community composters by many in the field) are often located in community gardens and at municipal parks. If taking up less than 500 square feet, these sites are exempt from Ohio EPA permitting.

In 2022, the Institute for Local Self-Reliance (ILSR) conducted a national census of community composters that indicated community composting operations are on the rise and can result in myriad co-benefits such as community engagement, youth education, and local use of compost.

Community-scale decentralized composting has various approaches for compost operations. One model is a “3-bin” system. Traditionally, these 3-bin systems are expanded versions of a backyard composting system (**Figure 5-7**) and are often managed by volunteers. In some communities, this approach is falling out of favor due to pest attraction and challenges finding and training volunteers. Similar to larger sites, these small-scale systems require a clean feedstock and active management to produce a quality product.

Figure 5-7 Traditional Community Garden 3-Bin System

Photo Source: Garden City Harvest, Missoula MT

Community composters have worked on installing Johnson-Su Bioreactors on many community garden and orchard sites within the City of Cincinnati. Johnson-Su Bioreactors are a passively aerated, no-turn composting system capable of composting up to one ton of material after a composting period of nine months to a year. These bioreactors are filled with a blend of wood chips and vegetative food scraps collected from Cincinnati restaurants and residents (**Figure 5-8**).

Figure 5-8 Johnson-Su Bioreactor

Developed at the Institute for Sustainable Agricultural Research at New Mexico State University, the Johnson-Su Bioreactor is one of many variations of composting systems. The Johnson-Su method allows the compost to break down fully to produce mature compost. The finished product is ready to use in 9 to 12 months, depending on the size.

Another approach is a forced-aeration microbin system, such as the one sold by O2 Compost (Seattle, WA). These microbins come in different sizes and have small blowers and perforated aeration piping to improve the composting process in the bin. One potential use of microbins would be for a pest-resistant design. The “3-bin system” would consist of:

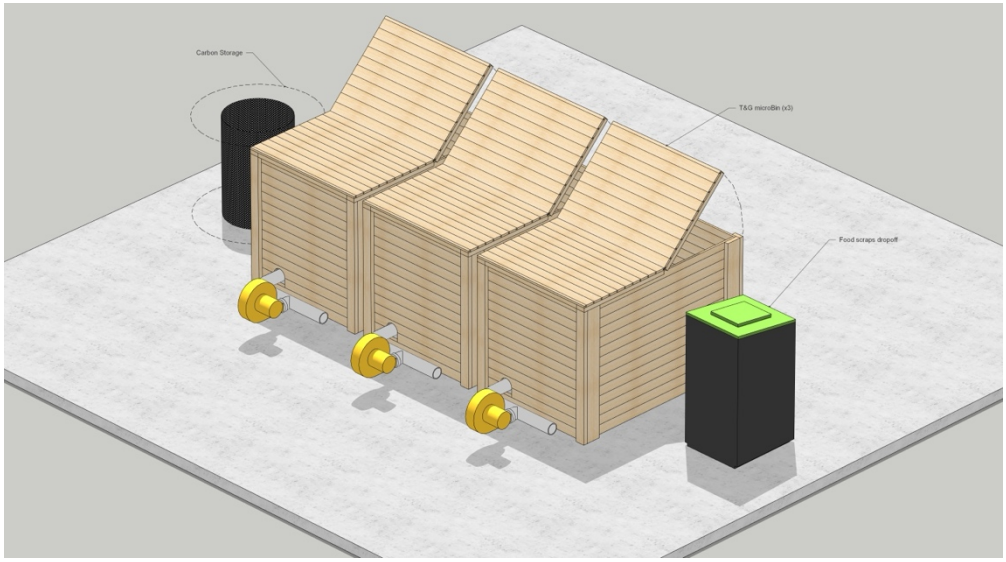
Photo Source: Civic Garden Center of Greater Cincinnati

- Three forced-aeration “microbins” on a 4-foot concrete slab, each measuring 6-feet wide by 4-feet deep by 4-feet high with hinged lids and removable front panels
- An expandable vertical open mesh storage cylinder for “browns” (mostly leaves and wood chips) and
- Optionally, a “smart bin” for allowing approved users to unlock and open the food scraps drop-off bin with an app on a cell phone.

Each system could divert between 4 and 5 tons of food scraps annually.

Forced aeration microbins are more efficient for composting food scraps than unaerated bins as the air introduced by the blower creates a hotter pile that will decompose material more quickly. Forced aeration also reduces the labor required to turn and flip piles. Composting is an aerobic process requiring oxygen. If blowers can accomplish the same task as volunteer crews, the system can become easier to maintain. This system requires electricity and would be located on a 4-inch thick concrete slab, with enough working room in front of the microbins for materials handling. **Figure 5-9** is an illustration of the concept. Some small-scale composting sites use a “compost tumbler” partially filled with wood chips to accept dropped-off food scraps. The rotation of the tumbler mixes the feedstocks and starts the composting process prior to moving the materials into the microbin.

Figure 5-9 Small-Scale Composting System Concept Illustration



Feedstocks suitable for small-scale composting are similar to the list of suitable feedstocks for backyard bins:

- Fruit and vegetable scraps, peelings, pits, and seeds
- Eggshells and nutshells
- Rice, pasta, cereal
- Bread, pastries, cookies
- Coffee grounds and coffee filters
- Teabags
- Cut or dry flowers
- Napkins, food-soiled paper towels
- Wine corks
- Wooden coffee stirrers

Unacceptable organic items would include:

- Meat, fish, bones
- Dairy products
- Fats, grease, oils
- Pet waste
- Charcoal
- Yard trimmings
- Dryer lint

Organics Infrastructure Options

Achieving additional diversion is constrained by lack of organics processing. As discussed in this chapter there are several technologies available to manage the approximately 231,000 tons of organics (85,000 tons from residential and 146,000 tons from commercial sources) landfilled from Hamilton County sources every year. The projected quantities that could be captured heavily depend on which sources are included (i.e., residential, commercial or both) and participation (see Chapter 3).

Small, medium, and large processing options each have their advantages, and depending on the

processing gaps can be combined. Small-scale organics processing options can be a starting point which can be added onto or expanded to increase processing capacity. Small-scale operations can be designed to work in concert with larger, large-scale facilities or as standalone operations. A large-scale facility requires a larger amount of land and may be less conveniently located for some. A large-scale facility could provide advantages in terms of economies of scale and can provide cost effective solutions for communities.

The compost industry does not have a standardized facility definition for small, medium, or large-scale facilities. A general accepted concept is:

- Large-scale is greater than 20,000 tons per year of feedstock
- Medium-scale is less than 20,000 tons per year of feedstock
- Small-scale can range anywhere up to 2,000 tons per year of feedstock

The projections from Chapter 3 demonstrate Hamilton County has options ranging from small to large-scale processing for developing composting infrastructure. The Project Team developed four infrastructure options for the modeled SSO and yard trimming scenarios, identified by size as described below. The technology requirements will vary depending on the option of infrastructure.

- **Alternative A – One Large-Scale Facility**
  - One centralized facility where all material is brought for processing.
- **Alternative B – Two Large-Scale Facilities**
  - Two facilities located in different parts of Hamilton County, similarly configured to the single centralized facility. This could be a viable option for strategic placement in Hamilton County given how urban the county is.
- **Alternative C – Three Medium-Scale Facilities**
  - Three medium-scale facilities present a more decentralized approach. Three medium-scale facilities would provide flexibility to exist in concert with small-scale composters and support existing infrastructure. Area requirements are smaller for medium-scale facilities and one or all could be designed to expand or increase capacity if needed.
- **Alternative D – Small-Scale Community Composting**
  - Community composting “can usually handle 300 to 500 cubic yards a year of feedstocks annually”[xvi]. Community composting handling 500 cubic yards a year is 200 tons. Community composting is a contextual definition not an engineering definition. There are examples of community composters ranging all the way up to processing 2,000 tons a year. If a community composter occupies 500 square feet or less, in Ohio, the composter is exempt from permitting. A composter in Hamilton County, Common Orchard, is an example of a community composter composting 150 tons a year of feedstock. Community composters may or may not be permitted in Ohio because it depends on the square feet. Regardless of permitting, small-scale community composting would require many sites to manage the modeled capacity and would not stand alone to serve the region.

Table 5-2 Processing Alternatives

Alternatives	Incoming Feedstock Estimates (Tons/Year)	Number of Locations in Hamilton County
A. One Large-Scale Facility	~146,000	1
B. Two Large-Scale Facilities	~65,000-75,000	2
C. Medium-Scale Facilities	~18,000 per site	3
D. Small-Scale Community Composting	Range up to 2,000 per site	Numerous

Many factors need to be considered to evaluate which alternatives are not only feasible but will also complement the comprehensive waste management system. The Project Team met with Hamilton County ReSource to discuss the four alternatives, expected tonnage needed for each, and weight criteria that would be used to evaluate the alternatives.

Weighted Criteria Matrix

The weighted-matrix evaluation technique was used to focus on those composting strategies listed in **Table 5-2**. The weighted criteria matrix is a decision-making tool used to evaluate alternatives based on specific evaluation criteria weighted by importance. By evaluating alternatives based on their performance with respect to individual criteria, a value for the alternative can be identified. The values for each alternative can then be compared to create a rank order of their performance related to the criteria as a whole. The tool is important because it treats the criteria independently, helping avoid the over influence or emphasis on specific individual criteria.

Evaluation Criteria and Weighting Factors

For each of the evaluation criteria, a raw (i.e., unweighted) score was assigned. Scoring was from 1 to 5, where 1 meant the alternative was least favorable with respect to the evaluation criterion and 5 meant it was most favorable. Raw scores are presented in Appendix C. Scores were assigned based on the knowledge of the GT Project Team about these systems and on best professional judgment.

Scoring rationale was as follows:

- **One Footprint for Processing**: Advantages of one footprint of one centralized facility could be ease in siting one facility versus several; one operator for developing public private partnership; only one site to manage; only one site to regulate and inspect; and could handle projected modeled feedstock for residential and commercial. Small to medium-scale facilities would require additional facilities to site and manage.
- **Lower Capital Development Costs**: All of the composting alternatives require capital to develop. Larger facilities have more development costs.

- **Lower Operational Costs:** All of the composting alternatives require operations. Larger facilities have higher operational costs.
- **Lowest Cost to Generator:** Small-scale community compost sites could provide the least cost for jurisdictions or generators to use.
- **Lowest Subsidy Cost by Jurisdiction or Hamilton County ReSource**: Cost is a very important consideration. Small-scale community compost sites will provide the least cost to Hamilton County ReSource.
- **Public Concern:** Larger sites may have the most public concern. Smaller sites handle less feedstock and are scale-appropriate which helps to minimize public concern.
- **Maximize Diversion of Food Scraps**: Maximizing diversion would require a major facility to handle the volume.
- **Feedstock Processing Capabilities:** The targeted organics for diversion to a recovery system would be food scraps (fruit, vegetables, coffee grounds and tea bags, breads, grains, pasta, meat and seafood), food soiled paper, pizza boxes, uncoated paper plates and bags, certified compostable liner bags, yard trimmings, and compostable plastic. Many of the composting technologies can accept these feedstocks. The small-scale community composting technologies accept a more limited list of feedstocks.
- **Ability to Provide Finished Compost**: Organics recycling systems operate under steady-state conditions, where incoming feedstocks are processed, digested/composted, cured, screened, and moved to market in a timely fashion.
- **Proven Concept for Food Scrap Processing**: Composting can take place effectively at various scales and sizes. While there is a growing movement in community composting, large, centralized facilities and technology are proven concepts.
- **Adequate Quantities of Carbon Material Available**: A food scrap processing facility needs yard trimmings and other woody material for the compost recipe. A larger facility's recipe may need more yard trimmings than Hamilton County ReSource can guarantee.
- **Minimal Siting**: Siting larger compost facilities can be time and capital intensive. Smaller decentralized sites could be operational sooner. Siting one facility presents a level of ease rather than siting two or more facilities. Likewise small-scale community compost sites that are less than a 500 square foot area do not require siting. Both would require community acceptance.
- **Hamilton County ReSource Involvement in Operations:** All of the composting alternatives assume private operations, though a community composting model could require between one and two full-time equivalents (depending on how many are developed and operating) of Hamilton County ReSource staffing. In the model of operating small-scale systems, it is assumed ReSource staff would help manage the community compost sites.

- **Public Private Partnership Risk Reliability is on the Private Sector**: Reliability is all about risk management. Risk with a large-scale centralized or two centralized facilities would be structured to the private sector.

Weighting factors were also assigned on a scale of 1 to 5, where 1 means the criterion is not important and 5 means the evaluation criterion is extremely important. Various stakeholders assigning weighting factors may have multiple perspectives on importance, so differing weighting factors are averaged before applying them to the evaluation criteria. The GT Project Team performed a multi-criteria two-stage weighting process. Weighting criteria was assigned by Hamilton County ReSource staff (**Table 5-3**) and the Hamilton County Solid Waste Policy Committee (**Table 5-4**).

Table 5-3 Hamilton County ReSource Staff Averaged Weighted Scores

Criterion	Averaged Weight
Tonnage throughput will dictate the size and land needed for a processing facility. Is it important that Hamilton County maximize the space to develop one footprint? Meaning if the same result is accomplished with a smaller footprint is a large footprint the goal.	2.4
How important are the development costs of an organic compost facility?	3.4
How important are the operational costs of an organic compost facility?	4.1
How important is the cost paid by the generator to have the ability to divert food scraps?	3.3
How important is the cost paid by the jurisdiction or ReSource to subsidize a food scrap facility?	3.1
How important is the public concern for a food scrap facility.	3.9
How important is it to maximize diversion of the food scraps currently ending up in the landfill?	5.0
Of the organic materials to divert identify the importance of diverting each material listed below: Fruit Scraps	4.7
Vegetable Scraps	4.9
Coffee Grounds & Tea Bags	4.7
Breads, Grains, and Pasta	4.4
Meat and Seafood	3.0
Food Soiled Paper	4.0
Pizza Boxes	2.7
Uncoated Paper Plates and Bags	3.2
Certified Compostable Liner Bags	3.1
Yard Trimmings	4.4
Compostable Plastic	1.9
How important is it that the finished product is a usable compost?	4.4
How important is a solution for food scrap processing to be a proven concept?	3.9
Are adequate quantities of carbonaceous material available?	3.0
How important is it that siting a food scrap processing facility is relatively easy?	3.5
ReSource has stated that they do not want to operate an organics composting facility. A decentralized option could be viable that would require ReSource staff in an operational	3.1

Criterion	Averaged Weight
capacity. How important is it to exclude ReSource staff as an option?	
How important is it in a Public-Private-Partnership that the reliability is on the private sector?	4.7

A second weighting step was conducted by the Policy Committee. The same weighting scale of 1 to 5 was used for the weighting factors. The Policy Committee members were asked to weight six criteria, an abbreviated grouping criteria list that correlates with the full set of criterion list. The criterion list in **Table 5-4** is reflective of the main topic criterion versus the detailed criterion. The weights were applied across the full set of evaluation criteria. This two-step weighting procedure produced a stable weighted results inclusive of a larger stakeholder group.

Table 5-4 Hamilton County ReSource Policy Committee Averaged Weighted Scores

Criterion	Averaged Weight
What is the importance that ReSource develop one centralized facility for processing organics?	2.8
Development Cost: How important is it that the cost of developing an organics processing facility be as low as possible?	3.6
Processing Type: How important is it that the organics processing facility does not create odors or nuisance?	4.2
Maximize Diversion: What is the importance of maximizing the diversion of food scraps over other compostables and organics?	3.8
Integrated Management: How important is it that ReSource supports current infrastructure (versus building for greater potential diversion)?	3.0
Public-Private-Partnership: How involved should ReSource be in the following activities:	
Construction of a processing facility	3.2
Operating a processing facility	2.4

To arrive at a weighted criterion to apply to the raw scores (see Appendix C) the first step weighting criterion were assigned into groupings that fall under the second weighting step criterion. The second step weights were applied to the first step weighting calculating a final weight. **Table 5-5** shows the final weights.

Table 5-5 Final Weight Scores

	Criterion	ReSource Staff Averaged Weight	Policy Committee Averaged Weight	Final Weight
What is the importance that ReSource develop one centralized facility for processing organics?			2.8	
	Tonnage throughput will dictate the size and land needed for a processing facility. Is it important that Hamilton County maximize the space to develop one footprint? Meaning if the same result is accomplished with a smaller footprint is a large footprint the goal.	2.4		6.72
Development Cost: How important is it that the cost of developing an organics processing facility be as low as possible?			3.6	
	How important are the development costs of an organic compost facility?	3.4		12.24
	How important are the operational costs of an organic compost facility?	4.1		14.76
	How important is the cost paid by the generator to have the ability to divert food scraps?	3.3		11.88
	How important is the cost paid by the jurisdiction or ReSource to subsidize a food scrap facility?	3.1		11.16
Processing Type: How important is it that the organics processing facility does not create odors or nuisance?			4.2	
	How important is the public concern for a food scrap facility.	3.9		16.38
Maximize Diversion: What is the importance of maximizing the diversion of food scraps over other compostables and organics?			3.8	
	How important is it to maximize diversion of the food scraps currently ending up in the landfill?	5.0		19
	Of the organic materials to divert identify the importance of diverting each material listed below: Fruit Scraps	4.7		17.86
	Vegetable Scraps	4.9		18.62
	Coffee Grounds & Tea Bags	4.7		17.86
	Breads, Grains, and Pasta	4.4		16.72

	Criterion	ReSource Staff Averaged Weight	Policy Committee Averaged Weight	Final Weight
	Meat and Seafood	3.0		11.40
	Food Soiled Paper	4.0		15.20
	Pizza Boxes	2.7		10.26
	Uncoated Paper Plates and Bags	3.2		12.16
	Certified Compostable Liner Bags	3.1		11.78
	Yard Trimmings	4.4		16.72
	Compostable Plastic	1.9		7.22
	How important is it that the finished product is a usable compost?	4.4		16.72
	How important is a solution for food scrap processing to be a proven concept?	3.9		14.82
Integrated Management: How important is it that ReSource supports current infrastructure (versus building for greater potential diversion)?			3.0	
	Are adequate quantities of carbonaceous material available?	3.0		9.00
	How important is it that siting a food scrap processing facility is relatively easy?	3.5		10.50
Public-Private-Partnership: How involved should ReSource be in the following activities:			2.8	
	ReSource has stated that they do not want to operate an organics composting facility. A decentralized option could be viable that would require ReSource staff in an operational capacity. How important is it to exclude ReSource staff as an option?	3.1		8.68
	How important is it in a Public-Private-Partnership that the reliability is on the private sector?	4.7		13.16

The stakeholder-average weighting factors were multiplied by the raw scores (Appendix C) for each evaluation criterion to arrive at a weighted score for each alternative, which were then summed for each alternative to arrive at a total weighted score for each. The values for each alternative were then compared to create a rank order of their performance related to the criteria as a whole.

The result of the alternatives scored in the following order:

1. Alternative C: Three medium-scale facilities
2. Alternative B: Two large-scale facilities
3. Alternative A: One large-scale one centralized facility
4. Alternative D: Multiple small-scale community composting

Table 5-5 Hamilton County ReSource Weighted Score Totals

	A One Large-Scale Facility	B Two Large-Scale Facilities	C Three Medium- Scale Facilities	D Multiple Small- Scale Community Composting
Total Score	**1,260**	**1,330**	**1,355**	**1,226**

Note: Individual scores can be found in Appendix C.

The alternative of a medium-scale decentralized approach consisting of three facilities had the highest weighted score and is the suggested alternative for Hamilton County ReSource.

Medium-scale decentralized facilities require a smaller footprint and can be established near a community garden. This decentralized alternative will complement the existing small-scale community composters in Hamilton County. Medium-scale facilities using the ASP technology can break down the same more difficult feedstocks such as meat and dairy that larger facilities can process.

Additionally, these facilities require a smaller footprint and can be located close to the point of food scrap generation, can help create local collection-to-processing loops, reduce truck traffic, and could help increase nutritional value of food grown at the community level. There are a few small-scale composters with acreage that could expand if there is interest in a public/private partnership with Hamilton County ReSource.

Medium-scale composting could be ideal for designing a phased approach. The smaller-footprint configuration could expand as the program grows and matures. Chapter 6 explains the footprint requirements needed for the medium scale facilities based on the incoming feedstock.

CHAPTER 6 Footprint Analysis

Composting organics is a volumetric processing system, so a footprint analysis is used to define the areas needed for each step in the compost manufacturing process. The footprint analysis is based on the recipe of feedstock ingredients and includes each processing step (e.g., waste receipt, mixing, composting, curing, etc.). This chapter explains what the composting recipe is and how it dictates facility sizing and site planning.

The weighted matrix evaluation scored the medium-scale facilities at the top. However, in the past, stakeholders in Hamilton County have shown significant interest in one large, centralized organics processing facility. To demonstrate the size of a large, centralized facility this chapter includes a footprint analysis for stakeholders to compare to the medium-scale facility footprint.

Composting Recipe

In addition to being a biological manufacturing process, composting is also a batch-type volumetric materials handling process. Compost recipes[xvii] are developed on a mass or weight basis to ensure that the mix conforms to desired process design criteria, but the feedstocks are commingled on a volumetric basis (i.e. so many cubic yards of Feedstock A mixed with so many cubic yards of Feedstock B, etc.). This volumetric version of the compost recipe is used to define the areas (footprints) of each step in the compost manufacturing process.

The exact recipe to be used on each day will depend on the feedstocks available at that time, but the mixing will be done in accordance with the key process design criteria of:

- Carbon-to-nitrogen ratio of ≈ 20:1 to 30:1
- Mix moisture content of 50% to 55%
- Volatile solids of more than ≈ 80%
- Free air space (structural porosity)[xviii] of 40% to 60%

Characterization data used to create a recipe should be taken from laboratory analysis of samples of SSO. Samples should be analyzed for total carbon, nitrogen, moisture content, soluble salts, pH, volatile solids and bulk density. Recipes must be adjusted for the lignin[xix] content of the woody amendments as lignin is not degraded in active composting by bacteria (it is degraded in curing by fungi).

Table 6-1 summarizes the composting recipe for a potential composting facility in Hamilton County. Characterization data used in the recipe was derived from other projects, so if Hamilton County ReSource decides to proceed with progressing a composting facility, feedstock sampling and analysis may be part of their responsibility.

Table 6-1 Hamilton County Composting Facility Recipes

Parameter	Targets	Residential SSO only	Residential and Commercial SSO
Annual Tonnage Capacity (Year 2030)		(Tons per Year)	(Tons per Year)
Food Scraps		15,008	39,550
Yard Trimmings		22,882	22,882
Purchased Wood Chips		15,000	50,000
Recycled Inoculant[1]		5,920	11,603
Overs from Screening		11,315	22,163
Total Incoming Feedstock		**70,125**	**146,198**
Avg. Daily Feedstock Volumes (CY/Day)[2]		768	1,503
Carbon: Nitrogen Ratio	> 20:1	21	22
Moisture Content	≈ 50%-65%	49%	54%
Volatile Solids	> ≈ 80%	77%	80%
Predicted Free Air Space	40% - 60%	64%	61%

Note:
[1]Recycled compost inoculates with acclimated microorganisms.
[2]Assumes the facility is open 5 days a week.

The recipe in **Table 6-1** is based on the Universal Availability Franchise/Subsidized Subscription residential collection model (Chapter 3). If a medium participation is achieved it is estimated approximately 15,000 tons of residential only SSO and 23,000 tons of yard trimmings a year would be captured. Based on the recipe mix, the total incoming material to a facility is roughly 70,000 tons. Including commercial, it is an estimated 146,000 tons.

As discussed in Chapter 3, limits of yard trimmings quantities are expected. The need for roughly 23,000 tons of yard trimmings a year is greater than the yard trimmings that Hamilton County ReSource has direct access to currently. Thus, purchased wood chips were assumed in the recipe to supplement the yard trimmings in order to reach the desired C:N ratios. C:N ratios closer to 20:1 than to 30:1 have a higher risk of odor formation as carbon becomes the limiting microbial nutrient, resulting in excess nitrogen being volatilized off as ammonia and/or amines.

Regional food scrap data is sparse both in the residential and commercial sectors, thus a methodology explained in Chapter 3 estimates food scraps regionally. Assuming the same medium participation is achieved — factoring in estimates of food scraps regionally — shows an additional estimate of approximately 23,000 tons of residential only SSO. More total incoming feedstock would result in a larger facility than estimated in **Table 6-1**.

Footprint Requirements – Alternative A: One Large-Scale Facility

The footprint analysis takes data from the compost recipe model to simulate the production footprint needed for processing defined quantities of feedstocks into compost. Options for several composting methods can be applied. The model includes several steps in the compost manufacturing process:

- Feedstock receipt
- Feedstock storage
- Feedstock mixing
- Contaminant removal
- Active composting
- Curing
- Product screening
- Product storage
- Product sales/load-out

Residence times in composting and curing, and percentage volume losses due to consolidation in each step can be varied.

The footprint model takes the estimated tonnages from the SSO generation models and modifies them into average daily equivalent volumes. These average volumes are used to calculate the amount of space needed for a particular step in the process. Each step in the process was analyzed similarly. Temporary feedstock storage was based on enclosing concrete bunkers. Contaminant removal was based on manual conveyor belt picking lines. Composting approaches modeled in this report included aerated static pile (single-stage positive aeration), aerated tunnel reactors, and aerated agitated bay. Curing approaches modeled were based on turned windrows. Screening yield assumptions were used. Wintertime product storage (4 months) was modeled in trapezoidal piles. Each step was summed up at the end to indicate the likely minimum footprint needed for processing the required volumes of feedstocks.

In addition to processing areas, composting facilities have to provide room for administrative and equipment maintenance functions, interior roadways that can handle tractor-trailer traffic, and buffer zones of healthy vegetation. This report includes a site office (24’ x 32’), 20 parking spaces, an equipment maintenance shop (50' x 80’) and a minimum 50-foot vegetated buffer zone at all property lines.

It was assumed that material receipt, grinding and contaminant removal would take place under a roofed structure to minimize potential for generation of contact water, while composting, curing, screening and product storage would take place outside (note that agitated bay composting is done inside a building).

As the actual composting approach (e.g., ASP, tunnels, agitated bay) is only one portion of the overall composting *system*, only ASP composting was modeled. There are far more ASP composting facilities for SSO than there are tunnel reactor or agitated bay facilities.

Though the weighted evaluation scoring and stakeholder input, did not score a large-scale facility the highest, the Project Team provided a footprint analysis for Hamilton County ReSource to understand the scale. **Table 6-2** summarizes the footprint analysis for the one large-scale composting option (in square feet required).

Table 6-2 Composting Footprints – One Large-Scale Facility

Process Step	Residential SSO (Square Feet)	Residential + Commercial SSO (Square Feet)
Activities under roof/in building		
Feedstock Receipt	11,000	14,000
Feedstocks Temporary Storage - SSO	1,500	3,000
Feedstock Grinding/Mixing	19,800	19,800
Contaminant Removal	2,700	4,400
Subtotal – Under Roof/In Building	***35,000***	***41,200***
Activities outside		
Yard Trimmings Storage	8,000	8,000
Wood Chips Storage	5,000	14,000
Screened Overs Storage	3,000	6,000
Composting Area	122,000	232,000
Curing Area	261,000	473,000
Screening	6,000	6,000
Product Storage Area	64,000	124,000
Equipment Maintenance Bldg. (80' x 50')	4,000	4,000
Site Office (24' x 32', w/ 20 parking sp.)	5,300	5,300
Subtotal- Outside	***478,300***	***872,300***
Subtotal Area Needed	***513,300***	***913,500***
Add 25% for Vehicle/Equip Movements	128,325	228,375
Add 25% for Vegetated Buffers	160,500	285,500
Total Square Footage Needed	802,125	1,427375
Acreage (processing only)	**18**	**33**
Acreage (including other infrastructure)	**20-25**	**35-40**

For a Residential SSO only composting option, Hamilton County ReSource should plan on a 20- to 25-acre site to accommodate storm water management, weigh scales/scale house and other associated infrastructure. For the facility to handle both residential and commercial, Hamilton County ReSource should plan on a 35- to 40-acre site. It is important to recognize that composting is a volume-based materials handling manufacturing system and “wide spots” are needed in the manufacturing process to avoid inventory accumulations that can lead to odor and water quality problems.

Another alternative would be to build two similar facilities on different sites. For the residential food waste-only option, each of these facilities would handle approximately 100,000 CY of compostable material (food scraps, yard trimmings, wood chips and internal materials recycling) per year. For the residential + commercial food scraps option, each site would be handling about 200,000 CY/year.

While some of the materials handling space requirements would shrink proportionately (e.g., feedstock storage areas, composting and curing pads, product storage area, etc.), some space needs would not and would be duplicated between two sites (e.g., waste receipt, feedstock pre-processing, contamination removal, product screening, scales and scalehouse, equipment maintenance, office and parking, access roads, storm water management, buffer zones, etc.). For a single facility, a suggested site size of 20-25 acres is recommended for the residential-only option while a site size of 35-40 acres is recommended for the residential + commercial food scraps option. For two identical sites, each handling one-half of the projected compostable feedstocks, recommended site sizes would be on the order of 15-20 acres for the residential-only option and 27-32 acres for the residential + commercial food scraps option.

Footprint Requirements – Alternative C: Medium-Scale Facility

As mentioned previously, quantities projected to be captured for recovery from households and businesses are heavily dependent on collection and a willingness to participate. Medium-scale composting alternatives could be ideal for designing a phased approach. The smaller-footprint configuration in Alternative C could expand as the program grew and matured. If designed to handle 18,000 tons per year of incoming feedstock, three medium-scale composting facilities would be able to process the modeled volume of residential SSO for Hamilton County.

As with the larger system modeled above, feedstock receipt, pre-processing, and contaminant removal would all take place under roof to minimize formation of contact water. Other compost manufacturing activities would occur outside. The infrastructure of site office, parking, equipment maintenance, vehicle movement space, and vegetated buffer would be similar to the larger alternatives modeled.

The recipe for one medium-scale SSO facility is modeled in **Table 6-3**. Due to the presumed lignin content of the yard trimmings, some additional higher-carbon wood chips are recommended. The footprint needs are summarized in **Table 6-4**.

Table 6-3 Medium-Scale Composting Facility Recipe

Parameter	Targets	Residential SSO only
Annual Tonnage Capacity		(Tons per Year)
Food Scraps		5,000
Yard Trimmings		5,000
Purchased Wood Chips		3,500
Recycled Inoculant[1]		1,421
Overs from Screening		2,734
Total		**17,655**
Avg. Daily Feedstock Volumes (CY/day)[2]		185
Carbon: Nitrogen Ratio	> 20:1	20
Moisture Content	≈ 50%-65%	51%
Volatile Solids	> ≈ 80%	78%
Predicted Free Air Space	40% - 60%	62%

Note:
[1]Recycled compost inoculates with acclimated microorganisms.

[2]Assumes the facility is open 5 days per week

Table 6-4 Composting Footprint – Medium-Scale

Process Step	Bunkered ASP (Square Feet)
Activities Under Roof/In Building	
Feedstock Receipt	3,900
Feedstocks Temporary Storage – SSO	900
Feedstock Grinding/Mixing	19,800
Contaminant Removal	900
Subtotal – Under Roof/In Building	***25,500***
Activities Outside	
Yard Trimming Storage	2,000
Wood Chips Storage	2,000
Screened Overs Storage	1,000
Composting Area	46,000
Curing Area	44,000
Screening	4,700
Product Storage Area	20,000
Equipment Maintenance Bldg. (80' x 50')	4,000
Site office (24' x 32', w/ 20 parking sp.)	5,300
Subtotal- Outside	***129,000***
Subtotal Area Needed	***154,500***
Add 25% for Vehicle/Equip Movements	38,625
Add 25% for Vegetated Buffers	48,300
Total Square Feet	**241,425**
Acreage (processing only)	**6**
Acreage (including other infrastructure)	**6 – 8**

Hamilton County ReSource should plan on a 6 to 8-acre site to accommodate storm water management, weigh scales/scale house and other associated infrastructure.

Of the four composting alternative options, the medium-scale facilities received the highest score (see Chapter 5). If each site is designed to annually handle 18,000 tons of food scraps, yard trimmings, and supplemental materials, such as wood chips. Three medium-scale composting facilities would be able to process the modeled volume of residential organics for Hamilton County. Depending on site availability and size, one configuration would be to build an initial 18,000 tons per year tranche of capacity and then, in future years as the diversion program grows and matures, add additional processing capacity for feedstock storage, composting, curing, and product storage. (See Appendix D for a case study on Pope/Douglas County implementing this initial design and capacity growth approach.)

Developing three different sites in the region would require some duplication of materials handling

equipment (e.g., front-end loaders) but some equipment (e.g., screens) could be shared between sites. This of course, depends on any public private partnership arrangements.

Because of the potential for growth and commercial volume, the design could be one that uses a phased approach.

CHAPTER 7 Markets and Applications

It is important to first look at existing compost markets when planning an organics processing facility. If SSO is going to be collected, transported to a facility, and then processed, there needs to be a clear end market or need for the finished compost. The success of a composting facility rests on its ability to produce a consistent high-quality product. Compost is a valuable material that has beneficial uses such as soil conditioners, erosion control, and improved soil nutrient retention. The compost industry has made improvements to optimize separation of contaminants from compost in the refinement step, using different configurations of screens, destoners, and air separators to maximize contaminant removal. The reader should note that units used in this chapter are volume-based units (e.g., cubic yards) rather than the weight-based units (e.g., tons) reported previously, as compost is normally sold on a cubic yard (CY) basis.

Market Applications

There are many markets and applications for compost which include: agricultural and horticultural, landscape and nursery, vegetable and flower gardens, sod production and roadside projects, wetlands creation, soil remediation and land reclamation, sports fields and golf courses, and sediment and erosion control. **Table 7-1** summarizes the major markets for compost and the potential for markets or market development in Hamilton County.

Table 7-1 Market Assessment Application

Market and Application		Market Condition	Hamilton County Potential
Agricultural	Amend soil (improves infiltration rates, water holding capacity, and soil tilth) Fertilize soil (supplement nitrogen, phosphorous, potassium)	Growth potential - largely untapped	1% or approximately 18,000 farmed acres of Hamilton County total acreage (~264,320 acres) Agricultural land use: Cropland (47%), Pastureland (11%), Woodland (22%), Other (20%). Top economic product: Grains, oilseeds, dry beans, dry peas. Ranked number 73 out of 88 in the State of Ohio *Source: Census of Agriculture County Profile: 2017*
Construction	Amend soil (improves infiltration and binds erodible sediment) Grow vegetated cover	Growing	Research found no post-construction soil policy to use compost in Hamilton County. Potential: Model Compost Procurement Policy - policy will enhance use of compost in construction projects. *Source: (Environmental Law Institute and the Natural Resources Defense Council)*

Market and Application		Market Condition	Hamilton County Potential
Green Infrastructure	Apply to green roofs, bio retention cells, or rain gardens Manage runoff and erosion	Growing	Research found no LEED-adopted policies in Hamilton County.
Homeowner and Community Gardens	Soil health Sustainable food systems	Pivotal market – swell toward locally-grown fruits and vegetables	In 2021, the homeownership rate in Hamilton County is approximately 59%, which is slightly lower than the Ohio approximate average of 66%. Research found over 70 community gardens in Hamilton County. *Sources: Data USA, Civic Garden Center*
Sod/Turf Production	Improve turf and sod quality Benefits sod production economics	Growth potential - Largely untapped	Research found 8 sod/turf producers in Hamilton County. *Source: Reference USA*
Landscaping	Retains water – beneficial as water shortages become more common Improve root growth and plant establishment	Established Largest market using compost	Research found 133 landscaping companies in Hamilton County. *Source: Reference USA*
Nursery	Grow media or substrate for containerized crops Amend soil Minimizes cover crops	Established	Research found 39 retail nurseries, lawn, and garden supply stores (SIC 5261) in Hamilton County. *Source: Reference USA*
Athletic Fields and Golf Courses	Extended color retention Light mulch on new seedlings Offsets chemical use of fertilizers and pesticides	Growth potential	Research found fourteen golf courses and more than 40 athletic fields in Hamilton County.
Land Reclamation	Improve marginal land Increases carbon storage sequester carbon	Growth potential	Potential for any development projects.

Compost Marketing and Sales

Once potential market applications have been explored for Hamilton County, the next step is to consider how the compost end product will be marketed and sold to different customers and end markets. Compost sales and marketing require different strategies, depending on the customer base and end market to be pursued. The first step in assessing potential demand for compost in the region will be to examine both traditional and emerging compost market segments for Hamilton County.

Traditional markets for compost and compost-based soils are landscaping and agriculture; and mulch markets are landscaping. Emerging new compost markets with high potential are in non-point source water quality management (i.e. rain gardens), sediment filtration and erosion prevention, low-impact development infrastructure, and in carbon sequestration/climate action plans. In some areas, a developing market for mulches is agricultural weed suppression. Market segments are summarized in

Table 7-2.

Table 7-2 Market Segments For Compost

	Dollar Markets	Volume Markets
Traditional Markets	Landscaping Turf grass	Landscaping (large projects) Agriculture – traditional Agriculture - specialty Containerized horticulture Engineered soils Private and municipal construction
Emerging Markets	Storm water quality management Green roofs Sports turf	Sediment and erosion control Landfill closure/ land restoration Carbon sequestration/climate action plans Development in soil organic matter programs Local government sustainability programs

Another emerging market trend that has evolved in recent years is the production of compost-based soil blends. This is driven by composters' need to diversify markets and reduce the seasonality of compost sales. Compost-based soil blends (usually blends of sands and/or sandy loam soils and composts) are made and marketed to consumers as topsoils, specialized plant soil amendments (e.g., Kellogg Garden Products Palm, Cactus and Citrus all-purpose indoor and outdoor mix), and to contractors and professional consumers for athletic field turf grass growth and maintenance media, storm water management vegetative growth media, golf course root zone mix, etc. Compost made from a variety of feedstocks can be used to make compost-based soil blends.

This feasibility study uses projections through 2041. Based on projected feedstock quantities for the year 2041, the following cubic yards of finished compost could be produced:

Table 7-3 Estimated Finished Compost Volume

Processing Options	Finished Compost Estimate (Cubic Yards per Year)	Recommended Number of Sites/Facilities	Total Annual Finished Compost Estimate (Cubic Yards per Year)
One Large-Scale Facility	≈ 150,000	1	≈ 150,000
Two Large-Scale Facilities	≈ 150,000	2	≈ 150,000
Three Medium-Scale Facilities	≈ 50,000 each	3	≈ 150,000
Small-Scale Community Composting	≈ 2,500 each	40+	≈ 100,000+

The size of the developed facility would help determine how compost product would be sold. Most large-scale facilities sell their product(s) as wholesalers to retail landscape supply centers. To determine how compost product would be sold, it is recommended market assessment and development will include a detailed marketing plan, along with comprehensive market research on distribution channels, buyers, competing products, and market communication channels. It would improve the potential for valid public private partnership proposals if Hamilton County could provide some perspectives on market strengths / weaknesses / opportunities / threats.

A detailed marketing plan is recommended to determine how compost product would be sold

Compost Demand

One of the most important factors to consider in any market analysis is whether there will be enough demand for the commodity produced. In this case, the question is whether there will be adequate demand to accommodate the potential supply of compost in and around Hamilton County. The GT Project Team conducted a preliminary demand analysis to discern a reasonable projection for the amount of compost that could be utilized in the area.

Residential landscaping at owner-occupied single-family dwelling units (O-O SFDUs) will likely be the main market for compost from a Hamilton County facility. The number of O-O SFDUs in the capture zone is approximately 225,000. Assumptions were made about likely landscaped ornamental bed areas (500 SF/house), turf grass areas (3,000 SF/house), percentage of homeowners using compost, and Hamilton County ReSource market share capture percentage (25% of market). This residential landscaping market has the potential to absorb more than 45,000 cubic yards per year of compost from a Hamilton County organics recovery system. Capturing this market share will require both a well-executed marketing plan and would benefit from support from local and regional governments promoting the use of compost made from food scraps.

Should Hamilton County decide to pursue a composting facility, it would be worthwhile to explore the feasibility of the County, and its political subdivisions, adopting a minimum soil organic matter content ordinance or mandate for new developments and a soil profile rebuilding requirement for redevelopment. This would create an internal “structural demand” for local compost and have ancillary benefits in improved storm water management (e.g., less runoff and more infiltration).

Table 7-4 Landscaping – Turf and Ornamental

County	Hamilton County
# Owned SFDU's (detached only)	226,444
Avg. SF beds (SF/SFDU)	500
Application Rate (CY/1K SF/yr.)	3
Bed Usage (CY/yr.)	339,665
Avg. SF Turf	3,000

County	Hamilton County
Application Rate (CY/1K SF/yr.)	1.5
Turf Usage (CY/yr.)	1,528,494
Total Usage (CY/yr.)	1,868,159
% Using	10%
Hamilton County Mkt. Share	25%
Hamilton County Sales (CY/yr.)	46,704

Compost use is a well-established practice in organic agriculture and is becoming a larger phenomenon in conventional agriculture. The supporting research shows the benefits of compost for crop yields, disease suppression, weed control, and improvements in soil quality from compost additions to agricultural soils. Other benefits to compost use in agricultural soils include improved soil organic matter, increased soil water-holding capacity (resulting in reduced irrigation demand), increased soil microbial activity (one of the reasons for improved disease suppression), long-term slow-release of plant nutrients, and improved soil pH buffering. The main drawbacks to its use in agriculture are the cost of transport to the fields and a historically low willingness-to-pay by farmers. Consequently, many compost professionals use agricultural markets as “relief valves” to clear space at their composting facility when needed.

Product used as an agricultural soil amendment does not need to be as mature and stable as compost used in landscaping or in container mixes as it is often incorporated into soils after crop harvest and allowed to “winter over” until the following spring planting season. Application rates depend on local soil testing for organic matter but are normally less than 20 tons per acre per year (approximately 40 CY/acre/year). This application rate typically achieves a planted soil organic matter content of 3 to 5% over a 3 to 5-year period.

The 2020 National Agricultural Statistics Survey reported more than 250,000 acres of farmland cropped in the seven counties in the Hamilton County region (**Table 7-5**). Primary crops grown are vegetables, orchards, soybeans, and corn for grain and silage. About 26% of this land is used to grow hay for animal feed. Making assumptions about likely application rates (20 tons/ac/yr), percentage of farms using compost (5%), and Hamilton County ReSource market share (30%), Hamilton County could move more than 95,000 CY per year (approximately 42,750 tons) into this market (**Table 7-6**), but the cost of application to farm fields (about $8/ton) depresses product sales prices (~ $4-$6/CY).

Offsetting this price pressure is a new Conservation Practice (CP 336 – Soil Carbon Amendment) a cost-share program under the USDA’s Natural Resources Conservation Service (NRCS). CP-336 has been adopted by the Ohio office of NRCS and will pay farmers up to $272/acre for compost used in their fields made at off-farm sites.

Table 7-5 Harvested Cropland by Crop and by County in Greater Cincinnati Region, Acres (2022)

County	Barley	Corn for Grain	Corn for Silage	Hay	Soybeans	Wheat	Vegetables	Orchards	Totals
Hamilton, OH		2,285		1,601	2,945		362	89	7,282
Butler, OH	136	18,231	570	10,790	26,235	3,475	110	367	59,914
Warren, OH		21,201		5,570	34,580	1,164	296	196	63,007
Clermont, OH		15,075		6,711	35,001	318	73	35	57,213
Ohio, IN		1,581		3,291	2,036			38	6,946
Switzerland, IN		7,809	64	5,823	10,881		14		24,591
Campbell, KY		357	40	8,095			50	37	8,579
Kenton, KY		298	154	7,874			50	73	8,449
Boone, KY		1,543	34	17,748	2,156		150	136	21,767
Totals	**136**	**68,380**	**862**	**67,503**	**113,834**	**4,957**	**1,105**	**971**	**257,748**

Table 7-6 Hamilton Potential Agricultural Market - Low Estimate

Crop	Crop Acreage	Application Rate (Tons/Ac./Yr.)	Percent Using	Acreage (Ac./Yr.)	Compost use (Tons/Yr.)	Compost use (CY/Yr.)	Hamilton Mkt Share[1]	Hamilton Sales (CY/Yr.)
Grains	73,473	20	5%	3,674	73,473	124,110	30%	37,233
Vegetable	1,105	20	5%	55	1,105	1,867	30%	560
Orchards	971	5	5%	49	243	410	30%	123
Soybeans	113,834	20	5%	5,692	113,834	192,287	30%	57,686
Totals	**189,383**							**95,602**

[1]Estimate of potential demand.

There are many factors at play that make projecting the horticultural and agronomic demand for this commodity challenging. However, it does appear that given the circumstances described there could be adequate demand to accommodate for the supply produced should Hamilton County facilitate the development of a composting system, subject to the design and implementation of a well thought-out marketing plan.

Implementation Considerations

If Hamilton County ReSource contracts with a third-party developer for the design, construction and operation of a composting facility, the developer will normally assume responsibility for compost marketing and sales. Hamilton County has an opportunity to enhance the sales of the product with education and outreach to County residents and businesses, potentially, with policies that develop an internal “structural demand” for the product. It is also possible to develop a revenue-sharing agreement with the developer.

Should Hamilton County decide to move forward with a municipally-operated composting facility, then the County should develop a detailed marketing plan for compost that assesses:

- Competition analysis,
- Strengths/Weaknesses/Opportunities/Threats,
- Marketing objectives and strategies,
- Market communication mechanisms, including branding and social media; and
- Resource allocation and monitoring.

CHAPTER 8 Development and Operating Models

A mechanism for Hamilton County ReSource to develop and manage composting infrastructure is with public-private partnerships (PPP). A PPP is a joint relationship between a public and private, for-profit, or not-for-profit sectors that formally commits all parties to providing a service. The public and private partners generally share responsibility for any one or more of the following activities:

- Deciding to provide a service in a community
- Financing the project using public and/or private funds
- Designing and/or constructing the facility
- Operating and maintaining the facility or service

A PPP could provide the resources and expertise of the private sector, foster new solutions, and bring private financing to the project. There is no standard definition of PPP and can describe a range of types of agreements between the public and private sectors. Typically, the initiative provides a public asset or service, in which the public and private party share risk, responsibilities, and rewards. How much risk depends on the arrangement.

This chapter explores PPP arrangements and partnership examples. Please note that some PPP models are not currently used in organics recovery systems, but that does not mean Hamilton County should eliminate them from consideration.

Public-Private Partnership Models

The primary objective of a PPP is to combine the efficiency, innovation, and financial resources of the private sector with the public sector's regulatory authority, public interest focus, and access to public assets. One characteristic of a PPP is that each party contributes:

- Resources
    - Financial
    - Human
    - Technical
- Support
    - Information
    - Political/legislative guidance
- Decisions
    - Participation
    - Shared process

In general, there are five PPP models:

1 Service Contracts

2 Management Contracts

3 Lease Contracts

4 Build Operate Transfer Contracts

5 Franchise Agreements / Contracts

Tables 8-1 through **8-5** summarize the roles of the public and private sector in each model.

Table 8-1 Service PPP

1 Service PPP Public Sector Role	Service PPP Private Sector Role
• Retains ownership and control of all capital assets and property and must finance fixed assets and working capital • Establishes the performance criteria, evaluates bids, selects and supervises the contract, and monitors the work to be carried out to ensure the contractor meets the performance specification • Ensures that it has sufficient revenue to pay contractor	• Manages personnel and services • Carries out the service to the specification established in the agreement and agrees to a fee for service. The municipality is the client of the contractor and the source of the contractor's payment

Many food scrap compost facility PPPs are structured with Service Contract PPPs where the public partner invests, either partially or fully, in the site development and agrees to deliver a specified amount of feedstock to the facility. The public partner investment could be land or equipment. The public partner often pays a tipping fee to the private operator for processing the feedstock. The private partner frequently is responsible for all operating and maintenance (O&M) expenditures and may have to secure additional debt or equity to finance development costs.

Hamilton County would face a barrier in this type of PPP because they have minimal feedstock they could guarantee for a facility. Hamilton County could leverage the yard trimmings from the Yard Trimmings Drop Off programs but collection of food scraps and other yard trimmings is outside of Hamilton County's control.

Table 8-2 Management PPP

2 Mgt. PPP Public Sector Role	Mgt. PPP Private Sector Role
• Retains ownership of assets • Responsible for capital expenditures, working capital, and the commercial risk associated with collecting service fees from users	• Manages operations without committing substantial investment capital or accepting the bulk of the commercial risk • Responsible for recovering O&M costs

Mgt. PPP Public Sector Role	Mgt. PPP Private Sector Role
• Monitors the management contractor to ensure they meet performance standards	• In short-term contracts, manages specific tasks • In longer-term contracts, responsible for all aspects of delivering the service and must introduce technical and management skills and bring specific improvements to the service delivery process

In a Management PPP, the public partner would also invest in the composting facility and award a contract for O&M. Under this scenario, the operator would charge Hamilton County ReSource for operations, and parties may negotiate profit and loss sharing. The primary difference between Service and Management PPPs is that the public partner does not guarantee the amount of feedstock, and subsequently revenue, to offset the O&M costs.

Table 8-3 Lease PPP

3 Lease PPP Public Sector Role	Lease PPP Private Sector Role
• Responsible for the capital investment required to upgrade existing assets or extend infrastructure to new areas	• O&M of the leased assets. In exchange for the exclusive right to use the assets to deliver service, the operator typically pays rent to the municipality and generates revenue by collecting fees from users for the services delivered • Bears the commercial risk of nonpayment; this is a fact that distinguishes leases from management contracts

The public sector frequently uses this model when privatizing waste collection and has outstanding debt on its existing fleet. The municipality leases its existing fleet to the private operator, and the private operator assumes the risk of collecting payment from customers. It is unlikely that this PPP model would apply to a new composting facility/infrastructure unless the private sector used a municipal fleet to collect food scraps.

Table 8-4 Build-Operate-Transfer PPP

4 B.O.T PPP Public Sector Role	B.O.T. PPP Private Sector Role
• Becomes both the customer and the regulator of the service • Agrees to purchase a minimum level of service over time • Eventually assumes ownership of the facility and operations	• Provides the capital to build the new facilities • Assumes the risk of operating the facility • Agrees to transfer the facility to the public partner after an agreed-upon period

Under this PPP model, the public sector would issue a request for proposals (RFP) and contract with a private partner to own and operate a composting facility for an agreed-upon time and then assume ownership/operations at the end of the contract term. The public sector may use this approach when they do not possess the institutional capacity to operate and maintain the facility. It is common for these contracts to require extensive provisions and authority for the public partner to monitor and regulate the facility and inspect equipment since they will eventually assume ownership. Some private partner staff may stay after they transfer ownership to the public partner. Public partners may assist the private partner to secure grants.

The primary difference between B.O.T model and the first three options is that the public sector's role is usually limited to regulatory oversight, while they intend to take over facility ownership at the end of a specified time period. Thus, it is essential that all parties agree to contractual arrangements for items such as land and equipment maintenance and ultimately property transfer.

Table 8-5 Franchise/Contract PPP

Franchise PPP Public Sector Role	Franchise PPP Private Sector Role
• Awards a franchise/contract agreement through a competitive process • Establishes performance standards • Ensures that the franchisee/contractor meets performance standards • May be responsible for the regulation of price, quantity, and quality • Sometimes provides land/utilities • May guarantee to deliver a specified quantity of feedstock and to purchase output	• Carries out any capital investments required to build, upgrade, or expand the system and is responsible for financing those investments • Responsible for capital and operational costs, including infrastructure, energy, raw materials, and repairs. In return, the private operator collects the fees directly from the system users

Under this scenario, the public sector would conduct a competitive procurement process to award a franchise for the processing and possibly collection of food scraps. There are primarily two types of franchise arrangements for MSW collection/processing services: non-exclusive and exclusive.

In a non-exclusive franchise agreement, multiple service providers compete with one another to provide service to individual customers. Customers decide which company they will use.

An exclusive franchise agreement is when the public sector partner typically awards a contract to a single hauler. This exclusive arrangement can be for the entire political jurisdiction or certain zones. Customers are required to subscribe for service from the franchised service provider. Sometimes, exclusive franchise agreements include standard rates that the public partner sets.

In both types of franchise systems, the public partner may assess a franchise fee, and the public partner can use the revenue from this fee to offset other expenses incurred. The City of Cincinnati requires commercial waste haulers to pay a franchise fee quarterly to the city equal to 20% of the franchisee's gross revenues. Cincinnati does not assess a franchise fee for commercial recycling collection.

A contract is similar to a franchise agreement. However, a contract is a formal agreement between two entities (in this context, Hamilton County and a private service provider) for specified services at an agreed-upon price. Typically, the public partner awards a contract through a competitive bid or proposal process, which may also include negotiations. In a contract, the public partner tends to have more oversight and involvement in the services than in a franchise system. For example, the public partner may pay the service provider(s) directly and bills residents on their property tax or utility bills.

Hamilton County ReSource has contracts with private companies to operate its yard trimmings drop-off sites. This is similar to the relationship between commercial food scrap generators and GoZero, where the generation establishment contracts for service.

PPPs and Risk Management

Three factors can characterize risk:

1. The risk.

   The possible occurrence that would affect the achievement. For example, if the compost facility does not receive enough feedstock, will they be able to sell enough product to recover development and O&M costs?

2. The likelihood of the risk occurring.

   The potential of the compost facility not receiving enough feedstock could be mitigated if there are delivery agreements.

3. Impact of the risk occurring.

   The impact could be financial, social, environmental, and/or political. If one compost facility is not successful, it may be difficult to obtain support for financial investment, social acceptance, and political support for additional compost facilities.

Strategies for mitigating risk in developing organics recovery infrastructure in Hamilton County include:

- Identify the risks before beginning the PPP procurement process.
- Assess the risk from both qualitative and quantitative angles before issuance of procurement documents and present to public partner stakeholders. Typically, the government agency that is progressing the PPP first presents the risks to internal officials to ascertain their perspective on whether additional risks can be considered and if there are any unacceptable risks. This process may define the most appropriate PPP model. Next, the government agency may seek input from external stakeholders. In this instance, it may be the community that will host the facility, organic waste transporters, investors, or compost end users.
- Develop a plan to respond to the risk, which assigns responsible parties and include it in procurement documents. Responses could include:

  - Avoidance
  - Prevention
  - Transfer
  - Retention - Basic principle: the risk should be borne by the party best able to manage it
- Reduce risk reoccurrence.

In deciding which PPP model is best for Hamilton County, the public partner should consider the level of risk the public wants to assume. Of the five PPP models, the Service PPP allocates most of the risk to the public partner, while the private partner assumes most of the risk in the franchise/contract agreement model.

Table 8-6 shows potential risks associated with developing, designing, constructing, operating, and funding a composting facility and possible public sector risk mitigation strategies.

Table 8-6 Compost Facility Risk Management

Risk Category	Examples	Mitigation
Development Risk	• The private sector cannot obtain land	• Public partner provides site
	• The site cannot be developed	• Public partner conducts environmental impact assessment (EIA) before RFP is issued
Design Risk	• The facility does not operate properly due to facility design	• Public partner requires certified engineering drawings and independent engineering reviews
	• Individual components do not work as an integrated system	• Public partner tours operating sites and provides case studies
Construction Risk	• Incorrect time estimates	• Include rewards and penalties in contract documents • Internally allocate contingency time
	• Not in my backyard (NIMBY). The facility can't be constructed due to public opposition	• Obtain support from neighbors before RFP is issued
Operational Risk	• Lack of adequate (both quantity and quality) feedstock	• The public partner controls the collection of feedstock
	• Limited markets	• Agreement/contract includes revenue/risk share provisions
	• Unable to obtain permits	• Public partner obtains permits
	• Lifecycle maintenance costs	• Full-cost accounting used

Risk Category	Examples	Mitigation
	• Non-performance	• The agreement or contract includes incremental penalties
Financial Risk	• Expenditures exceed budget estimates	• Have an explicit agreement/contract on: o Inflation o Contamination rates o Market prices o Utility costs o Labor force o Program modifications o Unforeseen circumstances

Example Partnerships

The GT Project Team is aware of many food scrap composting programs in the United States. While the franchise/contract system presents the least risk to the public partner, it may decrease the level of private sector partners willing to develop a facility. The most common PPP model for developing food scrap recovery systems is some version of a service agreement (PPP Model 1). San Antonio, TX and Ann Arbor, MI are traditional service agreement PPPs.

Prince William County, VA has a service agreement but with a much more limited role in developing the facility. Their service agreement provided land but did not include financial investment for facility development. The Prince William service agreement also requires the contractor to remove equipment and transfer the site back to the county at the end of the agreement. Thus, we consider the Prince William County PPP approach a hybrid of a service agreement, build-operate-transfer (PPP Model 4) and franchise agreement/contract (PPP Model 5).

In each of these three case studies, the public partner pays a tipping fee to the private operator in addition to financially supporting some site development costs. The fee is negotiated and is often dependent on the amount of public investment (i.e. land value and capital such as equipment) and the quantity and quality of guaranteed feedstock.

The final case study is from Cary, NC, where Cary did not play a role in developing the site and does not guarantee feedstock quantities. This one reflects the franchise/contract approach to a PPP (Model 5).

As we previously discussed, the Lease Contract would not apply to Hamilton County ReSource since a composting facility is not currently owned. The following are communities recommended to Hamilton County ReSource to consider as potential organics recovery PPP models.

San Antonio, Texas

- PPP model: Service contract
- Public role: Owns property, invested in equipment, collects and delivers residential feedstock, manages residual waste, pays a tipping fee of $27.50

- Private role: Operates and maintains the facility, markets the compost, accepts residential feedstock from sources outside of San Antonio

In 2012, the San Antonio Solid Waste Management District (San Antonio) introduced a combined yard trimmings and food scraps pilot program (organics) to 30,000 residents. During the pilot, participants subscribed for a 96-gallon green cart and paid $3.00 monthly. Very few residents subscribed to the program. In 2017, the San Antonio City Council waived the fee, and all San Antonio customers received a green cart. At the end of 2019, the city collected over 68,000 tons of organic material. However, only a small percent of the organics (about 3%) are food scraps. San Antonio has done some surveying, and many residents are concerned about odors and vermin if they put food in the carts. Also, almost all households have in-sink garbage disposals. The processing facility desperately needs more nitrogen even though the facility receives about two semi-loads of food daily from grocery stores.

San Antonio delivers organics to the Atlas composting facility. The city owns the land (former city landfill) and contracts with Atlas for the compost facility operations and maintenance. Atlas holds the operating permits and is responsible for compliance. The city awarded the contract in 2020. The previous operator rejected all loads due to extremely high contamination, including many plastic bags, rigid plastics, hoses, and 96-gallon carts. (When the collection vehicle's arm lifts and tips the cart, it's not uncommon for the cart to fall into the truck.)

Atlas uses a multi-tiered approach to remove contaminants. First, it has five full-time sorters who manually remove contaminants. Next, the organics are run through a shredder that feeds the material onto a conveyor system that uses artificial intelligence (AI) to remove contaminants. Finally, the processed organics are screened. From what Atlas shared, they have no problem marketing the bulk material.

The AI system costs about $5 million, and the city paid for it in exchange for a lower tipping fee. Also, the city is exempt from state and local sales tax. Like many cities, funds for solid waste tip fees come from an O&M budget, and capital improvement pays for capital costs. The San Antonio City Council is more concerned about O&M budgets as that more directly impacts residential solid waste rates. In addition to paying for the equipment, the city pays for disposal of contaminants if they exceed 5% by weight.

Ann Arbor, Michigan

- PPP model: Service contract
- Public role: Owns property, invested in equipment, collects and delivers residential feedstock, and pays a tipping fee of $28.00 per ton.
- Private role: Operates and maintains the facility, markets the compost, and accepts feedstock.

The city offers single-family residential properties one free 64- or 96-gallon compost cart if the homeowner picks up the cart from the city. Additional carts are available for a fee of $55. If the homeowner wants the cart delivered the cost is $61 per cart.

The city accepts:

- Plate scrapings and food scraps (including meat and bones)*

- Grass clippings*
- CMA-W certified compostable products*
- Leaves and brush
- Branches less than 6 inches diameter (must fit in cart with lid closed)
- Unpainted, untreated lumber (must fit in cart with lid closed)
- Weeds
- Undecorated and cut up Christmas trees
- Garden pruning, garden surplus, crab apples, etc.
- Used, cool wood ashes make great garden and flower bed fertilizer.

* These items must be contained in the cart.

The city does not accept BPI certified or other "compostable" plastic-like products.

Odor concerns are a significant barrier to people putting food scraps in composting carts. To increase the number of residents participating in the programs and deliver sufficient quantities of feedstock to the composting facilities, the city recommends the following odor prevention techniques:

- Sprinkle baking soda in compost cart and in the kitchen composter
- Store compost cart in the shade during warm weather
- Empty the contents of kitchen composter into your compost cart frequently
- Drain as much liquid as possible from food scraps before adding them
- Wrap extra-smelly food scraps in newspaper before placing in cart or put in the freezer until collection day
- Layer food scraps in between yard trimmings
- Rinse out kitchen countertop container and compost cart before materials build up
- Spray inside of compost cart with a vinegar and water solution

The city services the organics carts once a week and delivers the material to the city-owned composting facility.

In 2018, the city contracted with WeCare Denali for all management, supervision, personnel, materials, equipment, services, and supply expenditures necessary to operate and maintain the site. WeCare Denali also incurs all expenses associated with marketing the end products. The city currently pays WeCare Denali $28.00 a ton for these services.

The contract term is for five years with an option for two five-year renewals on the same terms. The option to renew shall be at the city's sole discretion, subject to agreement by the WeCare Denali.

The city conducts quarterly inspections to determine that repair and maintenance is being done properly. The City maintains the entrance and entrance roads on the city's property up to the compost site unless maintenance is required because of the acts or omissions of WeCare Denali.

WeCare Denali must allow residents to deliver 1 cubic yard per household per day of acceptable yard trimmings and food scraps, at no charge. The facility accepts household material Monday through Friday, 7 a.m.–4 p.m., with a valid driver’s license showing a City of Ann Arbor address.

To obtain free compost and/or mulch, residents can visit the compost facility on Saturdays only, 7 a.m.–11 a.m. between mid-April and late June, or while supplies last. They need to bring a valid driver's license with a city of Ann Arbor address. The limit is 1 cubic yard.

Prince William County, Virginia

- PPP model: Service contract with franchise agreement/contract and DBOT provisions
- Public role: Owns property, collects residential feedstock, pays the private operator a tipping fee of $33.00 to $38.00 a ton, depending on the type of organic material and whether it is bagged. Allows the private operator, Freestate Farms, to dispose 10,000 tons per year of residual waste at the landfill at no charge
- Private role: Invested in facility development, operates and maintains the facility, markets the compost, accepts feedstock

The Prince William County, Virginia Board of County Supervisors (county board) owns and operates the Balls Ford Road yard trimmings composting, mulching, and citizens convenience center. The county board also owns and operates the Prince William Sanitary Landfill (landfill). The board granted Freestate Farms the right to use a portion of Balls Ford to:

- Process material to produce and sell compost, mulch, specialty soil products, renewable energy, and greenhouse gas reduction (the "output")
- Dispose of the process residue at the landfill, and the non-processible fraction of the material at the landfill or at Balls Ford, as applicable
- Operate the mulching operation and site at the landfill,
- Ability to enter upon the site to design, construct, own, operate and maintain a facility to produce the output (the facility). The county board made no representations or warranties of any kind as to the condition or suitability of the facility site.

The initial term of the service agreement is 20 years, with two additional five-year periods. Freestate Farms must remove all its equipment within 12 months of the service agreement expiration and leave the facility site. Freestate Farms shall leave the facility site in a similar condition as it was on the commencement date. Any unprocessed or finished material remaining on site after the service agreement expiration shall become the board's property.

During the first two years of operations, the county board agreed to deliver 120,000 tons of organics annually, which increased to 250,000 tons in year three and remains constant through the agreement term. The county board pays a tipping fee of $33.00 to $38.00 a ton, depending on the type of organic material and whether it is bagged. Also, during the first two years of operation, Freestate Farms could dispose of up to 5,000 tons of residuals at the landfill at no charge. That increased to 10,000 tons in year three. Also in year three, Freestate Farms must pay the board $50,000 as an annual revenue share payment.

Cary, North Carolina

- PPP model: Contract agreement

- Public role: Currently collects yard trimmings curbside and operates a food scrap drop off site. Yard trimmings are composted at private facility and Cary does not guarantee a certain amount of yard trimmings to be delivered. City contracts for weekly collection from the food scrap drop-off and pays a tip fee of $17.62 per ton for yard trimmings; the food scrap tip fee will be $45 per ton if Cary begins a curbside food scrap collection program. Cary pays $205 per load and a fuel surcharge for transportation from the food scrap drop-off site.
- Private role: Invested in facility development, operates and maintains the facility, markets the compost, accepts feedstock from Cary and other communities.

The Town of Cary (Cary) contracts with the McGill Regional Composting Facility at Merry Oaks (McGill) for yard trimmings composting. This facility opened in 2002 and is about 30 minutes south of Raleigh.

Originally constructed to accommodate aerated, open bay (banked) composting, McGill retrofitted a few years ago for encapsulated processing to improve odor management and process efficiency and to add indoor, aerated curing. McGill incurred all the expenses with this retrofit. As a result, the site can process more material in the same space while ensuring consistent product quality.

McGill must ensure that all drawings, specifications, plans, surveys, reports, technical memoranda, testing protocol, designs, electronic databases, and other documents and all deliverables comply with all laws and regulations. McGill Contractor is responsible for all applicable taxes and license fees and shall acquire all licenses and permits required by respective laws and regulations.

The contract term is three years, beginning on July 1, 2021, and ending on June 30, 2024. Through a duly executed written amendment to the contract, the parties may mutually agree to a two-year renewal beginning July 1, 2024, and ending June 30, 2026. Cary can terminate without cause and for its convenience upon ten days' written notice to McGill.

Cary only collects residential yard trimmings curbside but has a combined yard trimmings and food scrap drop-off site. Cary delivers the curbside collected yard trimmings to McGill, and McGill services the drop-off site. McGill currently charges Cary $17.62 per ton for yard trimmings, and the food scrap tip fee will be $45 per ton if Cary begins a curbside food scrap collection program. Cary pays $205 per load and a fuel surcharge for transportation from the food scrap drop-off site.

CHAPTER 9 Ohio Regulations

Regulatory Requirements

The State of Ohio regulates composting as a solid waste disposal activity. Ohio law defines composting as a method of solid waste disposal using controlled biological decomposition.

Ohio EPA classifies composting facilities by the feedstocks they accept and requires facilities to obtain a registration, license and/or permit from Ohio EPA, as applicable. The classifications and what they are authorized to accept are:

- Class I: Mixed solid waste
- Class II: Yard trimmings, agricultural plant materials, animal waste, dead animals, raw rendering material and food scraps
- Class III: Yard trimmings, agricultural plant materials, animal waste, and dead animals, raw rendering material
- Class IV: Yard trimmings and agricultural plant materials

Class IV composting activities occurring at a residence and those activities using less than 500 square feet at a non-residential location are not subject to Ohio's composting regulations.

Facilities over 500 square feet must register and obtain a license (essentially permit-by-rule), which requires an annual fee based on the daily amount of tonnage handled, a plan of financial assurance, and a daily maximum amount of materials to be indicated by the operator. The "allowed daily maximum" waste receipt prevents the facility from receiving more material than it can handle in 24 hours. It gives the operator a baseline to avoid material back-up and related long-term issues.

Ohio's performance-based regulation requires quality levels to be met but does not dictate the exact way to achieve those standards. Operators of registered composting facilities in Ohio are responsible for determining and abiding by their capacities.

Even in the case of larger facilities (over 500 square feet) that require an on-site material limit, Ohio mostly avoids constrictive thresholds. It thus allows the operator to indicate this amount, based on facility capacity.

Table 9-1 Overview of Ohio Class I through IV Compost Processing Facilities

	WASTE MATERIALS ACCEPTED	FOOD SCRAPS?	SIZE RESTRICTIONS?
CLASS I	Mixed Solid Waste	Yes	No
CLASS II	Source-separated yard trimmings , agricultural waste, animal waste, **food scraps**	Yes	No

	WASTE MATERIALS ACCEPTED	FOOD SCRAPS?	SIZE RESTRICTIONS?
CLASS III	Source-separated yard trimmings , agricultural waste, animal waste	No, source-separated spent coffee and tea grounds only	Yes, the material placement area is limited to a maximum of one hundred thirty-five thousand square feet.
CLASS IV	Source-separated yard trimmings	No, source-separated spent coffee and tea grounds only	No

A more thorough overview of materials accepted at each licensed facility is listed in **Table 9-2**.

Table 9-2 Accepted Materials at Compost Facilities

	CLASS I	CLASS II	CLASS III	CLASS IV
Yard Trimmings	✓	✓	✓	✓
Agricultural Plant Materials	✓	✓	✓	✓
Dead Animals	✓	✓	✓	
Raw Rendering Materials	✓	✓	✓	
Food Scraps	✓	✓		
Mixed Solid Wastes	✓			
Bulking Agents	✓	✓	✓	✓
Additives	✓	✓	✓	Additives limited **to source-separated spent coffee and tea grounds**, urea, and bacterial or fungal inoculum
Authorized Alternative Materials	✓	✓	✓	✓

Compost made from food scraps is a regulated “compost product” under Ohio EPA’s Class II testing and metric regulations[xx]. Class II facilities must test compost prior to distribution. Compost product that meets the standards may be distributed for use in accordance with accepted agricultural, silvicultural, or horticultural practices.

If the compost facility only uses the compost product on the facility owners’ property, then Ohio EPA

does not require testing, but they do require reporting to show compliance. This exemption applies to farms with on-site composting.

Ohio Department of Transportation (DOT) and Compost

Many state departments of transportation use compost-based specifications in their construction projects for roadside vegetation support and for sediment and erosion control during construction. Specifications for roadside vegetation can include requirements to amend site soils with high-quality composts. Specifications for erosion and sediment control can call for the use of compost blankets (an erosion prevention mechanism) and/or compost berms or filter socks (a sediment capture device).

Ohio DOT standard specifications have 24 references to compost. As part of the Project Team's research into potential markets and demand for compost, the 2023 State of Ohio DOT Construction and Material Specifications legal document was reviewed. Research shows there is currently no direct requirement for usage of compost in construction. However, there is nothing forbidding its usage. If used, projects must follow the requirements set forth by the Ohio DOT. The below sections are pulled directly from the Ohio DOT Construction and Material Specifications document which was updated in 2023. The important highlights are as follows (emphasis added):

> **659.05 Topsoil**. If placing topsoil as specified in the plan, then stockpile off project site topsoil for testing and/or stockpile stripped topsoil from the project for testing. Perform the Soil Analysis Test from these stockpiles to determine the percent of organic matter present. The topsoil shall contain **between 4% and 20% organic matter** as determined by loss on ignition of samples oven dried to constant weight at 212 F (100 C) and consists of fertile, loose, friable, and loamy material that contains humus material. For topsoil to be considered loamy, ensure that the fraction passing the No. 10 (200) sieve does not contain more than 40% clay. Test topsoil according to AASHTO T 267. The DOT will review the sample test results and approve the stockpiles for use. Stockpiles outside the above limits will not be used. Stripped topsoil from the right-of-way (R/W) limits will be from the upper most layers of the excavation areas. Remove all heavy grass, weeds, and other vegetation before stripping topsoil from the excavation areas. A mixture of 1 part compost and 2 parts topsoil will be treated as topsoil.
>
> **659.06 Compost**. **Acceptable compost** shall include Ohio EPA rated Class IV compost, EQS biosolids compost, or a Department approved equal. Furnish compost with a nitrogen content of 1.4% or above. Obtain compost from an Ohio EPA approved facility. Before delivering compost, provide the engineer with the facility name and location.
>
> *Source: Ohio DOT Construction and Material Specifications, 2023*.

Given the specifications set forth above, there is an opportunity to use compost for DOT construction projects in Hamilton County. There will be other non-DOT construction projects that may have

compost/topsoil specifications that differ slightly from the above specifications. The compost facility operator could sell the compost to any projects looking to use compost or provide it free of charge (although it is worth noting that compost “given away” may be perceived by the users as having no value). Any compost used for this purpose is also creditable as diverted materials for Hamilton County ReSource.

CHAPTER 10 Next Steps

The feasibility study is designed to lay the groundwork to establish organics processing infrastructure in the region with a focus on food scraps. This study embraced stakeholder engagement at several stages of the feasibility study assessment and research to inform, gather ideas, gather data, and build vision. Ideas of building a resilient network to support current small-scale composting opportunities and backyard composting filtered as a theme through this study. Infrastructure development of three-medium scale processing facilities is a multi-faceted approach to organics management and processing that is mutually beneficial to various stakeholders. This approach will help Hamilton County ReSource recover the projected volume of food scraps in the waste stream, helping to meet the aspirational reduction goal.

The GT Project Team recommends these next steps for Hamilton County ReSource:

Site Exploration – Conduct a property search using ArgGIS, Hamilton County's CAGIS system, and known small scale processors who expressed interest in scaling into larger operations.

Narrow Sites – Use Ohio EPA regulations and objective criteria beyond regulations to find a list of potential properties that may be suitable for food scrap composting operations. Use criteria weighting to identify at least three potential sites to further explore. Develop high-level cost range of capital and operational costs.

Site Specific Development Costs – Estimate site development, capital and operational costs, and revenue from product sales for the three potential sites.

Define County Role – Define Hamilton County's role for collection, design, and operations of the organic recovery infrastructure. The most common PPP model for developing food scrap recovery systems is some version of a service agreement. There is no standard definition of PPP and it can accommodate a range of types of agreements between the public and private sectors.

Engage Community – Public education will play a crucial role in progressing food scrap recovery and demonstrating the benefits that a local organics recovery facility could bring to a community. Public education lays the groundwork for an open and transparent process of siting a food scraps facility. It creates a base of educated, engaged, and supportive community members.

Compost Market Assessment – No matter the arrangement for design, construction, and operation of the composting facility, Hamilton County has an opportunity to enhance the sales of the product with education and outreach to County residents and businesses, with potential policies that facilitate an internal "structural demand" for the product amongst County agencies.

Appendix A: Current Landscape Inventory Lists

Table A-1 Inventory of Regional Food Scrap Processing

County	State	Facility	Approximate Distance from Hamilton County
Clark	OH	Garick LLC Paygro Division	79 miles
Madison	OH	London Correctional Institution	89 miles
Montgomery	OH	Steven R. Rauch	50 miles

Note:
Ohio facilities are permitted Class II facilities.
Center point distance from Hamilton County used Cincinnati Zoo and Botanical Gardens as mapping location.
Indiana DEM and Kentucky DEP facility lists do not show processing within the region.
Source: Ohio EPA

Table A-2 Inventory of Yard Trimming Programs

	Type of Community Yard Trimming Program			
Political Jurisdiction	Household Christmas Tree Drop-Off	Curbside Service	Community Hauled Service	Household Drop-Off
Addyston	X			
Amberley		X	X	
Anderson Township	None			
Arlington Heights		X	X	
Blue Ash		Seasonal	X	
Cheviot	None			
Cincinnati		Seasonal	X	
Cleves	X			
Colerain Township	X			
Columbia Township		X	X	
Crosby Township				X
Deer Park		Seasonal	X	
Delhi Township	None			
Elmwood Place		Seasonal	X	
Evendale		X	X	
Fairfax		X	X	
Forest Park		Seasonal	X	
Glendale		X	X	
Golf Manor		Seasonal	X	

Political Jurisdiction	Type of Community Yard Trimming Program			
	Household Christmas Tree Drop-Off	Curbside Service	Community Hauled Service	Household Drop-Off
Green Township	None			
Greenhills		Seasonal	X	
Harrison (City)		Seasonal	X	
Harrison Township	None			
Indian Hill		X	X	
Lincoln Heights	None			
Lockland		X	X	
Loveland		Seasonal	X	
Madeira		Seasonal	X	
Mariemont		X		
Miami Township	X			
Montgomery		X	X	
Mt. Healthy	None			
Newtown		Seasonal	X	
North Bend	X			
North College Hill		Seasonal	X	
Norwood		X	X	
Reading		X	X	
St. Bernard		X	X	
Sharonville		Seasonal	X	
Silverton		Seasonal	X	
Springdale		X	X	
Springfield Township	None			
Sycamore Township		Seasonal	X	
Symmes Township				X
Terrace Park		X	X	
Whitewater Township	None			
Woodlawn		X	X	
Wyoming		X	X	

Appendix B: Case Studies

Case Studies – Curbside Models

Arlington County, Virginia

Location: Arlington County, VA

Contacts: Adam Riedel, Environmental Management Specialist, Department of Environmental Services; Erik Grabowsky, Bureau Chief, Department of Environmental Services

Program Overview	Cost & Performance

• **Population:** 238,643
• **Total Households**: 110,887
• **Eligible Households:** ~33,000
• **Program Type**: **Curbside**
  o *Voluntary organics drop-off allowed at county facility & farmers markets*
• **Number of Drop-Off Sites**: 13
	• **Program Cost:** $100,000 start-up (households already had organics carts)
	• **Household Fee:** *$15-20/house for food scraps*
	• **Annual Solid Waste Fee:** $406.14/year
	  o *Incl. trash, recycling, & organics*
	• **Participation Rate:** 10-20%
	• **Food Scraps Diverted:** ~9,000 tons/year
	  o *Incl. food scraps & yard trimmings*

Best Practices and Key Takeaways for Hamilton County	
• Consistent messaging and engagement with residents are key to success with a curbside organics program. Behavior change is challenging and takes time. Use multiple media channels... • Highlight greenhouse gas emissions reduction, County's waste diversion goals, and financial savings associated with household participation in an organics curbside collection program. • Consider quarterly audit of organics carts to troubleshoot issues. Arlington has found minimal contamination, in part because of education and ongoing audits of organics carts.	

Program Structure: Arlington County provides solid waste services to all single-family households (~33,000) in the county via a contracted hauler. It is a standard offer program; all households receive a black trash cart, blue recycling cart, and green organics cart. Food scraps are collected commingled with yard trimmings weekly. The county also operates a residential food scraps drop-off site at its Earth Products Yard, as well as at some of its Farmers Markets. (The Earth Products Yard is the county's household drop-off center for recyclables and organics.) . It is in the process of locating "smart" drop-off bins (accessed with a phone app) in other public locations. All food scraps are accepted, as well as food-soiled paper and pizza boxes. Compostable liner bags can be used.

Background: Arlington County has a zero waste goal of diverting up to 90% of its waste from incineration or landfill by 2038. Food scraps comprise over 20% of the residential waste stream, according to Arlington's internal quarterly waste audits. In 2016, the county purchased an Earth Flow composting vessel (Green Mountain Technologies) to manage the food scraps dropped off at the Earth Products Yard and the Farmers Market. The Earth Flow is located at the Earth Products Yard. Also in 2016, 64-gallon and 32-gallon green carts (residents have a choice of cart size) were distributed when the county initiated year-round yard trimmings collection. The addition of food scraps collection to the residential program was identified as a task in the County 2004 Solid Waste Management Plan to begin when a facility was opened to accept commingled organics. Prior to launch of the food scraps program, the county conducted a survey that found “overwhelming” support for food scraps collection — 79.9% of the 2,317 responses received supported it. Concerns raised by respondents included vector attraction (primarily rats) and if the cart lids would close securely. But the main driver to initiate collection was to make progress toward the county’s zero waste goal.

~80% Survey Respondents Support for Food Scrap Collection

The inclusion of food scraps was incorporated into the county’s solid waste collection contract with the existing hauler. Actual collection of food scraps was delayed until the facility designated to take the commingled food scraps and yard trimmings, Convertus/Freestate Farms in Manassas (VA), opened its doors. (Prior to 2021, the yard trimmings had been composted by a different facility that did not accept food scraps.) The program rolled out using the existing green carts in September 2021 for the approximately 33,300 single-family homes in Arlington County that receive curbside collection service. The rollout was during the tail end of the growing season, and the onset of fall leaves. Therefore, households were still setting out their green carts, making it difficult to assess if the ability to add food scraps led to more cart setouts when the program started.

Program Design: The organics cart is set out weekly with the trash and recycling carts. Arlington County bought and distributed 2-gallon countertop caddies which included a sticker that lists items accepted, a roll of certified compostable liner bags, and a manual on how to participate. Households purchase additional bags as needed at stores and online. **The annual solid waste rate, which includes collection of trash, recycling, and organics, is currently $406.14/household**. The county estimates that the portion **attributable to food scraps collection is about $15-$20/household/year**.

Program Costs/ Contractual Arrangement: The start-up costs for the curbside program were roughly $100,000; they include purchasing over 33,000 countertop caddies and approximately 35,000 rolls of compostable bags to include one roll with each caddy, as well as printing costs of educational materials. Because its contracted hauler was already collecting organics carts weekly when the food scraps program started, the hauler, per its contract with the county, stipulated a surcharge of approximately $2/month/household for the inclusion of food scraps in the organics cart.

Solid waste services are structured as a full cost recovery program. The contracted hauler has a fixed contract fee with an annual Consumer Price Index-All Urban (CPI-U) adjustment. As part of its annual budgeting process, Arlington County estimates the cost of providing curbside collection services for all households in the county, and then that amount is evenly divided among all households receiving

collection service.

Outreach, Education and Community Engagement: Arlington County uses a multi-layer outreach and education strategy, including printed materials, videos, social media, cart hangers, advertising on taxicab digital display boards, etc. This makes it difficult to gauge the impact of any single outreach and education tool. “We’ve learned that there is no perfect way to reach everyone,” noted the County’s Environmental Management Specialist. “When we did the original rollout, we had something tangible, i.e., the countertop caddy and bags, to engage people directly. They at least pondered what the caddy was and why they were receiving it, if only for a brief amount of time. The challenge we’ve found, and this applies to recycling as well, is people are so strapped for time, and separating food scraps has a learning component. It isn’t hard to do, but it is incredibly hard to get people to take five minutes to learn. Further, we not only need to get their attention but then keep engaging them in the practice. Behavior change is incredibly difficult to achieve and that is what we are trying to do.” He added that in the survey conducted prior to offering curbside collection of food scraps, almost 80% said they wanted collection. In reality, only 10% to 20% of households participate.

An important message to include in community engagement is why participating in the program is important, noted the Bureau Chief. In addition to greenhouse gas emissions reduction and achieving zero waste, the County highlights the financial savings households can achieve by using the food purchased and reducing the quantity wasted, which is upwards of $1,500 for a family of four annually, according to NRDC’s Save the Food website.

Arlington County emphasized the importance of being consistent, using multiple media channels, and promoting continuously to push residents to participate: “By being in front of residents all the time with messaging, there may be a moment where they will give it a try,” he said. To that end, solid waste staff have started collaborating with the Arlington County transit department to place placards promoting food scraps collection inside buses and in bus stops maintained by the county.

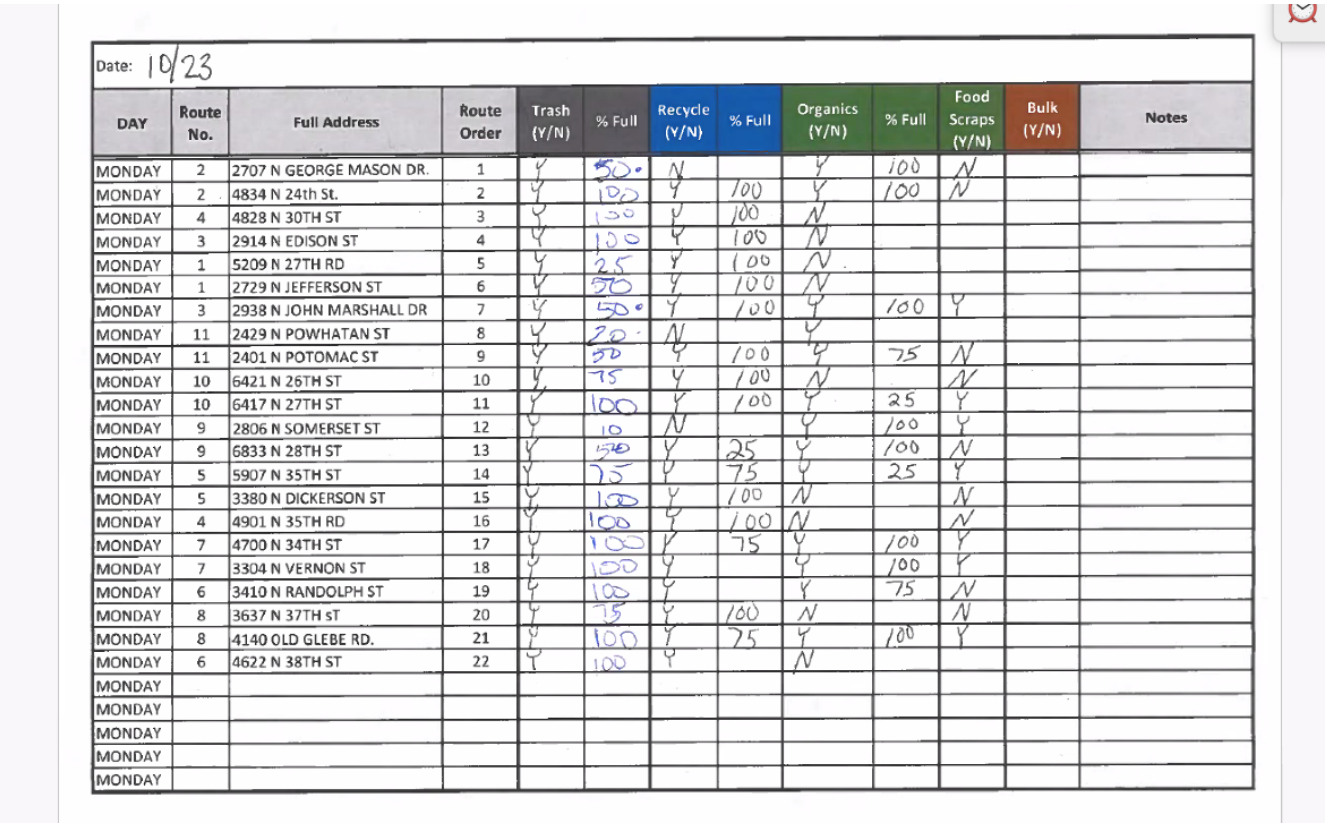
Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from the trash stream, and the jurisdiction’s assessment of its program’s success.

1. *Participation:* Each quarter, trash, recycling and organics carts at 100 houses — two households from all 50 collection routes — are inspected over the course of one week (about 20/day). In addition to sorting cart contents, the audit serves to gauge participation in the organics collection program. Two carts in each zone are tagged so that the hauler does not empty them. With a field inspector watching, the organics carts are emptied into a rear loading packer truck. An inspector estimates how full the carts are and notes if food scraps are included; information is captured on a form (Figure 1). Arlington County has found that residents in North Arlington are the most participatory, and then it declines on other routes. Using the data in Figure 1, a total of 22 addresses were inspected. Nine of the 22 households did not set out their organics cart. Thirteen set out their organics cart and included yard trimmings only. Seven of those households also included food scraps. Overall,

Arlington Estimates a 10-20% Participation Rate

Arlington County estimates a participation rate of 10% to 20%, as noted above.

Figure B-1. Arlington County Waste Audit Tracking Sheet



Date: 10/23

DAY	Route No.	Full Address	Route Order	Trash (Y/N)	% Full	Recycle (Y/N)	% Full	Organics (Y/N)	% Full	Food Scraps (Y/N)	Bulk (Y/N)	Notes
MONDAY	2	2707 N GEORGE MASON DR.	1	Y	50	N		Y	100	N		
MONDAY	2	4834 N 24th St.	2	Y	100	Y	100	Y	100	N		
MONDAY	4	4828 N 30TH ST	3	Y	100	Y	100	N				
MONDAY	3	2914 N EDISON ST	4	Y	100	Y	100	N				
MONDAY	1	5209 N 27TH RD	5	Y	25	Y	100	N				
MONDAY	1	2729 N JEFFERSON ST	6	Y	50	Y	100	N				
MONDAY	3	2938 N JOHN MARSHALL DR	7	Y	50	Y	100	Y	100	Y		
MONDAY	11	2429 N POWHATAN ST	8	Y	20	N		Y				
MONDAY	11	2401 N POTOMAC ST	9	Y	50	Y	100	Y	75	N		
MONDAY	10	6421 N 26TH ST	10	Y	75	Y	100	N		N		
MONDAY	10	6417 N 27TH ST	11	Y	100	Y	100	Y	25	Y		
MONDAY	9	2806 N SOMERSET ST	12	Y	10	N		Y	100	Y		
MONDAY	9	6833 N 28TH ST	13	Y	50	Y	25	Y	100	N		
MONDAY	5	5907 N 35TH ST	14	Y	75	Y	75	Y	25	Y		
MONDAY	5	3380 N DICKERSON ST	15	Y	100	Y	100	N		N		
MONDAY	4	4901 N 35TH RD	16	Y	100	Y	100	N		N		
MONDAY	7	4700 N 34TH ST	17	Y	100	Y	75	Y	100	Y		
MONDAY	7	3304 N VERNON ST	18	Y	100	Y		Y	100	Y		
MONDAY	6	3410 N RANDOLPH ST	19	Y	100	Y		Y	75	N		
MONDAY	8	3637 N 37TH ST	20	Y	75	Y	100	N		N		
MONDAY	8	4140 OLD GLEBE RD.	21	Y	100	Y	75	Y	100	Y		
MONDAY	6	4622 N 38TH ST	22	Y	100	Y		N				
MONDAY												
MONDAY												
MONDAY												
MONDAY												
MONDAY												

*Organics Y/N (column 9) indicates if households set out their organics cart at the curb

2. Food Scraps Diverted: Because food scraps are collected commingled with yard trimmings, it is difficult to determine what portion of organics collected are food scraps. **Arlington County reported that about 9,000 tons of organics were collected in 2023**. Table B-1 summarizes the compiled quarterly organics cart audit data for 2023 (total of 400 households). In general, the County sees a higher percentage of food scraps by weight in the green carts during the winter. For example, in January, it is 15% to 16% by weight. During heavy yard trimmings seasons, the amount of food scraps drops to 10% to 11% by weight.

Table B-1. 2023 Arlington County Audited Organics Cart Composition

Material	Pounds recovered	Percent of total weight
Food Scraps	476	10.5
Yard Trimmings	4,023.4	89.0
Paper & Cardboard	12.0	0.3
Trash	10.2	0.2
Plastics	0.5	<0.1
Hazardous Household Materials	0.5	<0.1

Material	Pounds recovered	Percent of total weight
Metals	0.1	<0.1
Total in Organics Carts	4,522.70	100

Source: Arlington County Department of Environmental Services

3. Assessment of Program Success: Arlington County measures success by the tons of food scraps in the organics loads. That number is currently about 20% by weight, and the county is uncertain where the upper limit of participation is. "Not one approach to food scraps collection works for everyone," said the bureau chief. "When the curbside program started, I was optimistically thinking we would capture 60% to 80% of the household food scraps generated, but the reality is that growth is incremental overtime." It is also important, he and the environmental management specialist added, to maintain the perspective that every ton diverted is a ton not going to the incinerator or landfill.

"Not one approach to food scraps collection works for everyone"

In both its quarterly curbside cart audits, and random inspection of loads being collected, the county has found minimal contamination in the food scraps stream.

Next Steps, Program Insights: Because households already had green carts, Arlington County explained the approach it took — adding food scraps to the existing green cart — was the best option to pursue to launch its curbside program. Using a separate smaller cart for food scraps where households could opt in to participate wasn't viewed as an option, especially given space constraints and costs involved with adding a fourth cart.

The County is challenged by the inability to conduct ongoing outreach and engagement due to the reality that its one communications department services multiple agencies. "You have to stay in front of households on an ongoing basis," says the environmental management specialist. "The virtues and values of managing food scraps in a different way must be continually reinforced. That requires a much larger outreach and engagement budget than our department currently has. A pattern we've observed is residents have some enthusiasm when they start but then it wanes. Sometimes it's fruit flies or a broken bag that is enough to cause a household to stop participating. Our job is to encourage them to keep participating."

There is some discussion about whether participation in the program should be mandatory, and what enforcement mechanisms would be needed to achieve compliance. That approach is not being pursued at this time.

Falls Church, Virginia

Location: Falls Church, VA

Contacts: Lonnie Marquetti, Solid Waste Programs Coordinator, City of Falls Church

Program Overview	Costs & Performance
• **Population:** 14, 586 • **Total Households**: 5,740 • **Households Eligible for Curbside:** 3,053 • **Program Type**: **Curbside + Drop-off** o *Voluntary food scraps subscription through Compost Crew contract* • **Number of Drop-Off Sites**: 1	• **Program Cost:** 40-60 split with households o *City pays 60% of curbside cost; households pay 40% of cost through direct bill from Compost Crew.* *Drop-off site, located at City Hall, is free for all to use.* **Household Curbside Fee:** $8 - $15/month o *7-gallon = $8* o *12-gallon = $15* o *Weekly pick-up; direct bill to households* • **Participation Rate:** 17-20% o 81% --> 7-gallon bin o 19% --> 12-gallon bin • **Food Scraps Diverted:** 221.71 tons o *Curbside & drop-off combined*
Best Practices and Key Takeaways for Hamilton County	
• Consider adding a third cart to curbside collection for commingled food scraps and yard trimmings collection, if budgetary constraints allow. • Start with one 96-gallon cart at local farmers market(s) to gauge resident interest and participation in food scraps drop-off collection. If enough interest, add a voluntary food scrap drop-off separately from the farmers market location, then explore curbside. • Consider subsidizing multi-family building fees to participate in food scraps collection at onset of program. Adjust annually/upon contract expiration if costs increase significantly. • Consider placing voluntary drop-off food scraps collection at a public, municipal building to lower contamination concerns and raise public awareness of the program.	

Program Structure: Falls Church offers households that receive curbside collection service (trash, recycling, and yard trimmings) a voluntary, fee-based weekly curbside food scraps collection option through Compost Crew, a Maryland-based private food scraps collection service provider. The City of Falls Church contracts with Compost Crew to provide the curbside collection, as well as service the City's one drop-off site. Households opt in directly with Compost Crew using a city-provided link. In 2023, as part of the contract renewal with Compost Crew, the City created discounted food scraps collection pricing for commercial generators in Falls Church, including multi-family buildings. Buildings sign up directly with Compost Crew. To date, no multi-family building has opted to participate in the subsidized food scraps collection program. Individual households within the building can sign up for food

scraps collection directly with Compost Crew, but not at the subsidized rate offered to households receiving curbside solid waste services. Multi-family building residents have access to the free drop-off site.

~60% of collection costs subsidized by the City of Falls Church

Background: The City of Falls Church (pop. 14,586, with 5,740 households) established a pilot food scraps drop-off program at its farmers market in 2016. The success of the pilot led the city to create a permanent drop-off site by City Hall in 2017. There is no fee to use the drop-off site. Due to the awareness created by the drop-off program, the City also decided to start a curbside collection program in 2017, available to the 3,053 households receiving trash and recycling collection. It contracted with Compost Crew to provide curbside food scraps collection to city residents. From inception, the City has subsidized the collection program; currently service fees paid by households to Compost Crew cover about 40% of curbside program costs and the city covers the remaining 60%. Falls Church does not have cart-based yard trimmings collection. Households pay $1/kraft bag to set yard trimmings out at the curb. Collection is once a week, year-round.

Program Design: Households pay $8/month for 7-gallon weekly curbside service, or $15/month for 12-gallon weekly service. The City pays the remaining 60% of the curbside cost. There is a one-time fee of $18 for a 7-gallon bin, or $35 for a 12-gallon bin to cover the setup and bin (Figure 1).

Left: 7 gallon bin; Right: 12 gallon bin, latched lid, wheels and handle for pulling. The larger bin incurs an additional fee.

Certified compostable liner bags are included in the starter package. Participating households are eligible to receive one free bag of finished compost each year The City provides households a free 2-gallon countertop kitchen scrap collector and compostable bags when they sign up (the countertop container is also available to purchase from Compost Crew) Of the current subscribers (582 in early May 2024), 81% use the 7-gallon bin and 19% opt for the 12-gallon bin. After collection, Compost Crew gives the bin a quick cleaning, replaces the compostable liner and takes the food scraps to a regional composting facility.

The drop-off site at City Hall is available to all residents; there is no fee to participate. The site is open 24 hours a day, 7 days a week (24/7). The bins are not locked and the site is not monitored. Because the drop-off site is at City Hall, solid waste staff will check the bins and remove visible contamination.

All food scraps, including meat, fish, and dairy, are accepted in both the curbside and drop-off programs. Compost Crew also accepts BPI-certified compostable foodservice ware (e.g., plates, cups, utensils),

food-soiled paper, and yard trimmings that fits in the bin.

The contract signed in 2023 with Compost Crew includes discounted food scraps collection pricing for commercial entities, including multi-family housing. The property manager has to sign up the building and offer services to the residents.

Contractual Arrangement: The original contract between the City of Falls Church and Compost Crew expired in 2023. In FY 2023 (prior to the original contract's expiration), 572 households subscribed (~19% of eligible households) to the curbside composting service and paid $6/month. That covered approximately $40,000 of the program cost, while the City budget covered the remaining $38,000 in annual costs. After a competitive bidding process in May 2023, the lowest bid to provide the curbside service — submitted by Compost Crew — was $141,000 (with cost-of-living adjustments annually). The City used an Information for Bid solicitation (vs. an RFP) as it knew "exactly what services we needed," explained the Senior Contract Specialist.

Because of the increase, the fee that the City charges residents needed to be adjusted. To help calculate the increase, City staff conducted a survey of current curbside food scraps subscribers to inquire if they would continue to participate despite an increase in costs. Of the 572 participants, 278 responded to the survey. The survey also asked how long residents have been participating and how frequently the drop-off program would be utilized if residents wanted to continue to divert food scraps but could not continue curbside pickup due to the cost. The results showed the following:

- 43% of respondents have been subscribing for 3-6 years
- 86% of respondents say they participate because it is better for the environment
- 39% of respondents would be willing to pay $10/month
- 30% of residents would utilize the drop-off program if curbside collection was not an option

Staff interpreted the survey findings to indicate that a monthly fee of over $10 would likely result in a decrease in subscriptions for the service. Table B-2 illustrates the cost variations depending on the fee charged to residents. Ultimately, the City decided to set the fee at $8/month for a 7-gallon container. Compost Crew offers Falls Church households an annual plan at $88/year for 7-gallon bin service if paid in full for the year; if paying by the month, the cost is $96/year. Compost Crew bills households directly for their portion of the service (e.g., the $8/month), and bills the City for the remaining amount (curbside collection and drop-off site services).

Table B-2. Cost Allocation Scenarios

Subscriber Monthly Cost	Subscriber Yearly Cost	Estimated # of Subscribers	% of City Households	Subscriber Cost Share	Contract Cost	City Cost Share	Required Budget Increase
$6	$72	575	19%	$41,400	$141,000	$100,000	$75,000
$8	$96	545	18%	$52,320	$141,000	$88,680	$63,680
$10	$120	515	17%	$61,800	$141,000	$79,200	$54,200
$12	$144	465	15%	$66,960	$141,000	$74,040	$49,040
$14	$168	415	14%	$69,720	$141,000	$71,280	$46,280
$16	$196	365	12%	$71,540	$141,000	$69,460	$44,460

Highlighted row is the current cost under the new contract signed in 2023.

Prior to the new contract, the City subsidized the curbside bin purchase, covering $8 of the $18 purchase price (7-gallon bin). Due to the significant increase in the cost to provide curbside collection under the new contract, Falls Church ended that subsidy and households are responsible for the full cost of the curbside bin purchase.

The contractor, Compost Crew, attributes the significant increase in the contracted price to the following factors:

- The contract the company was operating under was priced by the previous owner of the company.
- The original contract did not include cost-of-living increases.
- The maximum number of households that can be serviced by one truck is roughly 350. As the Falls Church program grew, a second truck was needed, which significantly increased the contractor's costs. The original contract didn't include that cost, which was factored into the new contract. Compost Crew staff each truck with one driver and one helper to maximize collection efficiency.
- The contract price includes truck costs (including maintenance, fuel, insurance) and the tipping fee at the composting facility. Providing free compost to program participants is not a large cost but is factored into overall pricing.

Outreach, Education and Community Engagement: To engage eligible but non-participating households — and to keep current participants up to date about positive program impacts — monthly data provided by Compost Crew is posted to the Focus, the City's weekly e-newsletter that residents can sign up for, as well as posted to its social media accounts. The report includes how many pounds of food scraps are diverted and how many gallons of gasoline the diversion offset, data that might be compelling for households to sign up and help make an impact.

Over the years, Compost Crew has provided yard signs for participating households to display and get neighbors to sign up. Falls Church has provided promotional material, e.g., given away free kitchen countertop caddies and certified compostable liner bags, and offered sign-up incentives, e.g., "get the first 4 months free." The goal is to make it easier and more compelling for households to enroll and start diverting food scraps, i.e., helping establish the behavior and teach residents this is the "new norm." Even with these incentives, the city isn't seeing a return in program sign ups.

Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from the trash stream, and the jurisdiction's assessment of its program's success.

1. Participation: There are 3,053 households in Falls Church eligible to participate in the curbside

program. Program participation is measured by the number of households signed up to receive curbside service. Currently, **participation fluctuates between 17% to 20%,** as households can cancel and join on an ongoing basis.

All Falls Church households (total of 5,740) are eligible to use the drop-off site. The City estimates the number of households using the drop-off site based on this calculation provided by Compost Crew and the original hauler servicing the drop-off site (Veteran Compost):

$$\frac{Average\ Weekly\ Collection\ (pounds)}{7-10\ pounds/patron\ using\ the\ drop-off} = Number\ of\ Households\ Participating$$

An average of 2,200 lbs/week is collected, therefore **an average of 220 to 315 households use the drop-off site on a weekly basis** (4%-5% of households). Patrons other than Falls Church residents can use the drop-off site, but the solid waste programs coordinator said that is a fairly small number and includes people adding their food scraps to the bins after eating in a nearby park.

2. Food Scraps Diverted: Trash from the City of Falls Church is taken to a waste-to-energy plant. The City reports that a total of 221.71 tons (curbside and drop-off combined) were diverted from the incinerator to composting in 2023. Quantities by collection method are:

- Curbside: 164.51 tons/year
- Drop-Off: 57.2 tons/year
- Tons diverted/households eligible for service (3,053 households): 0.07 tons/household/year (107.8 lbs/household/year)

3. Assessment of Program Success: The City of Falls Church's goal is to achieve 50% participation in the curbside program by 2030. City staff believe they have tapped enthusiasts and early adopters (who call food scraps collection a "beloved" program). They continually promote the curbside service to tap into the next segment on the adoption curve known as the early majority, defined as people who are open to new ideas but want to be certain participating is going to be useful. Hesitation is attributed to concerns about vectors (fruit flies, rodents), odors, cost, and/or a lack of space to store the bin in between collections. Some report they compost food scraps in their backyard. Another deterrent is that many residents in Falls Church are renters who tend to move frequently and don't want to commit to a weekly program.

Next Steps, Program Insights: The curbside food scraps collection program is strongly supported by the Falls Church City Council and upper-level city management. This was evident during the 2023 contract negotiations to continue the service despite the doubling of the program cost.

The City does not offer further subsidies to low-income families to participate in curbside food scraps collection. “The price point of $8/month is pretty low compared to Compost Crew’s monthly subscription rate of ~$32/month,” explained the solid waste programs coordinator.

The Falls Church solid waste programs coordinator noted that the program design was limited by budget constraints. Without those constraints, the ideal program, she noted, would be adding a third cart to curbside collection for commingled food scraps and yard trimmings — providing access to all households eligible for service at one time.

The coordinator emphasized that creating the opportunity to divert household scraps is important, whether participation is 5% or 20%. “Offering composting in general will always be a win,” she said. “I recommend that any municipality start with one 96-gallon cart at a Farmers Market to gauge residents’ willingness to participate. Our program started with one 96-gallon cart and by the end, before we moved the drop-off site to its permanent location at City Hall, we were filling up four 96-gallon carts each Saturday. If you know that residents are putting their food scraps in the car or walking with them to the Farmers Market, you know that being able to do it at home will be easier — as long as they are willing to pay.”

City of Minneapolis, MN

Location: Minneapolis, MN

Contacts: Kellie Kish, Recycling Coordinator, Division of Solid Waste & Recycling

Program Overview	Costs & Performance
• **Population:** 425,096 • **Total Households**: 185,674 • **Program Type**: **Curbside** o *Residents must opt-in for food scraps* o *PAYT structure for trash carts* o *Eligible households: 107,857* o *Number opted in for collection: 53% of eligible households (57,028)* • **Program Type: Drop-Off** • *20 sites* • *Households sign up to use a site and receive code to locks on bins*	• **Organics Collection Program Cost:** $5 million/year, not including overhead and administrative and educational costs o Drop-off: $3,518/site start-up costs + $1,458 annual cost/drop-off site to manage and maintain • **Household Fee (curbside):** $30.01/month o *Incl. recycling & organics* *Variable rate for trash carts selected* • **Participation Rate:** 53% • **Food Scraps Diverted:** 5,215 tons o *Incl. curbside and drop-off tonnage*

Curbside Program Best Practices and Key Takeaways for Hamilton County

- Utilize neighborhood and cultural organizations to engage/communicate with their neighbors and peers to build participation in curbside collection program
- Bundle fee for food scraps collection with monthly solid waste service charge to incentive households to opt in as they are paying for collection whether or not they participate
- Offer variable rates on trash cart sizes to further incentive food scraps diversion
- Collect food scraps separately from yard trimmings to more easily observe contamination and to enable weighing of food scraps diverted

Drop-Off Best Practices and Key Takeaways for Hamilton County

- Consider siting organic drop-off locations in high density neighborhoods. Convenience is key for increased diversion and participation rates.
- Require sign-ups to access drop-off sites. This facilitates communicating with site users about contamination issues when they arise.
- Encourage community groups to partner with businesses to host drop-off sites.
- Weekly pick-up from drop-off carts is recommended. Both cost-effective and efficient.
- Monitor drop-off carts periodically and plan for twice annual cleaning. Plan for annual replacement fee for broken cart locks and/or damaged and aging infrastructure.

Program Structure:

- **Curbside:** The City of Minneapolis (pop. 425,096) offers curbside food scraps collection to residents with city solid waste collection services (those in a 4-unit building or smaller). The City's solid waste rate structure is bundled into a monthly household base fee of $30.01, which

includes curbside food scraps collection (households pay whether they participate or not) and recycling. Currently, 53% (57,028.25) of the 107,857.25 eligible households are opted in to receive food scraps collection. Food scraps are collected weekly in a 32-gallon cart separately from yard trimmings, which can be set out in kraft paper bags or bundled at the curb or in the alley (depending on collection route). The 32-gallon cart was selected because it is the smallest size cart that fits on the rear loader trucks' cart tippers and addresses worker safety considerations regarding lifting, twisting, and tipping the carts by hand. All food scraps are accepted, along with food-soiled paper and BPI-certified compostable products.

- **Drop-Off:** The City also manages 19 of the 20 drop-off sites located predominantly in city parks. Households register to use the sites and receive a code to bin locks at the drop-off site nearest to their residence.

Background:

Curbside: Curbside collection of food scraps began as a pilot in 2008 and rolled out Citywide in 2015-2016. When the curbside pilot was launched in the Linden Hills neighborhood, the City and neighborhood group recruited block leaders who went door-to-door with educational materials and to answer questions, resulting in more than 50% of households in the targeted pilot neighborhoods signing up to participate. Food scraps, yard trimmings and trash are collected weekly; recyclables are collected every other week. The monthly rate for organics and recyclables collection ($30.01) is fixed in the monthly bill, however the trash cart fee is variable based on the size of the cart a household selects. This pay-as-you-throw structure incentivizes households to increase organics and recycling diversion. Collected food scraps and yard trimmings are taken to Specialized Environmental Technologies (a WM company), a commercial composting facility in Rosemount (MN).

Drop-Off: There was demand from households not in the pilot neighborhoods to have access to food scraps collection, which led the City to open its first drop-off location in 2014. Additional locations were opened periodically over the years, focusing primarily on neighborhoods not eligible for curbside collection, e.g., where there is density of multi-family households. In addition to providing food scraps collection access, the drop-off sites helped to create source separation behavior and develop "community leaders/super recyclers" who could be activated for the City's roll out of curbside collection (similar to use of block leaders in the first pilot neighborhoods). When each drop-off site opened, the hours to access them were limited (three hours on one weekday evening and on Saturday morning). Volunteers were recruited to staff the drop-off sites when open to collect information from households dropping off food scraps. Details requested included a household's willingness to use a drop-off site or pay more (and if so, how much) for curbside pick-up. Volunteers recorded the number of bags of food scraps dropped off and the household size. This data informed messaging in educational materials used to engage households to participate.

Hennepin County, where Minneapolis is located, adopted an ordinance in November 2020 that requires cities with a population of >10,000 to make organics recycling (not including yard trimmings) available to all households with curbside recycling service (single-family and dwellings up to four units) by January 1, 2022. The county is part of the 7-county Twin Cities metro area with a goal to achieve a 75%

recycling goal by 2030 under the state's solid waste plan. The Minnesota Pollution Control Agency's 2022 – 2042 Metropolitan Solid Waste Management Policy Plan, adopted in February 2024, now requires all cities in the 7-county Metro area with a population of >5,000 to have curbside organics recycling service.

Program Design:

Curbside: Residents in a 4-unit building or smaller receive City-provided curbside solid waste service that includes food scraps collection. Households can opt in at any time to receive a green food scraps cart — along with a home setup guide, refrigerator magnet, and a starter set of compostable bags — by completing a form on the City's website. About 70% of program participants are in single-family homes, and about 30% are in dwellings with 4 units or less. Residents without City collection services (5+ unit buildings) are not assessed a fee and it is free to use the drop-off sites. However, sign-up is required to access the drop-off bins as they are locked and a code is needed to open them. The City's staff and rear loader fleet service about half of the curbside households in Minneapolis. The other 50% is serviced by a consortium of private haulers comprised of "mom and pop" companies that have been providing collection in those neighborhoods for many years. The City wanted to support these haulers thus the consortium has had the collection contract since the food scraps collection program began.

Multi-family buildings (5+ housing units) may be eligible to opt into the City's collection program for organics-only service, or they can contract with a private hauler for food scraps collection. If accepted by the City's program, 64-gallon carts are provided. Depending on the building's interest, they can also be equipped with a locking mechanism, similar to a drop-off site, and building residents sign up and receive a code to access the cart. There has been a steady increase in the number of multi-family buildings joining the City's food scraps collection program, with several new buildings expressing interest each month.

Drop-off: The City of Minneapolis manages all but one drop-off site (19 out of 20). The exception is a site at a church near the University of Minnesota, serviced by a private hauler. The church welcomes students to use the food scraps dumpster.

"We have learned that in a high-density neighborhood, having to walk six blocks to reach a drop-off site is too far a distance."

Drop-off locations are open 24/7 and accessible with a code to open the lock on the carts. All drop-off sites managed by the City use 64-gallon carts. On average, three 64-gallon carts serviced once a week are sufficient for every 150 residents signed up for a location. Factors that go into determining a drop-off site location include proximity to another drop-off site, density of multi-family buildings, and how many rental or condo units are in those buildings (based on rental license data). "In some cases, if a neighborhood only has 12 or so buildings, we may decide to encourage them to start an organics program at their building rather than open a new drop-off site." explained the recycling coordinator. "Where there is more density, we may put drop-off locations within four blocks of each other. We have learned that in a high-density

neighborhood, having to walk six blocks to reach a drop-off site is too far a distance. The more convenient the locations are, the more sign ups we get." Costs to set up and maintain a drop-off site are highlighted in Table B-3

Table B-3. City of Minneapolis Drop-Off Location Costs (2022)

Item	Cost per Site
Hauling (staff + truck)	$923
Processing	$535
Lock & Locking Mechanism ($30 / cart; 4 carts / site)	$120
Site signage, brochures, yes/no lists, etc.	$600
100 compostable bag packets for welcome kits (Note: magnets, brochures printing covered by Hennepin County, Kitchen pails, donated by BioBag, cost is $2 / bag packet and freight of kitchen pails)	$1,340
Total cost for first year (start up)	$3,518
Annual cost / site (after year 1)	$1,458

Among the lessons learned over the 10 years of managing **drop-off sites** are:

- Requiring sign-ups for a designated site helps with contamination control. When contaminated carts are found at a specific location, all households signed up for that drop-off site receive an email notification about the contamination and a reminder on what is accepted.
- Encourage community groups to partner with businesses to host drop-off sites. One of the City's busiest sites is at a food co-op (12 carts).
- Once a week pickup and fewer carts at each drop-off site have been found to be adequate. One location originally had 16 carts being serviced three times/week (prior to the city-wide curb/alley roll-out). Today, it has an average of eight carts being serviced weekly.
- Monitor carts periodically and clean them one to two times a year. Also budget for loss of a few locks each year.

Program Costs: The City of Minneapolis has an enterprise fund to provide solid waste services. The rates are based on the City's costs to provide collection of trash, recycling, organics, and bulky items, and a residential garbage/building material drop-off voucher program — as well as the processing fees for all waste streams excepting trash. In a 2024 form submitted to the State of Minnesota's SCORE program (Governor's Select Committee on Recycling and Environment), the City reported the cost of organics collection is $4.92 million/year, not including overhead and administrative and educational costs. The SCORE program, administered through the counties, provides funding (derived from a state solid waste management tax) that counties pass through to its jurisdictions to cover program costs. The City of Minneapolis allocates a portion of its SCORE funds to cover the costs for the organics drop-off sites.

Outreach, Education and Community Engagement: When first launching the curb/alley collection program, outreach and education were done through paid media on television, radio and bus ads, and social media. Printed materials include mailers, utility bill inserts and distribution of flyers door-to-door.

In-person trainings and workshops are held. Sending an annual mailer (in Minneapolis' case it is a booklet) is required by state statute. "Anytime we send out a big mailing, we always see an increase in sign-ups," noted the recycling coordinator. "In the beginning (2015-2016), 50% of residents reported hearing about the program in some oral fashion – at an event, from their neighbor, or through door-knocking efforts."

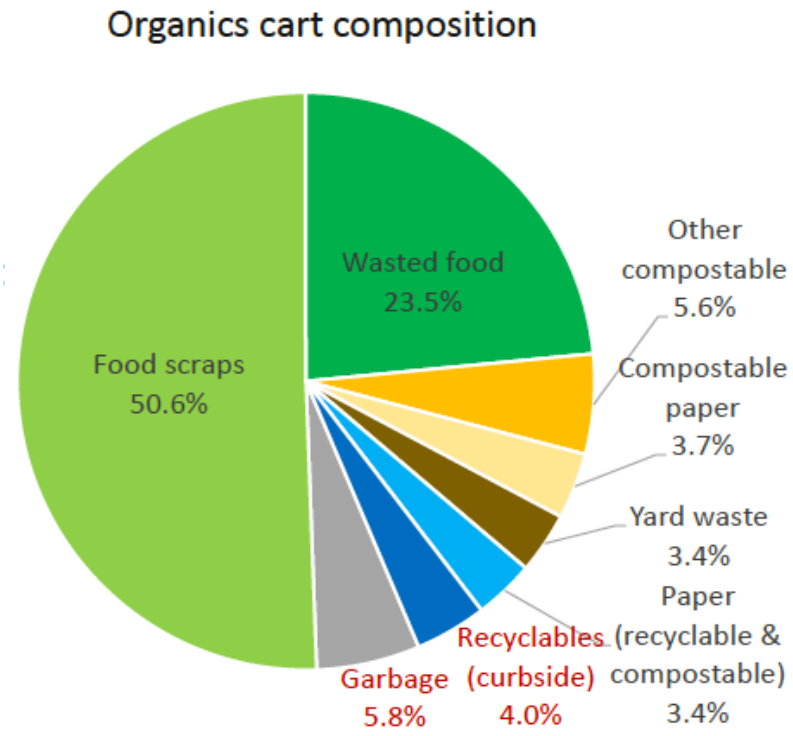
Community groups are eligible for Hennepin County's Green Partner grants (up to $12,000 for a one-year grant) for outreach initiatives that help residents take action to prevent and reduce waste, separate organic waste and recycle, reduce household hazardous waste, combat climate change, and more. One community group uses its Green Partner grant to increase household participation in the City's food scraps collection program. The group has submitted information requests to the Solid Waste & Recycling Division to get the addresses of households in the neighborhoods the group services who are enrolled in the curbside food scraps program. A map of those neighborhoods was created and push pins are used to mark participating households. The group takes the map to community events to engage households who are not participating.

Reluctance to participate cited by households includes concerns about odors and lack of space to accommodate a third cart. The most significant challenge the City faces in terms of enrollment is with rental housing, which comprises 50% of housing in Minneapolis. Landlords are not required to report when units turn over, and new tenants may not learn about their access to food scraps collection until the City sends its annual mailer. "In one neighborhood where we were doing door knocking, we learned that 50% of the housing units are rental, and that they turn over every six months," said the Recycling Coordinator. "If we could find a mechanism to know when new renters move in, we could get them into the program more quickly."

Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from trash stream, and the jurisdiction's assessment of its program success.

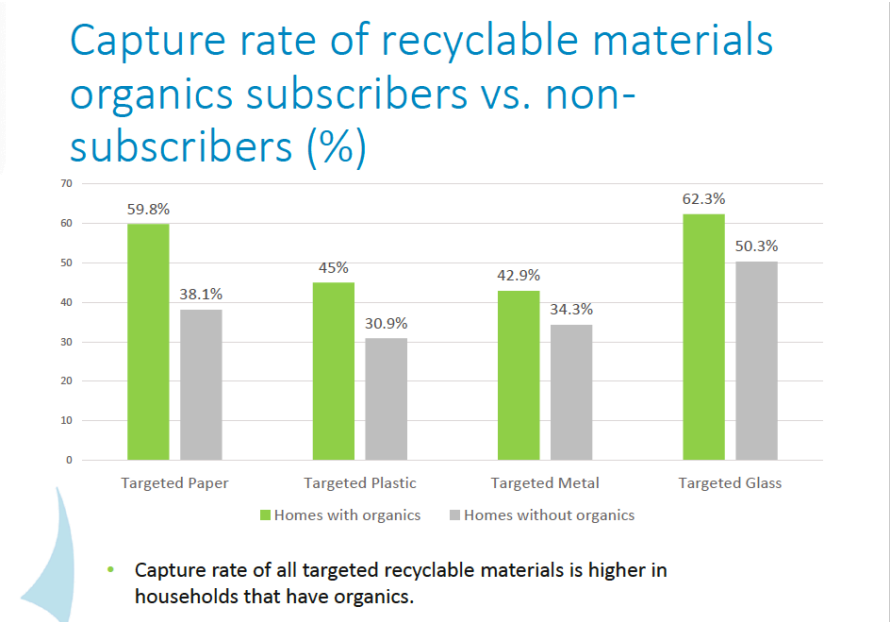
> *1. Participation*: The City conducted a Residential Waste Characterization and Capture Rate Study in 2022 to obtain accurate data on quantities of recoverable commodities (recyclables and food scraps) in the trash, recycling and organics carts. A total of 700 random single-family homes were selected; 50% of the selected homes were signed up for food scraps collection and 55% of those homes had their carts out for collection. Figure B-2 shows captured data for the organics carts set out.

Figure B-2. Findings of Organics Cart Contents



The findings also provided insight on a correlation between households opted in for organics collection (Figure B-3): "Results from this 2022 Study indicate organics program subscribers have a much higher total average capture rate (including both recyclables and compostables) compared to non-subscribers," according to the final study report. "Also, the recycling contamination is much lower in the subscribers' group compared to non-subscribers."

Figure B-3. Increased recycling by organics cart subscribers



2. Food scraps diverted: In 2023, a total of 5,215 tons of food scraps were captured from the curbside and drop-off food scraps collection programs. To measure the quantity of food scraps from drop-off locations only, the City uses the number of carts emptied and an estimate of about 50 pounds of food scraps in each cart (an average accounting for the variation of materials in the cart, e.g., pizza boxes vs. watermelons). In 2022, a total of 4,018 drop-off station carts were emptied, capturing an estimated 100.5 tons of food scraps collected at drop-off sites.

3. Assessment of Program Success: Based on low contamination rates and more than 50% of households eligible for curbside food scraps collection opted in, the City of Minneapolis views its program as a success so far. “At 53%, we want to keep it growing and find less wasted food in the organics and the trash streams,” noted the recycling coordinator. The 2022 Capture study found that wasted food — defined as food that could have been eaten (vs. inedible food like eggshells, banana peels) — comprised the largest amount (by weight) of recoverable materials in the trash stream. The amount was less in the organics stream, but still present.

Collection crews check carts each time before they are emptied. If contamination is found, the cart is not serviced, and an educational tag is attached to the cart. For households that continuously contaminate, the cart is taken away. Instead of paying a fee to get the cart back, households have an option to take a training class to learn how to participate correctly. The City describes this process of cart contamination monitoring as “crew intervention.” Explained the recycled coordinator: “Our 2022 Waste Characterization & Capture Rate Study did not include crew intervention and found a contamination rate of 9.8%. Our back-of-truck hand sorts evaluate material collected after crew intervention and have consistently found 1% or less contamination. Collection crew intervention results in a significant reduction in contamination going to the composting facility.”

Next Steps, Program Insights: An increased focus on utilizing neighborhood and community groups to promote participation in the City’s food scraps collection programs is a priority going forward, especially with Hennepin County’s Green Grants program. “Minneapolis has well organized neighborhood groups for every part of the City,” said the recycling coordinator. “We also want to work more closely with cultural groups in the city to facilitate programming for non-English speaking residents.”

The Solid Waste & Recycling Division’s goal is to have 100% of households in Minneapolis signed up for food scraps collection, both curbside and drop-off. Its ultimate goal is to reduce the amount of wasted food in the trash by 95%.

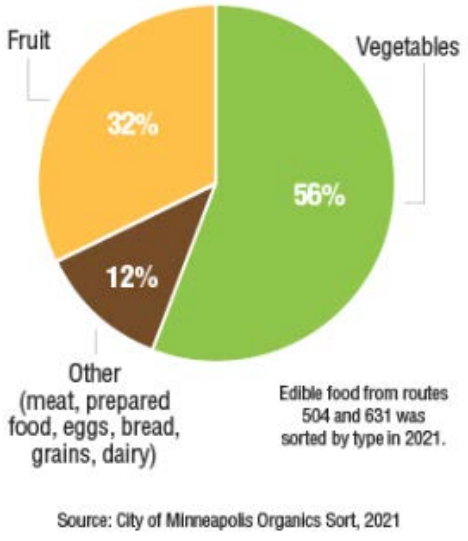
The division is planning to conduct a sort of the organics carts in 2024, which it last did in 2021 on carts from four different collection routes in the City. Two of these routes have stayed the same as a baseline and two additional routes from around the city have been chosen to fill in data gaps. Results of the 2021 sort as compared to two previous ones are highlighted in Table B-4. The 2021 sort also included measuring the amount of edible food in the load (Figure B-4).

Table B-4. City of Minneapolis Curbside Organic Cart Sorting Data

	Organics load (lbs)	Plastic-lined paper (lbs)	Recyclables (lbs)	Other contaminants (lbs)	Total contamination (lbs)	Total contamination (%)	Organics lbs/household signed up
2018	3,245	8.05	3.52	7.91	19.64	0.68	3.50
2019	4,932	11.37	4.51	25.46	31.27	0.68	4.82
2021	4,410	18.96	9.13	16.35	44.43	1.00	5.36

Data from Minneapolis Solid Waste & Recycling Organics Sorts Report

Figure B-4. Edible Food by Type in Sorted Organics Load



Source: City of Minneapolis Organics Sort, 2021

City of Vancouver Public Works Department, Solid Waste Services

Location: Vancouver, Washington

Contacts: Julie Gilbertson, Solid Waste Supervisor; Elizabeth Erickson, Solid Waste Analyst

Program Overview	Costs & Performance
• **Population:** 194,512 • **Total Households**: 77,418 • **Program Type**: **Curbside** o *Franchised hauler; households opt-in to receive services* • **Eligible Households:** 47, 614	• **Household Fee:** variable; see below • **Program Cost:** $2.4 million (2024 cost, all solid waste services) • **Participation Rate:** 61% o 28,971 subscribed to organics collection (yard trimmings + food scraps) • **Food Scraps Diverted:** 11,791 tons o *Incl. yard trimmings*
Best Practices and Key Takeaways for Hamilton County	
• Make sure transfer stations and/or composting facilities have the capacity to accept organics as participation grows. • Increase outreach and engagement to curbside subscribers to raise awareness of what can be thrown in organics carts. • Seasonal shifts to commingled yard trimmings and food scraps, with food scrap collection in curbside carts increasing in the winter by volume collected.	

Program Structure: In the Fall of 2019, the City of Vancouver expanded its existing every-other-week household yard trimmings collection service to include food scraps. Presently, the city has 47,614 households eligible for curbside collection; they subscribe directly with the contracted hauler to receive carts for trash, recycling and organics. Residential customers are required to maintain a minimum level of garbage service and pay for recycling service whether or not they opt to recycle. The cost for garbage and recycling are bundled on customer bills. Organics collection service is optional and listed separately on customer bills. All food scraps are accepted. Currently, about 60% of eligible households subscribe to organics collection. Residential food scraps drop-off sites are being developed by the county (Clark County) and some may be located at community gardens and near larger multifamily buildings in the City of Vancouver.

Background: The decision to include food scraps in the yard trimmings collection carts was prompted in part by the city's 2009 waste collection contract that was due to expire in 2020. The 2009 contract included two provisions:

1. Provided for up to two additional one-year extensions; or
2. Allowed for up to a 10-year negotiated extension, provided that a curbside food scraps/organics program was implemented.

The decision was made by the Vancouver City Council that the best path forward was in establishing a new comprehensive collection contract which supported initiation of food scraps collection. The residential yard trimmings service was reintroduced as organics collection with the inclusion of food scraps.

Dirt Hugger, the composting facility that services the City of Vancouver program, only accepts source separated food scraps; no food-soiled paper or compostable products are allowed. Households can use compostable bags, which are cut open at Dirt Hugger's facility and disposed. Waste Connections, Inc. of Washington (Waste Connections), the contracted hauler, takes collected organics to a transfer station in the county where they are tipped and then transferred in trailers to Dirt Hugger. In Washington State, inclusion of postconsumer food scraps in a separated organics stream requires that they be treated like municipal solid waste and must be tipped onto a floor that is under cover. Tip floor capacity at the transfer station is very space limited. The owner and operator of the facility was able to carve out a dedicated area at the facility to receive and reload organics. The space constraints at the transfer station are a limiting factor to aggressive expansion of food scraps diversion in Vancouver and the broader region. The city's Climate Action Framework supports diversion of food scraps, in alignment with Washington's Organics Management Law. The space limitation is viewed as a hindrance to furthering the food scraps program, explained the Solid Waste Supervisor.

In 2019, when the organics program was rolled out, about 60% of households were already subscribed to yard trimmings collection and transitioned to the organics service. Customers subscribing after the establishment of the organics program receive a dedicated green organics cart. The number of organics cart subscribers is essentially the same after three full years of the food scraps program implementation.

Program Design: The city sets the fees for solid waste services provided by Waste Connections and the service provider is required to actively promote the service to all customer classes and generator types (i.e., single family, multi-family, and commercial customers). The organics cart fee is inclusive of collection, transfer/reload and the composting facility tip fee. When establishing rates for inclusion of food scraps, it was important to city officials that residents did not experience a significant rate increase with the switch. At one point, the city approved raising customer rates for organics collection to cover the city's share of Dirt Hugger's increased air quality and permit costs associated with its facility's expansion/improvements.

Households have a choice of four cart sizes for organics collection — 20-, 32-, 64-, or 96-gallons serviced every-other-week (EOW). The 20-gallon volume is achieved by putting an insert in a 32-gallon cart. Prior to inclusion of food scraps, households only had the choice of a 64- or a 96-gallon cart for yard trimmings collected EOW. Rates vary based on cart size and the number of carts. An example of the varying carts sizes and rates for EOW organics collection is provided in Figure B-5. A comparison of trash and organics cart rates based on cart size is provided in Figure B-6.

Figure B-5. Organics cart 2024 rates with every-other-week collection

Figure B-6. Trash and organics cart pricing 2024 example based on cart size

The most popular service choice for single-family household is a 32-gallon trash cart collected weekly, and 96-gallon carts for recycling and organics collected EOW, notes the Solid Waste Supervisor. Table B-5 shows the breakout of organics carts selected by subscribing households in the month of June, from 2020 to 2023.

Table B-5. Organics cart size selection by subscribing households, 2020-2023

	Jun-20	Jun-21	Jun-22	Jun-23
Basic Subscription, with 20 Gallon Cart	506	1,054	1,153	1,056
Basic Subscription, with 32 Gallon Cart	644	1,287	1,490	1,594
Basic Subscription, with 64 Gallon Cart	4,902	5,568	5,639	5,559
Basic Subscription, with 96 Gallon Cart	22,510	23,167	22,408	21,249
Total	28,562	31,076	30,690	29,458

To enable the EOW option for organics, the solid waste division worked with the city's public health agency to ensure that EOW frequency was allowed under the Vancouver's public health and nuisance code. It was noted that households were able to opt for EOW trash collection thus allowing it for the organics cart was similar, i.e., food scraps at households without an organics cart are putting them in the trash for EOW service. The EOW option helps Vancouver achieve its overarching goal to keep the cost for organics service as low as possible. "We know city residents prefer having options and the ability to customize the service, including cart size and collection frequency, to control the costs," noted the Solid Waste Analyst. To assist residents in selecting the program that works best for their household, Organics 101 training sessions are held that run through several scenarios, e.g., reduce the size of trash cart and go with a larger cart for EOW organics collection. "This helps put together the service plan that fits best at the lowest cost," she added.

Residents are offered Organics 101 training to assist in selecting the best cart sizes

Even though the new contract with Waste Connections was signed in Spring 2019, the city decided to wait until October to launch the organics program. "We didn't want to launch during the summer, which is peak yard debris season and when there are more chances for fruit flies and odors due to warmer temperatures," explained the Solid Waste Supervisor.

To date, at least 6 large multi-family properties within the city limits have signed up with Waste Connections to provide food scraps collection for their residents. Vancouver requires the hauler's education team to actively promote food scraps collection and identify properties that would benefit from the service.

Program Costs, Contractual Arrangement: The organics program roll-out and start-up costs were all borne by Waste Connections. When it was rolled out from yard trimmings only to yard trimmings and food scraps, the same trucks were utilized. For single-family residents, the contractor invested in new cart size options and implemented a new cart color/brand standard. The one-time costs for delivering food scraps kitchen pails, labels, and educational materials also were paid by the hauler as outlined in its contract with the city.

Vancouver sets a "City Fee" (essentially a franchise fee) that Waste Connections pays to the city annually. In 2024, the fee is $200,330.78/month or $2,403,969.38 for the full year. The money funds its solid waste program and services, including oversight and administration of collection services, special programs (neighborhood cleanups, coupons, bulky pickups, grants) and other city-wide litter abatement and disposal needs. The fee is adjusted as part of the hauling contract with Waste Connections and tracks with inflationary adjustments applied to rates.

Outreach, Education and Community Engagement:

Program Launch: Flyers were distributed door-to-door and in-person training and classes were held.

Ongoing: Ongoing promotion of the organics program includes:

- All new accounts receive educational materials about participating in organics collection.

- Inserts in annual utility bill mailings
- Presentations about the food scraps program by City and hauler staff at neighborhood association and community group events
- Exposure to food scraps recycling via the Clark County Green Schools program, which actively promotes food scraps collection at public and private schools. This helps reinforce the behavior at home for households enrolled in organics collection.

Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from the trash stream, and the jurisdiction's assessment of its program success.

1. Participation: A total of 47,614 households received solid waste collection services. Of those, 28,971 subscribed to organics collection — a program participation rate of 61%. Because yard trimmings and food scraps are commingled in the cart, the service provider does not track how many carts include food scraps.

2. Food Scraps Diverted: A total of 33,420.28 tons of MSW and 11,791.38 tons of organics (commingled yard trimmings and food scraps) were collected — an overall organics diversion rate of 26.08%. The month-by-month data on tons of organics collected in 2023 track with peak months for yard trimmings generation: May-June (3,140 tons) and October-November (2,325 tons). February (490 tons) and March (690), months with minimal yard trimmings generated, may reflect the food scrap quantities captured. The City does not have actual tonnage data on what portion of the collected organics are food scraps.

3. Assessment of Program Success: City staff would like to have the other 40% of households receiving trash and recycling collection subscribe to having an organics cart. They describe this as "turning on full service."

Next Steps, Program Insights: When food scraps collection was implemented in 2019, roughly 60% of the households with a yard trimmings cart rolled that subscription over to organics. Since then, the city's population has grown, but participation in organics collection has remained the same. Increasing outreach and engagement to the 40% of subscribers without an organics cart is being planned. "A lot of subscribers don't know they can put food scraps into their carts, or the full range of what they can put in," said the Solid Waste Analyst. Having the ability to move to a standard offering program, with all single-family households receiving an organics cart along with the option to opt out if desired, would require Vancouver City Council to adopt an ordinance. The solid waste supervisor pointed out that households currently subscribing are willingly signing up and that their solid waste bills can remain relatively the same based on the cart sizes and collection frequency selected. The minimal potential impact on household costs is a factor in considering a possible shift to a standard offering program.

As noted, program expansion is constrained by space at the transfer station to reload and transfer the organics that are tipped. The composting facility has capacity to accept more organics from the City of Vancouver, but the transfer station is a stress point in the collection system.

Case Studies – Drop Off Models

Anoka County, Minnesota

Location: Anoka County, Minnesota

Contact: Kathryn Jordan, Program Specialist, Organics, Waste Prevention & Reuse

Program Overview	Costs & Performance

• **Population:** 372,441
• **Total households**: 134,930
• **Eligible households:** 134,930
• **Program Type**: Drop-off
  o *Hauler-offered subscription program also available*
• **Number of drop-off sites**:13
	• **Household Fee:** $0
	• **Program Cost:** $1,171,059 or $8/household
	• **Participation rate:** ~5%
	  o 7,100 households registered
	• **Food Scraps Diverted:** 249 tons/year

Best Practices and Key Takeaways for Hamilton County	
• Registration required to use the drop-off site. • Minimal contamination, in part because 2 of the 3 county locations are staffed and the contract operators can pick out any contamination that is in the food scraps • Implement multiple targeted drop-off sites at once vs. a patchwork roll-out. • Conduct county-wide education on new drop-off sites once the program is launched to increase participation rate and diverted materials collected.	

Program Structure: Anoka County (372,441 pop.) has a mix of rural and densely populated areas. There are 134,390 households in the county (2022). The County operates three food scraps drop-off sites, two at county solid waste facilities and one at a public library. Ten cities or townships in the county also have food scraps drop-off locations. Funding from the State of Minnesota is passed through to the jurisdictions to establish the drop-off sites. There is no fee for households to participate. In addition, five cities offer curbside food scraps collection through their contracted haulers. Households opt in for the collection and pay an additional fee.

Background: Anoka County is one of seven counties in the Twin Cities Metro Region required by law to recycle 75% of total solid waste generated in the Metro area, as compared to 35% for non-Metro area counties. Organics recycling is counted towards that goal, which prompted Anoka County to set up residential food scraps drop-off sites at its yard trimmings composting facilities in 2017.

Counties in Minnesota receive annual funding from the state's SCORE program that are made available to jurisdictions in their counties in the form of grants. The grants can be used for a wide range of solid waste programs, including to establish residential food scraps collection. All food scraps are accepted at the drop-off sites, along with food-soiled paper and BPI-certified compostable products. The county has two yard trimmings composting facilities, one in Coon Rapids (Bunker Hills) and one in Lino Lakes (Rice Creek). Households bring yard trimmings to the composting sites or can receive yard trimmings

collection from their hauler. In 2023, the Rice Creek facility began processing the food scraps dropped off at its site in static piles on a covered cement pad (roughly 200 square feet). The Bunker Hills facility is finishing construction of its food scraps composting “barn” and pad and will start to process collected food scraps this year. Each site is limited to having 120 cubic yards (cy) of food scraps in process at one time. Contractors manage the facilities. Prior to creating its own food scraps composting capacity, food scraps from the Anoka County drop-offs sites were hauled to SET, Inc.’s composting facility in Rosemount (MN). Most of the County’s cities/townships’ collected food scraps are also hauled to SET.

Program Design: Households are asked to sign up to use a drop-off site managed by a city/township or the county. Once signed up, they can pick up a free starter kit that includes a 2.5-gallon food scrap collector for the kitchen, educational materials, and a supply of certified compostable bags. The county covers the costs of the starter kits, signage, and outreach and educational materials, including a welcome letter that a township or city can customize. The County sends out a widely-read newsletter three to four times a year, which includes food scraps collection updates. Social media has been used to promote drop-off program sign ups but is used only minimally at this time. The County’s drop-off sites have a compostable bag dispenser, as do many of the cities/townships’ locations. The County’s sites use dumpsters for collection (these are not locked) as its hauler does not allow use of carts for food scraps collection. Jurisdictions primarily use carts. The containers are not locked, therefore households who haven’t signed up for the program can utilize the site.

On March 1, 2024, Anoka County opened its third drop-off site in the parking lot of the library in Johnsville. The city is in the south-central part of the county where population density is the highest — unlike the rural locations of the County’s original two sites. A targeted mailing was sent to 5,000 households in the closest radius of the library, and flyers were distributed to nearby apartment buildings and schools. This location of the third drop-off site meets the County’s goal of ensuring that all residents can access a drop-off site within a 10-minute drive. Response to the site has been positive. The 2 cy-container has been filling up each week and the County was planning to replace it sooner than anticipated with a 4-cy dumpster.

Contamination in food scraps dropped off at the county’s sites at its composting facilities has been minimal, in part because those locations are staffed and the contract operators can pick out any contamination that is in the food scraps. Details weren’t available about contamination at the jurisdictions’ sites.

Program Costs, Contractual Arrangement: Anoka County’s annual budget for its food scraps collection and composting operations (yard trimmings and food scraps) is $1,171,059, or about $8/household in the county. Establishing a drop-off site, especially if an enclosure isn’t necessary, is fairly low-cost, requiring a container(s), signage and compostable bag dispensers. The largest expense is hauling collected food scraps to the commercial composting facility. The costs vary by hauler servicing the program.

Outreach, Education and Community Engagement: Anoka County uses its quarterly newsletter to promote the drop-off sites. Based on its experience with the City of Johnsville library site, the county is planning to promote more locally (vs. countywide) as new locations open. The cities and townships use newsletters, websites and social media to promote their organics programs.

Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from the trash stream, and the jurisdiction's assessment of its program success.

1. Participation: The number of households signed up to use a drop-off site (county and cities/townships) is used to calculate program participation. Roughly 7,100 of the 134,390 households — about 5% — have signed up to use one of the 13 drop-off sites. That is likely an underestimate, said the Organics Program Specialist, because it doesn't account for households using the sites without signing up.

2. Food Scraps Diverted: In 2023, the Anoka County drop-off sites collected 129 tons of food scraps. The county estimates that about 12 tons/year are collected from the 10 cities and townships with drop-off sites, or 120 tons in total in 2023. Therefore, a total of 249 tons of food scraps were collected in 2023.

3. Assessment of Program Success: Anoka County measures program success by households signing up to use the drop-off sites. The popularity of the new site in Johnsville is encouraging (an estimated 100 households have signed up since it opened), and the county plans to use a similar approach to siting and launching its new drop-off sites in the future. This will help to address the convenience factor, as existing drop-off sites — even though they are open 24/7 — are not in convenient locations that residents pass by on a regular basis. While having households use the drop-off sites without signing up to participate challenges the county's ability to measure success more accurately, the fact that food scraps are being diverted is a plus.

Next Steps, Program Insights: To achieve the state of Minnesota's required recycling rate of 75% by 2030, Anoka County's goal is to have food scraps and yard trimmings recycling account for 27.6% of all waste by volume being recycled by 2030. Currently, 9.76% of all waste is recovered organics. In its 2022-2042 Metro Solid Waste Policy Plan released in January 2024, the Minnesota Pollution Control Agency included a requirement that all cities with more than 5,000 people in the Metro area counties provide curbside organics collection by 2030. To comply, it is likely most cities and townships in Anoka County will contract with their existing waste haulers to offer organics collection.

Housatonic Resources Recovery Authority

Location: Brookfield, CT

Contacts: Jennifer A. Heaton-Jones, Executive Director

Program Overview	Costs & Performance

• **Population:** >266,000
  o *14 member towns in western Connecticut*
• **Total households**: 65,400
• **Eligible households:** 45,519
• **Program Type**: Drop-off
• **Number of drop-off sites**: 9
	• **Household Fee:** Varies (see Table 1 below)
	• **Participation rate:** 12-17%; varies by town
	• **Food Scraps Diverted:** 76 tons
	  o *Only 3 of 9 towns have scales*

Best Practices and Key Takeaways for Hamilton County	
• Install scales at all drop-off sites to aid in data collection and accurate program metrics. Reported food scrap diversion numbers are lower than actual collection to-date. • Co-locate a small-scale composting site with food scraps drop-off at each transfer station. This will save money and increase convenience. • Charge a fee for food scraps drop-off collection to cover program costs.	

Program Structure: The Housatonic Resources Recovery Authority (HRRA) is a regional, governmental, waste management and recycling authority serving 14 municipalities in western Connecticut. Nine of the 14 member towns have established residential food scraps drop-off sites at their transfer stations. HRRA typically uses grant funds to help the town establish and promote the drop-off site. Individual towns are responsible for transporting collected food scraps to a processing facility and the tipping fee. Towns with food scraps drop-off sites are required by HRRA to give a limited quantity of free compost to participants. One drop-off site has a co-located small-scale composting operation, with a second coming online in September 2024.

Background: The HRRA services a population of over 266,000 people and about 65,400 households. In 2014, the Authority gave assistance to the Town of Bridgewater to establish a residential food scraps drop-off site at the town's transfer station. As of 2024, nine towns have food scraps drop-off sites at their transfer stations. All 45,519 households in those jurisdictions are eligible to participate in the towns' food scraps drop-off service. All food scraps, along with BPI-certified compostable liner bags, are accepted. Except for the Town of Weston and Wilton, which secured its own funding, HRRA either identified a funding source or utilized funds from grants it applied for to cover drop-off site start-up costs. The towns utilize area composting facilities and a food waste-only anaerobic digester to process collected food scraps. There are two private subscription-based food scraps collection companies that provide curbside service to households in the HRRA towns.

The HRRA received funding from a US Department of Agriculture (USDA) grant to construct a solar-powered aerated static pile composting site at the Town of Ridgefield's transfer station. The town

composts collected food scraps and leaves. The site is permitted to process 12 cubic yards/month of feedstocks. The HRRA is working on partnering with one food scraps hauler in the area, Curbside Compost, to tip some of the residential food scraps it collects at the Ridgefield composting site. The tipping fee will be about $15 cheaper than the closest commercial-scale processing facility. In 2023, Newtown received a grant from the Connecticut Department of Energy and Environmental Protection (CT DEEP) to help construct a similar composting site at its transfer station.

Program Design: Originally, HRRA provided free starter kits to the towns to distribute to households signing up to participate in the drop-off programs. A household starter kit — which includes a 6-gallon carry container, a 1.5-gallon vented kitchen counter bin, and two rolls of Biobags — costs about $16, said the Executive Director. The Authority no longer provides free kits as not all households that received the kits participated in the program. Bethel and Newtown offer program participants free kits. Weston and Wilton sell kits directly to households for $20; households in the 5 other towns purchase kits from HRRA (prices vary by town based on the makeup of the kit). Table B-6 summarizes the fees households pay to utilize the drop-off program. In four towns, the fee to drop off food scraps is included in the annual transfer station permit households purchase to drop off trash and recyclables. In Bridgewater, there is no fee to drop off food scraps nor is a transfer station permit required.

Figure B-7. Household food scraps starter kit

Table B-6. Drop-off site fees, per household, by town

Town	Food scraps drop-off fee	Transfer station permit purchase required?	Starter kit fee?
Bethel	$1/site visit	Yes	Free
Bridgewater	No fee	No (for food scraps)	$20
Kent	Included in transfer station fee	$20/year to drop off food scraps only	$10
New Fairfield	$1/2-gal bag; $2/6-gal tote	Yes	$20
Newtown	No fee	No	Free
Redding	$0.10/lb (garbage is $0.25/lb)	Yes	$20
Ridgefield	Included in transfer station fee	Yes	$15

Town	Food scraps drop-off fee	Transfer station permit purchase required?	Starter kit fee?
Weston	Included in transfer station fee	Yes	$20[1]
Wilton	Included in transfer station fee	Yes	$20

[1]*First 100 households to sign up received a free starter kit.*

Program costs typically covered by HRRA include public education (flyers, social media, and outreach by tabling at the transfer stations for face time with the public), signage, and providing a designated landing page for each town on its website. The flyers range in price from a few hundred dollars for smaller communities to over $1,000 for larger communities. The CT DEEP requires the drop-off sites to have a permanent sign that displays the rules of the program; HRRA purchases the signs ($200/sign).

Figure B-8. Permanent signage is required by CT DEEP at town drop-off sites

Contractual Arrangements: HRRA does not have contractual arrangements with its towns' food scraps drop-off programs. The food scraps haulers servicing the towns provide the collection containers at the transfer station. Some haulers utilize 32-gallon carts and others provide a 2 cubic-yard container. With the latter, the towns pay a pull fee and the tip fee is paid directly to the processor. One of the private subscription services, Curbside Compost, has a contract with two towns for $433 a month for up to 12 containers. In another town, Curbside Compost charges $80 per pull with an additional $5 for each toter pickup.

Outreach, Education and Community Engagement: HRRA takes responsibility for outreach, education, and community engagement for the member towns with food scraps drop-off sites. The towns also promote the drop-off sites to their residents via their newsletters and community events.

Program Performance: Performance is measured by three factors in the case studies: program participation, tonnage of food scraps diverted from trash stream, and the jurisdiction's assessment of its program's success.

1. *Participation*: The only tool available to HRRA and the towns to measure participation is program signups, although that isn't necessarily an accurate measurement because some households sign up and don't participate, while others don't sign up because they don't want to share their personal information but use the drop-off sites, explained HRRA's executive director. For example, in Ridgefield (total of 2,980 households; pop. 7,655), 237 households have signed up for the drop-off program (8% participation rate); HRRA estimates another 10-15% of households utilize the program but didn't register. In Newtown (pop. 27,560), 1,200 of the town's 9,560 households are signed up (13% participation rate).

2. *Food Scraps Diverted*: Three of the nine towns with drop-off sites — Bethel, Kent and

Newtown — have scales at their transfer stations to weigh food scraps dropped off. Bethel and Kent have not been open for a full year. Table B-7 reports the tonnages collected from the fall of 2023 to date.

Table B-7. Tons of food scraps collected (3 towns)

Town	Food scrap tons collected	Number of weeks, 2023-24
Bethel	8.1	36
Kent	19.78	40
Newtown	47.70	29

3. Program Success: HRRA ultimately measures program success by the amount of food scraps collected and diverted from disposal. The challenge, the Authority noted, is data — measuring all the organics recycled and the reduction in solid waste disposed. Having a scale available at all the drop-off sites would aid in data collection. Another measure of success is program participation, which HRRA and the towns try to track via signups to participate. While a gauge of participation, signups are voluntary and thus not a fully accurate measurement. HRRA has observed that participation is higher in more affluent towns even though each program is implemented the same way. Another factor impacting participation is the rural locations of some of the transfer stations with drop-off sites, making it inconvenient for households who would otherwise not use the transfer station.

Next Steps, Program Insights: To make food scraps drop-off more accessible in towns with programs, HRRA has applied for additional grant funding to create convenient satellite locations. The Authority is working with metroSTOR, which sells food scraps drop-off enclosures that can accommodate 35-, 65-, and 95-gallon carts. The enclosures can be accessed with a smartphone app. HRRA plans to locate the enclosures in the center of town and along frequently traveled routes, e.g., on the way to schools or grocery stores.

Having transfer station operators who are supportive of the food scraps collection sites contributes to overall program success, including monitoring for contamination and keeping the bins in a convenient location for households to access. Ten years in, two modifications to its program design that HRRA has learned are to have towns charge a fee for drop-off program participation and to co-locate a small-scale composting site at each transfer station. “The first program started in Bridgewater in 2014 was free for households to use, and we’ve learned that charging a fee — which includes receiving free compost once a year — is needed to offset the towns’ costs to operate the sites,” said the Executive Director. “And the convenience — and cost-savings on processing facility tip fees — of having a composting site at each transfer station is a change I’d make if we could start over. Our experience to date with the Ridgefield solar-powered ASP has been positive. And we are in discussions with one of the curbside food scraps collection services about serving as the composting site operator. The company could compost its food scraps at the site, saving them money as well.”

Appendix C: Raw Scores for Weighting Criteria

Table C-1: Raw Scoring

Strategy	ALTERNATIVES			
	A One Large-scale Facility	B Two Large-scale Facilities	C Medium-scale Facilities (three)	D Small-scale Community Composting
Maximizing diversion of food scraps	5	5	3	1
Adequate quantities of Carbonaceous material available	1	1	3	5
Processing is capable of diverting				
Fruit	5	5	5	5
Vegetable	5	5	5	5
Coffee Grounds & Tea Bags	5	5	5	5
Breads, grains, and pasta	5	5	5	5
Meat and Seafood	5	5	5	1
Food soiled paper	5	5	5	5
Pizza Boxes	5	5	5	1
Uncoated paper plates and bags	5	5	5	5
Certified compostable liner bags	5	5	5	1
Yard Trimmings	5	5	5	5
Compostable Plastic	5	5	5	1
One footprint for processing	5	3	3	1
ReSource involvement in operations	5	5	5	1
Ability to provide a finished compost	5	5	5	5
Lower capital development costs	1	2	4	5
Lower operational costs	1	2	4	5
Lowest cost to generator	1	2	4	5
Lowest subsidy cost to jurisdiction or ReSource	1	2	4	5
Minimal siting	1	1	1	3
Public Private Partnership risk reliability is on the private sector	5	5	3	5
Public concern	1	3	3	5
Proven concept food scrap processing	5	5	3	1

Table C-2 Hamilton County ReSource Combined Weighted Average Scores and Totals

Question Group	Strategy	A One Large-scale Facility	B Two Large-scale Facilities	C Medium-scale Facilities (three)	D Small-scale Community Composting
Group 1	What is the importance that ReSource develop one centralized facility for processing organics?	33.6	20.2	20.2	6.7
	Tonnage throughput will dictate the size and land needed for a processing facility. Is it important that Hamilton County maximize the space to develop one footprint? Meaning if the same result is accomplished with a smaller footprint is a large footprint the goal.				
Group 2	Development Cost: How important is it that the cost of developing an organics processing facility be as low as possible?	50.4	100.8	201.6	252.0
	How important are the development costs of an organic compost facility?				
	How important are the operational costs of an organic compost facility?				
	How important is the cost paid by the generator to divert food scraps?				
	How important is the cost paid by the jurisdiction or ReSource to subsidize food scrap facility?				
Group 3	Processing Type: How important is it that the organics processing facility does not create odors or nuisance?	16.3	49.0	49.0	81.7
	How important is the Public concern for a food scrap facility?				

Question Group	Strategy	A One Large-scale Facility	B Two Large-scale Facilities	C Medium-scale Facilities (three)	D Small-scale Community Composting
Group 4	Maximize Diversion: What is the importance of maximizing the diversion of food scraps over other compostables and organics?	1,031.7	1,031.7	964.4	735.0
	How important is it to maximize diversion of the food scraps currently ending up in the landfill?				
	Of the organic materials to divert identify the importance of diverting each material listed below:				
	Fruit Scraps				
	Vegetable Scraps				
	Coffee Grounds & Tea Bags				
	Breads, grains, and pasta				
	Meat and Seafood				
	Food soiled paper				
	Pizza Boxes				
	Uncoated paper plates and bags				
	Certified compostable liner bags				
	Yard Trimmings				
	Compostable Plastic				
	How important is it that the finished product is a usable compost?				
	How important is a solution for food scrap processing be a proven concept?				
Group 5	Integrated Management: How important is it that ReSource support current infrastructure (versus building for greater potential diversion)?	19.5	19.5	37.5	76.5
	Are adequate quantities of Carbonaceous material available?				
	How important is it that siting a food scrap processing facility is				

Question Group	Strategy	A One Large-scale Facility	B Two Large-scale Facilities	C Medium-scale Facilities (three)	D Small-scale Community Composting
	relatively easy?				
Group 6	Public Private Partnership: How involved should ReSource be in the following activities:	108.9	108.9	82.8	74.0
	Construction of a processing facility				
	Operating a processing facility				
	ReSource has stated that they do not want to operate an organics composting facility. A decentralized option could be viable that would require ReSource staff in an operational capacity. How important is it to exclude ReSource staff as an option?				
	How important is it in a Public Private Partnership that reliability is on the Private Sector?				
	Total Score	**1,260**	**1,330**	**1,355**	**1,226**

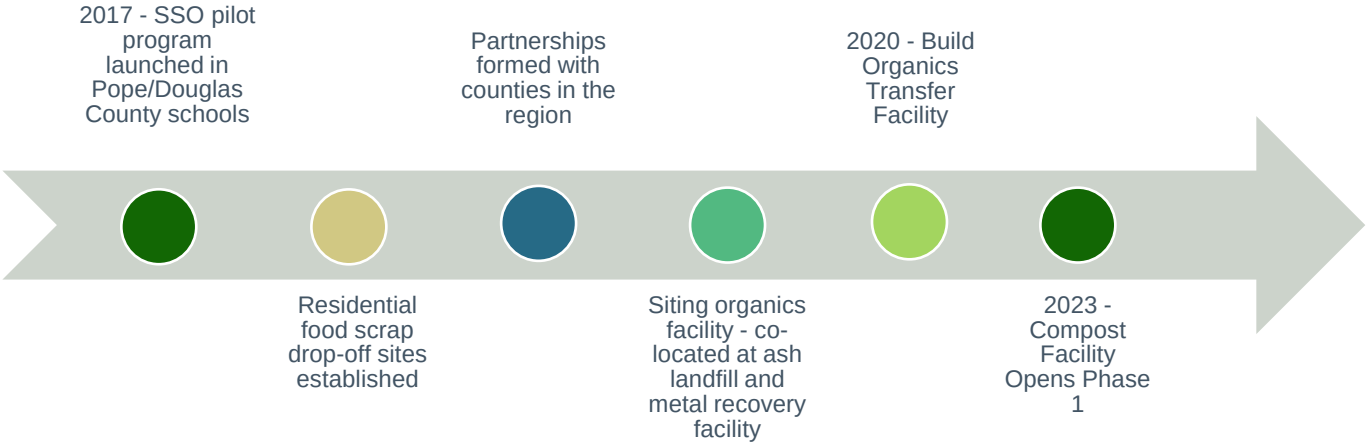
Appendix D: Case Study Pope/Douglas County, MN

Background: Pope/Douglas Solid Waste Management (PDSWM), based in Alexandria, Minnesota, is a partnership created by Pope and Douglas Counties in 1983 to manage the municipal solid waste (MSW) stream generated in both counties. Approximately 80,000 tons/year of MSW are received from a 7-county area at PDSWM's Mixed Waste Material Recovery Facility (MWRF) and an adjoining Resource Recovery Facility (a waste-to-energy plant). The MWRF preprocesses incoming trash via mechanical and human sorting to recover recycled materials, including corrugated cardboard, ferrous and nonferrous metals, and wire. Hazardous wastes are also removed, and then the sorted MSW is combusted at the Resource Recovery Facility.

Organics management consisted of several small yard trimmings composting sites in the two counties. Though, PDSWM does not view food scraps as a beneficial input to the Resource Recovery Facility as it has a low BTU value. Food scraps and nonrecyclable paper comprise up to 30% of the total MSW generated in Pope and Douglas Counties. After a pilot, and construction of an organics transfer facility, an organics composting facility was opened in 2023.

In 2023, PDSWM expanded the existing MWRF into an Advanced Materials Recovery Facility designed to pull additional items out of the raw MSW stream as well as sort single-stream recyclables collected curbside and at drop-off centers. This new MRF is expected to come online at the end of first quarter 2025.

Organic Infrastructure Timeline:



In 2017, a pilot program was initiated to collect source-separated organics (SSO) from several schools and businesses in Pope and Douglas Counties. All food scraps, uncoated paper, and BPI-certified compostable liner bags and products were accepted for the pilot. Collected organics were brought to Tri-County Organics in St. Cloud (MN) to be composted. In addition, several residential food scrap drop-off

sites were established (there are currently 9 in total).

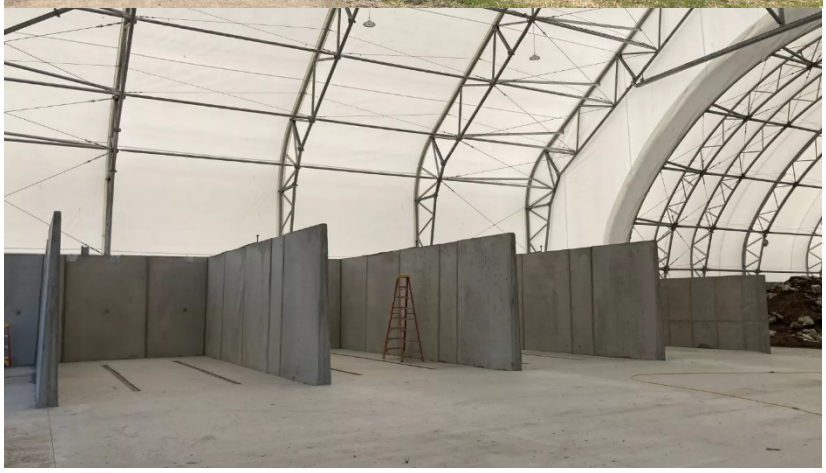
During the pilot, PDSWM began laying the groundwork for a SSO composting facility that would service its two counties, as well other counties in the region. Partnerships were formed with Grant, Stevens and Otter Tail counties to utilize the facility. PDSWM collects SSO from businesses and institutions in its counties; partner counties work with their local haulers.

The first phase of construction in 2020 was to build an Organics Transfer Station — a fabric covered structure with a concrete floor — with capacity to transfer up to 1,000 tons/year of material. Capital cost for the transfer facility was about $256,000. Until the composting facility was constructed, collected SSO in Pope/Douglas counties and the other counties in the service area was brought to the transfer station, consolidated, and hauled to a composting facility over 80 miles away.

Design Considerations: The composting site is co-located with an ash landfill from PDSWM's waste-to-energy plant. Also located at the landfill site is a Metal Recovery Facility to remove ferrous and nonferrous metal for recycling. PDSWM selected Engineered Compost Systems, Inc. (ECS) to develop a phased solution centered around high aeration rates and automated temperature control. Design criteria had to factor in:

- Processing challenging feedstocks
- Phased approach
- Function during cold winter climate (-30°F)
- Minimize odor
- Water management - Contact water is defined by Minnesota regulation as water that generally comes in contact with tipping and mixing areas (raw feedstocks) and active compost piles that have not met PFRP (Process to further reduce pathogens).

Enclosure of the active piles reduces the amount of contact water (leachate) that must be managed separately from storm water.



The initial facility (Phase 1) is designed to process 2,500 tons/year, including yard trimmings, and then doubling that amount over the next four to five years. Phase 1 is comprised of four positively aerated static pile (ASP) zones on the east side of the fabric structure and four on the other. Trench style aeration floors were installed to uniformly distribute air and capture leachate. The zones are designed for future conversion to reversing aeration that enables the system to recirculate air, which conserves thermal energy during the winter and allows cold piles to heat up much more rapidly. Below grade hardware was installed on the west side during the concrete pour, but the aeration ducts have not been connected.

The four zones on the east side serve as the active composting area and have bunker walls separating each zone. The other four zones are designated for curing. Because of the current SSO throughput (around 1,2000 tons/year), only the east side with bunker walls has been used for the active and curing phases. The Phase 1 build-out has capacity to manage up to 6,000 tons/year by using the non-bunkered zones on the west side and outside windrows for final curing.

In 2023, its first full year of operation, the facility received 500 to 600 tons of SSO and an equivalent amount of wood chips and yard trimmings. The initial mix is comprised generally of one-third SSO, one-third wood chips and one-third yard trimmings.

Phased-In Facility Design: The compost facility is permitted from the Minnesota Pollution Control Agency to process up to 15,000 tons/year of SSO, yard trimmings, wood chips and other amendments. PDSWM projects a 10- to 15-year timeframe to grow to that capacity. PDSWM used a phased-in capacity approach for facility design and construction, accommodating what was needed at the outset (first five years), and then anticipating 5- and 10-year increases in flow and facility capacity.

Phase 2 will add eight more zones and ductwork to enable reversing and recirculating aeration. It will require expanding the pad space and covered area and includes an additional four zones to the east and west sides, for a total of 16 zones of active composting capacity. The zones on the east side are planned to be upgraded to reversing/recirculating aeration. There is adequate land area at the facility to

expand if and when needed.

A total of $2.145 million in state and local matching bonds was used to construct the compost processing building and operations office. While the lowest capital cost in terms of construction would be to purchase and install the entire system at once, the reality for PDSWM is that it would be paying for infrastructure long before it would be using it. Instead, PDSWM matched its capital investment to the expected organics load. Including the below grade aeration infrastructure for the four zones on the west side of the building was a cost savings to PDSWM as it enabled the contractor to pour the entire floor and construct the building in a single mobilization.

PDSWM plans to adopt an ordinance that would require commercial and institutional generators to divert food scraps from the incinerator and is collaborating with the other county solid waste officers to adopt similar provisions. It's anticipated that the ordinances would more than double the current flow of SSO to the composting facility.

SOURCE PAGE

[i] FRED Economic Data. St. Louis Fed. https://fred.stlouisfed.org/data/LAUCN390610000000005
[ii] Ohio EPA Directors Final and Findings, July 22. 2009
[iii] https://www.cultivatingplace.com/post/the-civic-garden-center-of-greater-cincinnati-80-years-and-growing-karen-kahle and https://www.civicgardencenter.org
[iv] https://www.commonorchard.com/compost and http://chrismyth.com/projects/
[v] https://tikkunfarm.com/nourishing-families/
[vi] Survey response from July 2023 distributed survey as part of this study.
[vii] Survey response from July 2023 distributed survey as part of this study.
[viii] Composting Consortium, managed by Center for the Circular Economy at Closed Loop Partners. Unleashing the Economic and Environmental Potential for Food Waste Composting in the U.S. July 2024.
[ix] 2023 Fall Season and 2024 Spring Season Residential Waste Audit raw data provided by Hamilton County ReSource
[x] https://www.biocycle.net/residential-food-waste-collection-access-in-u-s/
[xi] Natural Resources Defense Council. *Estimating Quantities and Types of Food Waste At The City Level*. October 2017.
[xii] The analysis is limited to single-family households since multi-family households do not directly subscribe for waste management services.
[xiii] U.S. Census, Hamilton County. https://data.census.gov/table/ACSST1Y2022.S1101?q=Households%20in%20Hamilton%20County%20Ohio%20in%202022
[xiv] New York State Pollution Prevention Institute. https://www.rit.edu/affiliate/nysp2i/food-waste-estimator
[xv] Ohio EPA composting and licensed facility list. 2023. https://epa.ohio.gov/divisions-and-offices/materials-and-waste-management/reports-and-data/tableau-licensed-regist-sw-cddfacilities
[xvi] Platt, Goldstein, Coker. “State of Composting in the US What, Why, Where & How”. July 2014.
[xvii] See http://compost.css.cornell.edu/OnFarmHandbook/apa.taba1.html for tables of characteristics of various feedstocks and http://cwmi.css.cornell.edu/composting.htm for instructions on how to make a compost recipe.
[xviii] Porosity is the percentage of void space in a compost pile. It is defined as the ratio of the volume of the voids or pore space divided by the total volume. It is written as either a decimal fraction between 0 and 1 or as a percentage.
[xix] Lignin is a class of complex organic polymers that form key structural materials in the support tissues of most plants. Lignins are particularly important in the formation of cell walls, especially in wood and bark, because they lend rigidity and do not rot easily.
[xx] Compost distribution requirements for Class II: https://epa.ohio.gov/static/Portals/34/document/currentrule/3745-560-220_current.pdf