Organics Management Plan

Warren County, New York

Warren County Department of Public Works

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→ **The Power of Commitment**

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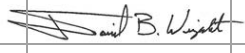
S4	1	M. Knapp	D. Wright		B. Smith		7/31/2023

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Executive Summary

Warren County, New York (County) is acting on a strategic vision to develop a comprehensive plan that addresses the sustainable management of wasted food, and other organic wastes, in the County.

GHD Consulting Services Inc. (GHD) was retained by the County's Department of Public Works (DPW) to support the study and prepare an Organic Management Plan (OMP) for the County's use. This study has been funded by the New York State Department of Environmental Conservation as an outcome of the Climate Smart Community Grant Program, Title 15 of the Environmental Protection Fund.

The OMP study evaluated:

– the County's current solid waste management practices related to organic wastes in the County, and in reference to the Local Solid Waste Management Plan (LSWMP);
– community engagement and interest in composting, including outreach and a community survey;
– potential composting technologies that could be used in the County;
– potential pilot programs including backyard composting, curbside collection of organic waste and community drop-off locations; and
– a centralized composting facility that could either be municipally owned and operated, realized through a public-private-partnership, or privatized operations on municipally-owned land.

Work Plan Summary

Task 1, the Existing Conditions Report, defined the current state of practice with respect to organic waste management in Warren County. Currently, there are 12 municipally owned and operated Transfer Stations/ Recycling Centers operating and 2 locally owned Construction and Demolition (C&D) landfills within the County. Warren County does not have any active municipal solid waste (MSW) or waste-to-energy facilities, they do not currently have a centralized solid waste and recycling system.

In the LSWMP it was estimated that 74,000 tons of MSW was generated in the planning unit in 2019. It is estimated that 41,500 tons or 56 percent of waste was residential MSW and approximately 32,500 tons or 44 percent of waste was commercial/institutional MSW. Based on the New York Department of Conservation estimates composition of waste generated, an estimate was made as to the quantity of waste generated that could be available to a municipal composting facility. It was estimated that approximately 115 tons per day of MSW is compostable. This value was used as Design Point 2 in Task 5, evaluating the feasibility of a centralized facility.

Task 2 included six Advisory Committee Meetings, community survey, and two community engagement sessions. Throughout this study, the progress was discussed with the Advisory Committee in virtual meetings, they provided community insight and feedback for the preparation of the OMP. GHD prepared and hosted a survey on behalf of the County, this survey provided feedback on the level of interest from the community on organics management. The Survey was conducted for 31 days in the month of March 2023 using MS Forms, there were a total of 178 responses received. The results indicate that there is an overall support for composting in Warren County. The first community engagement session presented the overall study to residents and provided them will examples of other municipal composting facilities. Residents were able to ask questions and provide feedback for the OMP.

In Task 3, GHD provided an overview of potential compost technologies that could be utilized for a centralized composting facility being considered by Warren County. The County and the Advisory Committee reviewed and provided input on a list of compost facility objectives. Relative weights of importance were assigned to each objective. Based on the relative importance, GHD performed an analysis that compares the alternatives against a numeric score. The results of the evaluation determined that Turned Windrow, Uncovered Aerated Static Piles, and Covered Aerated Static Piles were the technologies to be further assessed in Task 5, as they scored the highest overall.

Warren County recognizes that long term program sustainability is a key factor that can be informed through results and feedback gained in pilot programs. As per Task 4 of this study, three common residential organic programs used throughout New York State were presented. The pilot programs include backyard composting, residential drop-off at a centralized location, and curbside collection. Backyard composting is a good fit for rural communities such as Warren County, where the hauling distance may create a barrier and deter participation in other composting programs. Given the current waste management practices, curbside collection would be challenging due to the availability of local haulers with the ability to provide this service. Curbside collection also presents the highest capital out of the three pilot programs, which is a main concern for the County. After discussions with the County and the Advisory Committee, and reviewing the results from the community survey it was determined that drop-off locations would be the most suitable for the County to pilot. This would give residents the opportunity to learn what materials are to be composted and the County could develop a small on-site composting system to gather initial data on organics received. In preparation of a pilot program, the County should explore funding opportunities, there are several grant opportunities in New York State that provide supplemental support and ease the burden of costs required to pilot new organics programs.

Task 5 evaluated the feasibility of a centralized facility. Based on the estimated organics that could be composted, GHD evaluated a phase approach for the sizing of the compost facility for the County to optimize initial investment and take advantage of the modularity of composting technology. Design Point 1 represents initial investment that will be sized to handle approximately 10,000 tons of organic wastes per year. This estimate was based on the 2022 landfill disposal data provided by the County and includes large generators within 25 miles of the facility. Large generators were considered in Design Point 1 due to the recent Food Donation and Food Scraps Recycling Law that became effective January 1, 2022. This Law requires businesses and institutions that generate an annual average of 2 or more tons per week donate excess edible food and recycle all remaining food scraps if they are within 25 miles of an organics recycler. Design Point 2 was based on Warren County's LSWMP that estimated the total compostable waste within the County, this value amounted to 24,000 tons of organic wastes per year. Design Point 2 will be a potential future estimate therefore not evaluated in the OMP.

Additionally, two site locations have been proposed by the County for a centralized facility. Location 1 is located in the Town of Lake George in a residential commercial area. Location 2 is located in the Town of Queensbury in a commercial and industrial area. The County suggested that the site location not be selected during this study to maintain open options as the evaluation for a compost facility continues.

A conceptual cost estimate was prepared for Design Point 1, potential constructed quantities were assumed from typical expectations in reference to project of similar size, scale, and complexity. All three technologies were assessed in the cost estimate, Turned Windrow technology presented the least capital costs and operational costs and Covered Aerated Static Pile technology presented the highest capital costs and operations costs. These costs are to be considered when the County determines the best overall technology for a centralized facility in the County.

The county should consider developing a business model for a compost facility in the County, a good business model would ensure the success of the facility. The County may wish to explore potential partnerships with non-profits, organizations, and businesses, there are multiple in the County that the county could consider. These organizations could potentially provide initial funding for construction and help encourage the community by marketing and providing public outreach events for the facility. Additionally, the County would want to consider the materials to be accepted at the facility, facility costs as initial investment and future operational costs and expenses, and potential revenues needed to keep the facility operational and cover capital costs.

There are many project delivery methods that the County could consider when exploring potential partnerships. GHD presented three project delivery methods for the County to consider, Design-Bid-Build, Build-Own-Operate, and Design-Build-Finance-Operate. For Design-Bid-Build the owner would contract separate entities for design and construction, the operation and maintenance of the completed facility is contracted separately or completed by the owner. For Build-Own-Operate delivery method, the owner sells to a private sector party the right to construct a project according to agreed design specifications and to operate and maintain the facility. in the Design-Build-Finance-Operate delivery method the owner contracts with a single entity for design, construction, operation, and maintenance

of capital infrastructure, following the construction time period the owner would resume control of operation of the facility. These are three project delivery methods that the County could consider when designing a compost facility.

Development of OMP

To summarize the development of the OMP, GHD presented a schedule with the tasks, Advisory Committee Meetings, community engagement sessions, and final OMP. This schedule was used throughout the study to track the progress of the study and the interim deliverables used to gain feedback on the OMP. A final OMP Roadmap is presented in the OMP as an overall timeline for major activities towards implementing an overall program and facility. This roadmap was presented over 3 years and suggests the next steps Warren County should consider in the OMP.

The DPW asked GHD to provide a summary of the program's strategic value and preliminary recommendations which follows.

Strategic Value

1. Presents an opportunity to reduce the quantity of organic waste managed to landfill disposal
2. There seems a public interest in the program based on the survey results and engagement
3. Opportunity to create locally available alternatives to fertilizer, and improve soil health
4. Opportunity for job creation (e.g., construction, operations, consultation, program management)
5. Aligns with NYS Solid Waste Management Plan, the Climate Leadership and Community Protection Act (CLCPA, July 2019) and the NYS Food Donation and Food Scraps Recycling Law (January, 2022)
6. Opportunity to offset current costs of landfill disposal; ROI not estimated in current study (future step)

Preliminary Finding and Recommendations

There are several steps for Warren County to consider before constructing a centralized facility.

Preliminary Recommendations include:

– Hire a Solid Waste Coordinator, and a Recycling coordinator is recommended by fiscal year 2025
– Pursue grant applications for the 6-month pilot (estimated to be <$270k) and infrastructure (estimated to be $2M to $4.5M)
– Implement the pilot program in 2024, including a waste characterization study
– Explore partnerships for privatized operations, e.g., a Request for Expression of Interest or Request for Qualifications (RFQ) and/or Request for Proposals (RFP)
– Finalize the municipal business case, including market assessment for finished compost
– Consider expanding County support of local composting initiatives (e.g., outreach and engagement)

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1. Introduction

Warren County (County) is acting on a strategic vision to develop a comprehensive plan that addresses the sustainable management of food waste and yard wastes in the County by diversion of these organic materials from landfill to composting.

To support the strategic vision, the County's Department of Public Works (DPW) retained GHD Consulting Services Inc. (GHD) to undertake a comprehensive study. The final deliverable for the study is this document, which is referred to as the Organics Management Plan (OMP). In this OMP (study/report), the evaluations completed during the study are summarized, and a set of interrelated strategies recommended to meaningfully increase organics recovery, diversion from landfill, and conversion to compost.

The types of organic wastes for composting considered in the study included:

– Residential food waste / food scraps
– Commercial and institutional (C&I) food wastes, pre- and post-consumer
– Municipal, C&I and residential yard waste such as leaves, grass clipping, or woody waste

This OMP excluded the following wastes generated in the County:

– Biosolids
– Contaminated Soils
– Animal Mortalities
– Agricultural waste such as horse manure
– Other inorganic materials or recyclables
– Commingled municipal solid waste (MSW)

This study intended to support the County in taking steps forward towards sustainable organic waste management practices by composting material that is currently disposed to landfill. The key findings of this report were presented to the County's Board of Supervisors on June 14, 2023, and the report will be reviewed with the New York State Department of Environmental Conservation (NYSDEC) in conformance with the funding made available for the study through the Climate Smart Community Grant Program, Title 15 of the Environmental Protection Fund.

1.1 Purpose of this report

The purpose of this report is to:

– Summarize study Tasks 1 through 5.
– Present a graphic showing how the OMP was developed.
– Present a project road map for the County, including an overall timeline for major activities for implementing a program, summary of the strategic opportunity, timeline for implementation, and estimated costs.

This report constitutes the final deliverable for the study.

2. Development of the OMP

The OMP was developed through multiple tasks and deliverables throughout the study. The study consisted of five interim deliverables which were reviewed by the DPW, six Advisory Committee Meetings where the committee provided community insight and feedback for the OMP, two community engagement sessions to encourage composting initiatives and gather feedback from the community on the draft plan, and a community survey to aid in the development of the OMP.

Figure 2-1 below is the schedule used for in this study to progress the OMP and constitutes a graphic showing how the OMP was developed.

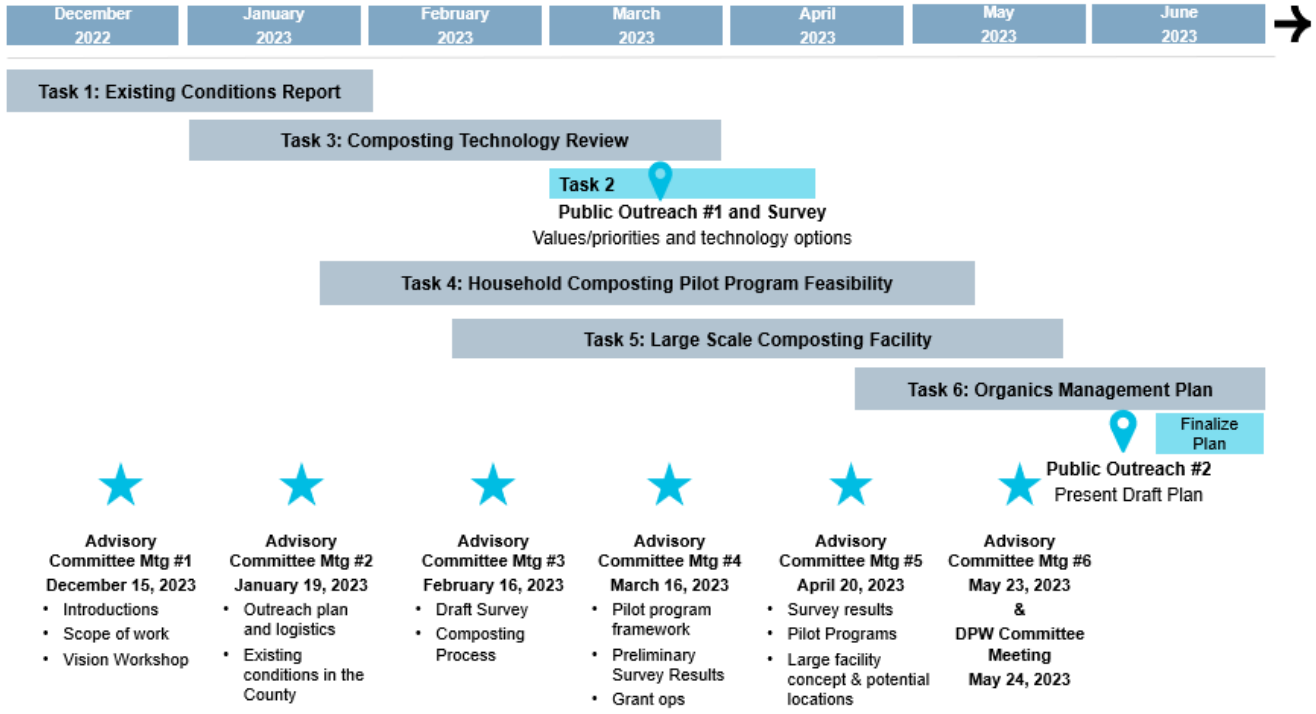


Figure 2-1 Schedule for the Development of the OMP

3. Work Plan Summary

The following sections summarize the entirety of the study's five main tasks. As the study was being completed, GHD prepared interim deliverables in the form of Technical Memorandums (TM) to report progress within each task. The comments received on the interim deliverables were considered in the development of this OMP.

Tasks included:

– Task 1 – Existing Conditions Report
– Task 2 – Public Outreach
– Task 3 – Composting Technology Review
– Task 4 – Household Composting Pilot Program Feasibility
– Task 5 – Large Scale Composting Facility Feasibility

3.1 Task 1: Existing Conditions Report

The first deliverable for the study included the Existing Conditions Report to define the current state of practice with respect to organic waste management in Warren County. A core document used to understand the status of organic waste characterization (quantity and quality) in the County was the County's 2021 Local Solid Waste Management Plan (LSWMP).

3.1.1 Methods of Information Gathering

As defined by the agreed Scope of Work, GHD completed a review of available documents to evaluate the existing conditions. The LSWMP prepared by the County in 2021 (revision and update to the 1993 LSWMP) was used as the primary report, there were no other existing reports provided to GHD. While the County's Request for Proposals (RFP) identified a Climate Action Plan and Sustainability Framework, neither of these documents are currently available, but would be further developed by the County and most likely following the completion of this study. In addition, GHD completed the following steps to gather additional information:

- A Project Kick-off Meeting was convened with the County DPW on November 29, 2022, to discuss current methods of waste management in the County, including a discussion on existing organic waste management systems.
- Three introductory meetings convened with representatives of the Advisory Committee on December 12, 13 and 14, 2022, to introduce the project team and discuss general information about organic waste practices in the County.
- A project visioning workshop with the Advisory Committee on December 15, 2022, to discuss the overall project vision, scope of work, and perceived challenges and opportunities to be considered during the Study.
- GHD prepared a Questionnaire for the response of the Advisory Committee, 3 written responses were forwarded from DPW to GHD as of January 9, 2023.
- A Request for Information (RFI) was submitted to the County DPW in January 2023 and written responses were provided to GHD in February 2023.

In addition, the New York State Pollution Prevention Institute (NYSP2I) maintains an online database known as the Organic Resource Locator, which is a web-based mapping tool that provides information on organic waste resources and utilization pathways in New York State. The County DPW has identified two potential locations for a composting site, which were pinpointed on the map, and considered in identifying potential "Designated Food Scrap Generators" as defined by the NYS Food Donation and Food Scraps Recycling Law.

3.1.2 Baseline

3.1.2.1 General

Upon the expiration of the 1993 LSWMP between Warren County, NY and Washington County, NY, the County decided to conduct its solid waste planning as a separate Planning Unit. The purpose of the original 1993 LSWMP was to document the current waste management practices of the County. The 1993 LSWMP was last updated by the County in 2021.

Warren County encompasses 932 square miles, this includes 65 square miles of water. The population of the County is over 64,000 residents and consists of over 25,000 permanent households. The County is surrounded by Washington County to the east, County of Saratoga to the south, County of Hamilton to the west, the County of Essex to the north, and the popular destination of Lake George is in Warren County. Lake George is also located in Washington County and the County of Essex which were previously mentioned as surrounding counties.

In 2011, the County sold its interest in Hudson Falls waste-to-energy Facility (HFWTEF). Since the implementation of the 1993 LSWMP, the County has also closed a Material Recycling Facility (MRF) located at 299 Lower Warren Street, Queensbury, New York. The closure of the MRF was due to costs and historic lack of cost-effective markets for the recovered recyclables.

There are currently 12 local, municipally owned and operated Transfer Stations/ Recycling Centers operating within Warren County (see Table 3.1 below). There are also 2 locally owned Construction and Demolition (C&D) landfills. Warren County does not have any active municipal solid waste (MSW) or waste-to-energy facilities. Warren County does not currently have a centralized solid waste and recycling system.

Table 3.1 Transfer Stations Operating in Warren County

Transfer Stations	Address	Ownership
Town of Bolton Transfer Station	107 Finkle Road, Bolton Landing, NY 12814	Town of Bolton
Chestertown Transfer Station	62 Landon Hill Road, Chestertown, NY 12817	Town of Chester
City of Glen Falls	Uses Town of Queensbury Transfer Station	Town of Queensbury
The Hague Transfer Station	27 Valley View Road, Hague, NY 12836	Town of Hague
Town of Horicon Transfer and Recycling	Tannery Road, Brant Lake, NY 12815	Town of Horicon
Town of Johnsburg Recycling Center Transfer Station	Ski Bowl Road, North Creek, NY 12853	Town of Johnsburg
Town of Lake George Transfer Station	56 Transfer Road, Lake George, NY 12845	Town/ Village of Lake George
Lake Luzerne Transfer Station	123 Towner Road, Lake Luzerne, NY 12846	Town of Lake Luzerne
Ridge Road Transfer Station	1396 Upper Ridge Road, Queensbury, NY 12801	Town of Queensbury
Stony Creek Transfer Station	20 Hill Road, Stony Creek, NY 12878	Town of Stony Creek
Thurman Transfer Station	Erving Baker Road, Thurman, NY 12810	Town of Thurman
Warrensburg Transfer Station	U.S. Route 9, Main Street, Warrensburg, NY 12885	Town of Warrensburg

3.1.2.2 Current State of Food and Yard Waste Management in the County

The following defines the current state of organic waste management in the County:

– Presently, there are no municipal or centralized commercial organic waste composting facilities in Warren County.
– From previous discussions, local landscapers have expressed interest in locally available, quality finished compost.
– Some of the local Towns do receive seasonal yard wastes (e.g., leaves or storm debris) to their transfer stations or other local yards where they are stockpiled. The current transfer stations that manage yard wastes include:
  - Town (T) of Queensbury
  - Lake George (T)
  - Warrensburg (T)
– There are no existing municipally managed residential curbside collection programs for source-separated organic wastes.
– There is an existing small-scale operation that receives weekly or bi-weekly pickup of 5-gallon buckets of food scraps for a small fee. It is known as the Adirondack Worm Farm that uses standard composting methods and vermiculture composting methods, and provides services in the Towns of Glens Falls, Hudson Falls, Queensbury, Fort Edward, South Glens Falls/Moreau, Lake George, and Fort Ann.
– Current known composting initiatives in Warren County include:
  - Adirondack Worm Farm operates a vermiculture composting system;
  - Adirondack Compost Education Council (ACEC) was formed 2-years ago to assist Warren County to establish a composting facility for large food waste generators;
  - Rotary Club (Glens Falls) engaged the community with a program on community composting education;
  - Town of Queensbury hosted a compost bin sale in 2021, 2022, and 2023;
  - SUNY Adirondack has a composting operation run by students, including participation of their culinary school; and
  - Some local businesses promote composting in the community.

– Previously, some businesses not identified in the NYSDEC list of “Designated Food Scrap Generators” expressed interest in participating in a food waste diversion program.

We note that wastewater biosolids are not considered in the current study.

3.1.3 Quantity of Solid Waste Generated

GHD was provided with the LSWMP for Warren County to understand the current waste management practices, further details of waste quantity and characterization can be found in the following sections.

The County does not have a centralized solid waste and recycling system. Each Town, City, and Village located within the County arranges their own solid waste and recycling program. In addition, each of the local municipalities retain private waste haulers. The County provides each municipality with enough roll-off containers to operate their municipally owned transfer station. The roll-off containers are used to store solid waste and recyclables at the transfer stations. The County Purchasing Department also manages the bidding for transportation services on behalf of the municipal transfer stations.

As extracted from the 2021 LSWMP, the following sections characterize and estimate the overall solid waste generated within Warren County, New York.

3.1.4 Municipal Solid Waste

The LSWMP that was provided to GHD estimated that over 74,000 tons of MSW was generated within the planning unit in 2019. It is estimated that 41,500 tons or 56 percent of waste was residential MSW and approximately 32,500 tons or 44 percent of waste was commercial/institutional MSW. The United States Environmental Protection Agency (USEPA) estimates that individual waste generation is about 4.9 pounds of waste per day, in 2019 the population in Warren County was about 64,300 residents, this amounts to approximately 57,000 tons of residential MSW. The USEPA estimate was compared with the LSWMP estimates from the NYSDEC, the USEPA estimates about 37% more residential MSW than the County LSWMP estimated. The County’s municipalities spent approximately $2,055,000 in 2019 for its waste and recycling services.

Table 3.2 shows the total amounts of solid waste handled and disposed by each municipality and the cost associated with waste disposal as presented in the LSWMP.

Table 3.2 Municipality Waste Generation and Disposal Cost

Municipality	Volume of MSW, C&D, and Recycled Material Handled for Disposal	Cost of Waste Disposal
Town of Bolton	In 2019, the Town transfer station accepted approximately 499.18 tons of MSW and 496.9 tons of C&D material for disposal. The Town transfer station accepted approximately 303.21 total tons of recycled material.	The Town spent approximately $230,000 on solid waste and recycling services.
Town of Chester	In 2019, the Town transfer station accepted approximately 467.86 tons of MSW and 419.66 tons of C&D material for disposal. The town also accepted 148.4 total tons of recycled material.	The Town budgeted for $241,000 for its 2019 solid waste and recycling services.
City of Glens Falls	Material accepted on behalf of the City of Glens Falls by the Town of Queensbury is not accounted for separately from the total volume of material accepted at the two Town of Queensbury-operated transfer stations. Of the material accepted 292.16 tons were recycled.	NA

Municipality	Volume of MSW, C&D, and Recycled Material Handled for Disposal	Cost of Waste Disposal
Town of Hague	In 2019, the Town transfer station accepted approximately 138.26 tons of MSW and 104.56 tons of C&D material for disposal. Additionally, 37.27 tons of MSW were accepted for recycling.	NA
Town of Horicon	In 2018, the Town transfer station accepted approximately 252.35 tons of MSW, 307.59 tons of C&D material for disposal and an additional the Town received 118.64 total tons of material for recycling.	The Town budgeted for approximately $115,200 for solid waste and recycling services.
Town of Johnsburg	In 2019, the Town transfer station accepted approximately 905 tons of MSW, 340 tons of C&D material for disposal and an additional the transfer station received 234.69 total tons of recycled material.	The Town spent approximately $202,000 on its solid waste and recycling services.
Town of Lake George	In 2019, the Town transfer station accepted approximately 615.7 tons of MSW and approximately 53.4 tons of C&D material for disposal. The Town transfer station accepted approximately 234.69 total tons of recycled material.	The town spent approximately $193,000 on solid waste and recycling services.
Village of Lake George	Material accepted on behalf of the Village of Lake George by the Town of Lake George is not accounted for separately from the total volume of material which the Town accepted at the Town-operated transfer station.	NA
Town of Lake Luzerne	In 2019, the Town transfer station accepted approximately 1,030 tons of MSW for disposal. The Town also accepted C&D material and recycled material at the Town transfer station, however, this data was not recorded.	The Town budgeted $345,000 for solid waste and recycling services.
Town of Queensbury	In 2018, the Town accepted approximately 1,865.67 tons of solid waste material for disposal. This volume includes waste accepted from City of Glens Falls residents. The transfer station also received approximately 295.36 tons of recycled material.	The Town spent approximately $490,400 on solid waste and recycling services.
Town of Stony Creek	In 2019, the Town transfer station accepted approximately 149 tons of MSW and 105 tons of C&D material for disposal and an additional 32.17 tons of material recovered for recycling.	The Town spent approximately $51,000 on solid waste and recycling service.
Town of Thurman	The Town accepts C&D material and bulky waste MSW items at the Town Drop Off Center. Volume of the material handled by the Town is not available.	The Town spent approximately $29,000 on solid waste and recycling services.
Town of Warrensburg	In 2018, the Town transfer station accepted approximately 937.8 tons of MSW and 243.8 tons of C&D material for disposal. The Town received approximately 261.99 total tons of recycled material at the Town transfer station.	The Town of Warrensburg budgeted $158,000 for solid waste and recycling services.

The County provided GHD with the Private Hauler Data for 2022. The total MSW transported by private haulers was 73,603 tons. The table below shows the MSW transported from January 2022 to December 2022 for all transfer stations.

Table 3.3 Private Hauler Data

Months in 2022	MSW Hauled to Landfills (tons)
Quarter 1- January, February, March	14,364
Quarter 2- April, May, June	18,149
Quarter 3- July, August, September	21,944
Quarter 4- October, November, December	19,146
Total	73,603

3.1.5 Construction and Demolition Waste

The NYSDEC estimated that 17 percent of the construction and demolition (C&D) waste in the state is residential, 25 percent is non-residential, and 58 percent is from infrastructure or other waste. Based on this estimate the C&D waste was calculated in the LSWMP.

It was estimated that there was approximately 2,911 tons of residential C&D material generated in 2019. Most of the municipalities in Warren County accept a limited amount of residential C&D debris at the municipally owned transfer stations. As previously stated, Warren County has two C&D landfills that residents of the towns which the landfills are in can dispose of their residential C&D material.

In the LSWMP it was estimated that 4,281 tons of was non-residential C&D was generated in the County in 2019. Non-residential C&D generated in the County is typically handled by private haulers who collect, process, transport, and recycle/dispose of the material using their own facilities and resources.

The infrastructure waste within the County is mainly concrete, asphalt, rock and bricks that are typically generated by the municipalities. Municipalities that cannot reuse the C&D material or dispose of it in their own C&D landfill contract a private hauler to collect, process, transport and recycle/dispose of the material using their own facilities and resources. Using the NYSDEC data it was estimated that approximately 9,932 tons of infrastructure/other C&D material was generated in 2019.

The County provided the amount of C&D transported by private haulers from January 2022 to December 2022

Table 3.4 Private Hauler Data for C&D Waste

Months in 2022	Recycling Waste Hauled (tons)
Quarter 1- January, February, March	1,714
Quarter 2- April, May, June	2,589
Quarter 3- July, August, September	2,950
Quarter 4- October, November, December	2,812

3.1.6 Industrial Waste

Manufacturing within the County mainly consists of medical equipment, medical supplies, and forestry papermaking. Due to the large inventory of natural forests the largest volume of industrial waste was found to be paper sludge and paper making by-products. The waste generation and disposal information from industrial waste was not collected, it was assumed that the Green Ridge RDF landfill, located in Saratoga County, adjacent to Warren County, took most, if not all, of Warren County's Industrial waste. The LSWMP reported that in the Green Ridge RDF- Consolidated Landfill Active Solid Waste Landfill 2018 annual report, it accepted approximately 13,460 tons of industrial waste, approximately 8,000 tons of paper bags, brown stock, boiler ash and precipitated calcium carbonate.

3.1.7 Specialty Wastes

Specialty wastes were defined as waste that was not generated in the planning unit that do not fall under the MSW, C&D or industrial waste categories.

Healthcare and social assistance industry is the largest employer in the County. Regulated Medical Waste (RMW) generated within the County is not directly handled by the County or any of the municipalities. RMW generators directly handle their own waste or contact a third party to collect, process, transport, and recycle/dispose of the material using their own facility resources.

During the study there were five active wastewater treatment facilities operating in Warren County. The NYSDEC estimates that more than 90% of septage generated in New York is further processed at a wastewater treatment.

Table 3.5 was provided to GHD in the LSWMP and shows the municipalities that currently operate a wastewater treatment facility.

Table 3.5 Wastewater Treatment Operational Waste

Municipality	Material Handling Description	Annual (2019) Tonnage
Town of Bolton	Biosolids generated are hauled to the Schenectady County Landfill. Grit and grease from pump stations are hauled away by Casella Waste. The town does not accept any septage.	Data not currently collected
City of Glen Falls	Biosolids are dried onsite and incinerated at the HFWTEF. The source is the Glens Falls sewer district and septage from approximately 40 haulers. The wastewater treatment plant operates at 40 percent capacity.	7,119 tons
Town of Hague	Biosolids generated by the Hague sewer district are being transported to the Franklin County landfill by a private hauler. No septage is accepted at the wastewater treatment plant.	60 cubic yards
Village of Lake George	Biosolids are processed through a belt press then hauled to the Washington County Compost Facility or the Northumberland Landfill. The wastewater treatment plant accepts septage from seven local haulers.	1,500 tons
Town of Warrensburg	Town is currently removing biosolids under DEC supervision from the Warrensburg sewer district. No outside septage is accepted.	NA

3.1.8 Recycling

Municipalities in the County reported the waste that was recycled in 2018 or 2019 for the purpose of completing the 2021 LSWMP. The exact volume of waste being recycled in the County was difficult to determine from the LSWMP due to the lack of complete recycling data from municipalities, the lack of recycling data from private haulers servicing the area and issues which arise when estimating waste generation volume and composition within the County. The recycling rates estimated in 2019 for each municipality are shown in Table 3.6. However, the County anecdotally reported a present-day recycling rate of approximately 10%.

Table 3.6 Municipality's Recycling Rates

Municipality	Recycling Rate
Town of Bolton	23%
Town of Chester	14%
City of Glens Falls	31%
Town of Hague	13%

Municipality	Recycling Rate
Town of Horicon	17%
Town of Johnsburg	11%
Town of Lake George	32%
Village of Lake George	32%
Town of Lake Luzerne	NA
Town of Queensbury	31%
Town of Stony Creek	11%
Town of Thurman	NA
Town of Warrensburg	18%

Recyclables commonly handled include glass, newspapers, magazines, phone books, junk mail, plastics, steel cans, aluminum cans, and cardboard. Due to the lack of complete recycling data from municipalities and the lack of recycling data from private haulers servicing the area it was difficult to determine the precise volume of waste being recycled within the county. In the 2021 LSWMP the recycling rate was calculated and then applied to future waste disposal generation estimates provided by the NYSDEC. The estimation did not take into consideration the amount of waste not handled at the municipally controlled transfer stations or the amount of waste that is composted in residents' backyards.

The County provided GHD with the private hauler data for recycling waste hauled in 2022 from the transfer stations. Table 3.7 presents the recycling tonnage for January 2022 to September 2022.

Table 3.7 Private Hauler Recycling Waste Data 2022

Months	Recycling Waste Hauled 2022 (tons)
Quarter 1- January, February, March	1,766
Quarter 2- April, May, June	2,227
Quarter 3- July, August, September	2,859
Quarter 4 – October, November, December	2,023
Total	8,875

3.1.9 Reuse Programs

There are reuse centers established in the Town of Chester, the Town of Bolton, and the Town of Lake George at their transfer stations. As presented in the LSWMP, residents can drop off reusable items such as clothing, furniture, books, and toys for free at a designated location within the Town-owned transfer stations. Residents are encouraged to look over the items and take anything that they can reuse. The amount of material diverted from disposal and dropped off to the Reuse Centers is unclear. The continuous volume of traffic at the reuse centers indicated the success of the centers in diverting waste from disposal. In addition to the Reuse Centers, there is a Salvation Army in the City of Glen Falls, a Salvation Army Thrift Store in the Town of Queensbury and "the World's Largest Garage Sale" located in the Town of Warrensburg that help to reduce material disposal by reusing materials.

3.1.10 Estimated Quantity of Organic Waste in the County

Based on the composition of waste generated in the 2021 LSWMP, an estimate was made as to the quantity of waste generated that could be available to a municipal composting facility. Table 3.8 shows the estimated amount of organic waste to be composted over one year, based on the assumed composition from the 2021 LSWMP.

Table 3.8 Estimated Composition of Organic Waste Generated in One Year

Composition of Waste Generated	Est. Quantity in One Year (tons)
Food Waste – Estimate assumes 50% of Total Generation	6,000
Yard Waste	4,600
Wood	2,600
Other Compostable Paper	5,400
Additional Woody Amendment (estimated for bulking food waste)	5,400
Total Potential Composted Organic Waste (tons/year)	**24,000 tons/year**
Total Potential Composted Organics (tons/day)	**~115 tons/day (rounded)**

The average number of days per week that the transfer stations are operating is 4 days per week. GHD assumed a composting facility would be operational 4 days a week which is 208 days per year. Based on the estimations of waste generated in the 2021 LSWMP, it was determined that the potential waste to be composted is about 115 tons per day. Warren County could compost approximately 32 percent of their total garbage generated in the County, as presented in Figure 3.1.

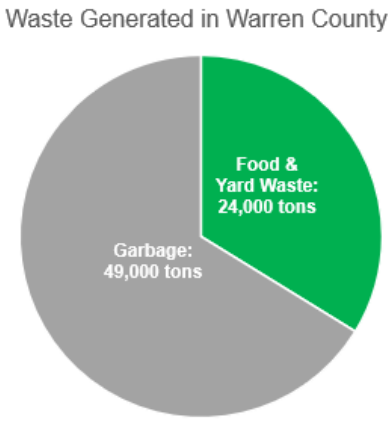


Figure 3-1 Overall Waste Generated in Warren County

3.1.11 Discussion on Potential Quality of Organic Waste

Yard waste consists of wood waste, green waste, yard clippings, weeds, remains of garden plants, and leaves. Yard waste does not include construction debris, demolition wastes, or clean wood.

Residential food waste consists of compostable items such as fruit, vegetables peelings, left over table scraps, bread, grain, rice, pasta, eggshells, coffee grinds and filters, tea bags, and more. Warren County is considering the potential of a curbside collection program as part of this Study, the approach of which will be evaluated in Section 3.5.4.

Pre-consumer Commercial & Institutional food waste consists of food that was discarded before it was ready for consumer use. Typically, items are characterized as waste during the manufacturing process.

Post-consumer Commercial & Institutional food waste consists of post-consumer food and food by-products that have been discarded or recycled by the consumer after the manufacturing process, these items may include packaging, fruit skins, bones in meat, etc.

The County may consider the value of introducing certified compostable products as a feedstock to a commercial composting facility. However, the quality of the resulting compost would need to be closely monitored or further evaluated.

3.1.12 Potential Large Organic Waste Generators

New York State passed the Food Donation and Food Scraps Recycling Law which became effective January 1, 2022, and requires that designated food scraps generators (DFSG) that generate an annual average of two tons of wasted food per week or more must donate excess edible food and recycle all remaining food scraps if they are within 25 miles of an organics recycler. Large food waste generators were defined as generating an annual average of two tons a week or more. GHD referenced the New York State Pollution Prevention Institute's (NYSP2I's) Organic Resource Locator to determine the large food waste generators in the County, further details are found in Section 3.6.1 below.

3.2 Task 2: Public Outreach

During the study, there were six Advisory Committee Meetings, a community survey, and two community engagement sessions to aid in the preparation of this OMP.

3.2.1 Advisory Committee Meetings

GHD prepared presentations for six Advisory Committee Meetings. The Advisory Committee was formed by local officials, the local planning departments, and stakeholders with a high level of interest in waste management, such as the Zero Waste Warren County and the Adirondack Compost Education Council. The progress of the study was discussed with the Advisory Committee in virtual meetings to gain feedback and community outlook on the Project.

Table 3.9 Advisory Committee Members

Committee Members	Organization
Dan Barusch	Lake George Planning Department
Josh Westfall	Town of Bolton Planning Department
Gene Merlino	Elected Official in Lake Luzerne
John Strough	Elected Official in Town of Queensbury
Marisa Muratori	Elected Official in Lake George
Barbra Joudry	Zero Waste Warren County
Kathy Bozony	Zero Waste Warren County
Tracy Frisch	Zero Waste Warren County

3.2.2 Community Survey

GHD prepared and hosted a survey on behalf of the County to ascertain the level of interest from the community on an OMP. A draft of the survey questions was prepared in TM format and reviewed by the County. In addition, GHD prepared a one-page background paper which was posted with the survey on all of Warren County's social media, website, and in the news.

The survey was conducted for 33 days from February 28, 2023, to March 31, 2023 using MS Forms, there were a total of 178 responses received. Upon survey results analysis, it was found that three quarters of the total respondents already compost and majority of them compost their food and yard waste all the time. A quarter of the respondents do not currently compost but would like to participate in a composting program. The most common reasons for not composting were determined to be the lack of awareness of composting programs and the inconvenience of composting.

The results also showed that majority of the respondents who do not currently compost would prefer to take their food and yard waste to a nearby drop-off station as compared to using a backyard composter. This population also believed that the County should do more in terms of organic waste management. The results indicated that there was an overall support among residents and businesses, which shows that there is a market and demand for an OMP in Warren County. The respondents that are in support of composting programs would like the County to consider cost, convenience, and suggest a broad promotion for its implementation.

Appendix A includes a copy of the one-page briefing, final survey questions, and survey results.

3.2.3 Community Engagement Sessions

Community Engagement Session 1 Summary

On March 15, 2023, at 6:00 PM, Warren County hosted Community Engagement Session 1 at the Warren County Municipal Center in Lake George, New York with a virtual option via Zoom. The group included GHD Consulting Services Inc. (GHD), Warren County Department of Public Works (DPW) and members of the community interested in composting initiatives within the County.

The purpose of the Community Engagement Session 1 was to present the overall study to the residents in Warren County, provide residents with information of the current composting feasibility study, and examples of other municipal composting facilities.

Community Engagement Session 2 Summary

On June 6, 2023 at 6:00 PM, Warren County Department of Public Works and GHD hosted Community Engagement Session 2 at the Warren County Municipal Center in Lake George, New York with a virtual option via Zoom and live stream on YouTube.

The purpose of the Community Engagement Session 2 was to present the preliminary findings and recommendations for the Organic Management Plan for Warren County and obtain feedback from the community that GHD considered in this final OMP.

The Advisory Committee Meetings, Community Survey and Community Outreach events help aid in the preparation of the OMP, it provided insight as to the needs of Warren County and help gage the community support for compost initiatives.

Appendix B includes the meeting highlights from the two Community Engagement Sessions.

3.3 Task 3: Assess Available Compost Technologies

Task 3 included an overview of potential composting technologies that could be utilized for a centralized composting facility being considered by Warren County.

Guiding principles that underscore a holistic approach to evaluating composting technologies included:

1. Feedstock characteristics – Understanding the types, quantities and qualities of organic wastes received now or potentially in the future over an agreed planning horizon for the facility.
2. Strategic outcomes – Defining what are the strategic outcomes for the facility and site development, permitting requirements and strategies, and considering in terms of the County's definition of success such as technical feasibility, economic feasibility, and sustainable context.
3. Infrastructure needs – Considering the need for infrastructure to achieve the strategic outcomes desired.

In line with the agreed Scope of Work for Task 3, the following sections will include the following components:

– Estimated quantity of organic wastes to composting

– Summary of composting alternatives:
  - Open windrow composting (front-end loader managed)
  - Turned windrow composting
  - Extended aerated static-pile (E-ASP) composting
  - Aerated static pile (un-covered) composting
  - Containerized in-vessel aerated static pile composting
  - Fabric-membrane covered aerated static pile (C-ASP) composting
  - Horizontal rotating drum / bioreactor composting
  - Agitated bed composting
– Identification of objectives for composting facility and discussion on relative importance ("ranking")

3.3.1 Estimated Quantity of Organic Wastes Available for Composting

As explained above, the estimated potential composted organic waste, 24,000 tons per year, or 115 tons per day, which was used as the conceptual basis for sizing technology alternatives.

3.3.2 Generalized Composting Process

The general composting process is described below and is presented in the simplified process block diagram.

– Receiving (weighed-in over scale, if appropriate) – Wastes are received to the facility, with commercial wastes being recorded by weight over a truck scale. Tare weights could be recorded for vehicles. An office trailer would be located in line of sight of the truck scale. An outbound scale may be required based on the peak daily traffic volume.
– Pre-processing (pre-sorting, material temporary storage, segregation, etc.) – Organic wastes are received to a dedicated area. For food waste, this area is typically under cover, to divert stormwater from waste receiving areas that generate contact water. Each load that is "dumped" is inspected by the lead operator, and inorganics are removed to the extent feasible. Some screening equipment could be used depending on the nature and consistency of the organic wastes received. Size reduction, such as shredding, may also be employed at this stage for large woody debris, or green wastes.
– Feedstock mixing – Before placing compost into the active phase, especially for aerated static pile (ASP) composting methods, the feedstock is mixed to create a homogenous mixture with sufficient bulk density, moisture content, carbon-to-nitrogen ratio and porosity.
– Active compost processing – This is the first phase of compost processing and is required to satisfy Vector Attraction Reduction (VAR) and Process to Further Reduce Pathogens (PFRP) criteria.
– Secondary composting (curing) – This is the second step of compost processing and allows the process compost to be further mixed and stabilize.
– Screening ("overs" returned to process feedstock mix) – Cured compost is screened. Non processed organic material could be reintroduced to the front of the process. Potential to use two screens or three and recover recyclable materials / inorganic contaminants if present through a variety of means.
– Finishing – The remainder of the compost process for further stabilization prior to off-site distribution. Note, this is not always a requirement depending on the consistency and temperature profile of the processed materials.
– Finished compost storage (finished compost is stored under cover) – On-site storage, typically under a cover, to mitigate precipitation in finished product. Some facilities may bag their finished compost for sale and distribution.
– Distribution of finished compost and other soil/mulch products
– Disposal (inorganics to landfill or alternative treatment / beneficial reuse when feasible)

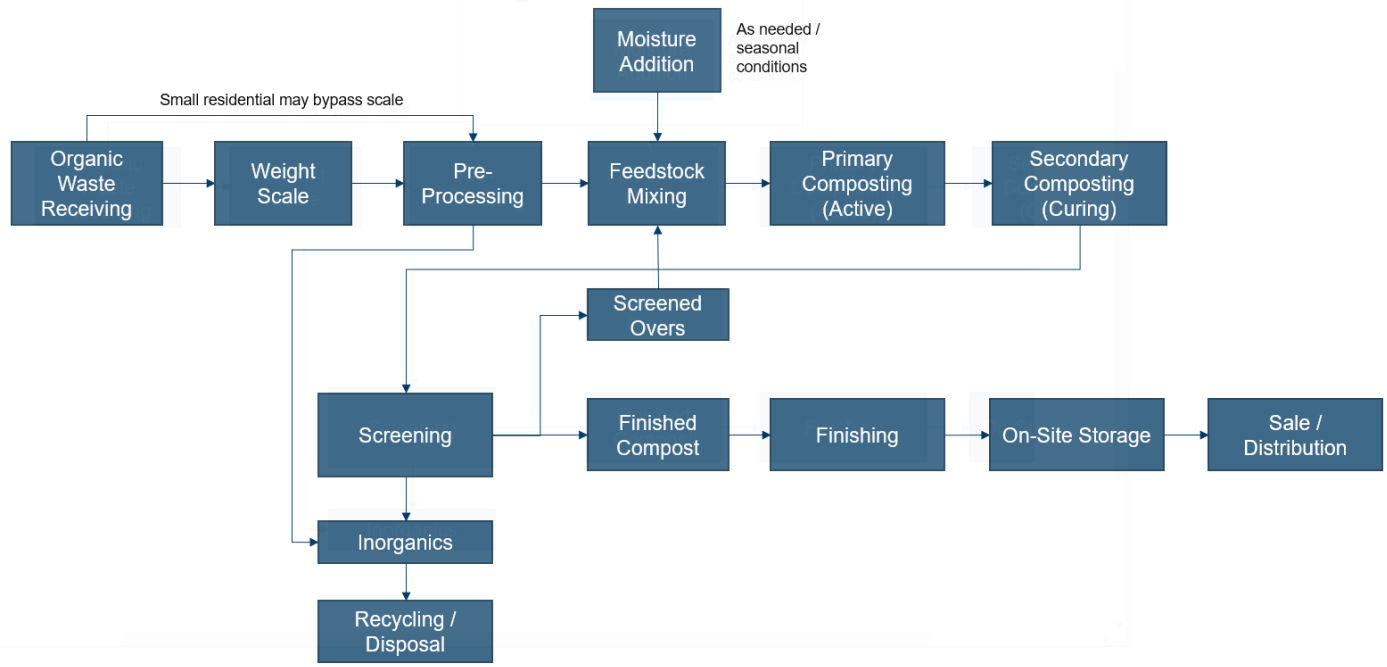


Figure 3-2 Generic Process Block Diagram for Compost Facility

A generic site layout is presented in Figure 3.3 below.

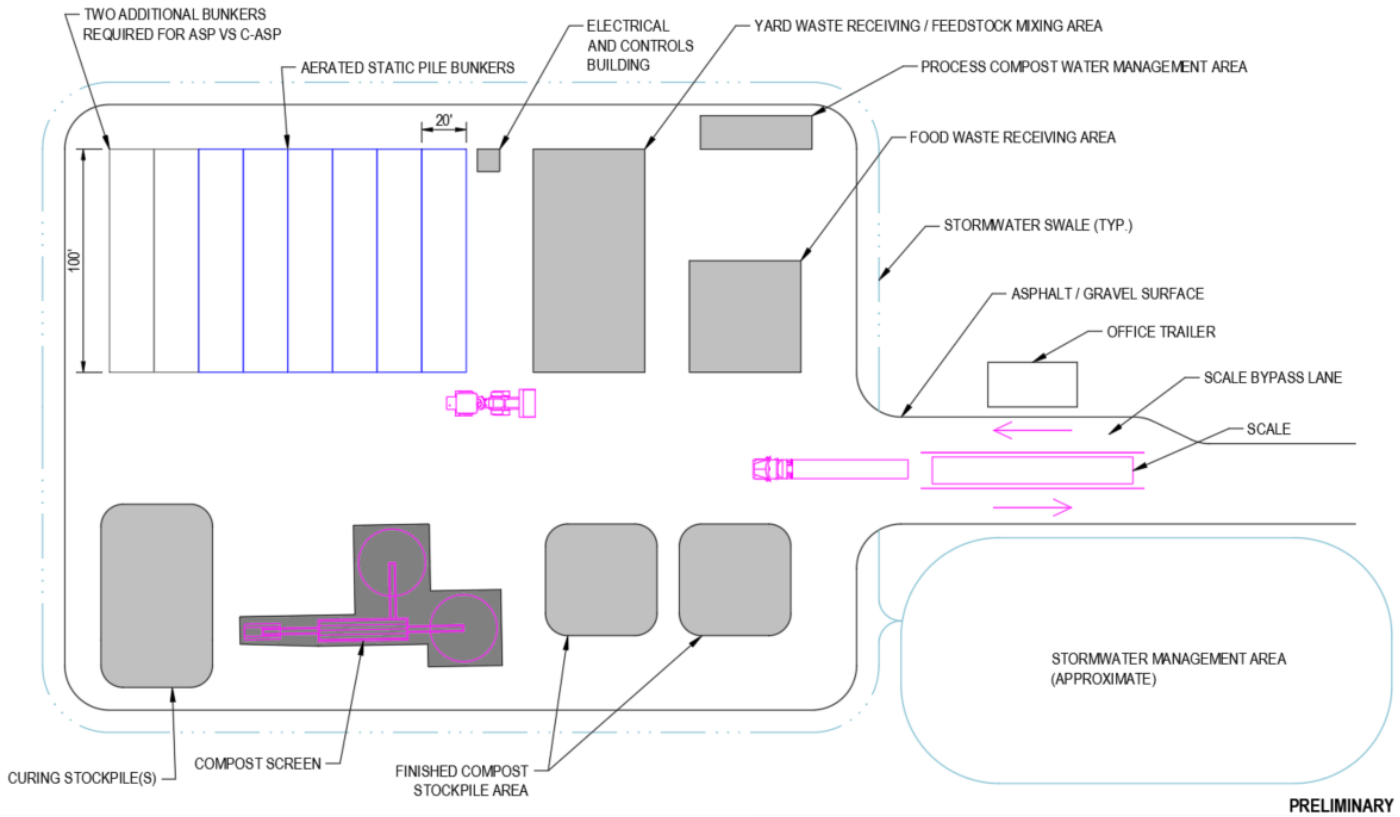


Figure 3-3 Generic Compost Site Layout

3.3.3 Composting Alternatives

This section presents the potential composting alternatives for Warren County explored in this study.

3.3.3.1 Front-end Loader Managed Windrows (Typical 9 – 12 Mo. Process Time)

This operation consists of front-end loader turned windrows. This is the most common method for composting of yard wastes. Windrows are typically 3 to 12 feet high, 10 to 12 feet wide, and can be several hundred feet long (depending on site layout). Windrows are formed using a front-end loader and can be turned by a front-end loader or a specialized piece of equipment now as a windrow turner (see below). This method of materials handling is more labor-intensive because there is activity in moving the material on a daily basis.

With this method, the typical processing time for finished compost is approximately 9 to 12 months. The rate of turning is recommended once every 5 to 7 days and depending on season and feedstock characteristics. For facilities processing less than 10,000 cubic yards per year, windrows must be turned a minimum of two times per year as per 6NYCRR Subpart 361-3.2(b)(1). There would need to be a minimum of 49 active windrows with an additional 35 windrows for curing. The dimensions of the windrows would be 15-feet wide x 250-feet long x 7-feet high. The area that would be needed for the windrows is approximately 8 acres. The site area required is estimated at 10 acres to include areas for site access and stormwater management features.

Front-end loader managed windrows are most used with low daily volumes, low handling requirements, and operator availability. This method of composting is not common for commercial or larger municipal operations due to the handling inefficiencies and limited environmental control.

Figure 3-4 Example of Front-end Loader Managed Windrow

Source: ocregister.com/2021/12/03/new-law-aims-at-keeping-food-out-of-the-trash/

3.3.3.2 Turned Windrow (Typical 6 – 9 Mo. Process Time)

Turned windrow composting is widely used due to its relatively simple equipment requirements (i.e., a windrow turner) and finished compost product quality. Turned windrow operations utilize a level pad, over which a windrow turner passes. For Warren County's application the operations procedure would include feedstock mixing and then placed into active phase windrows. A windrow turner can sometimes be used for the initial mixing step. In this option, the windrow turner would pass over the active phase windrows once every five to seven days, and mechanically mix the process material. The weekly mixing is important for speeding up the compost process by circulating material from the outside of the pile which is cooler to the inside of the pile which is warmer because of the heat resulting from aerobic decomposition of the organic waste. The mixing process also creates preferential air pathways to ensure oxygen can reach greater amounts of material and support continued aerobic microbial reactions. The ideal windrow pile dimensions are a height of 4 to 8 feet with a width of 14 to 16 feet (depending on turner size and performance). This size of windrow is typically large enough to generate heat and maintain temperatures, and small enough to allow

oxygen to flow to the windrow's center. It is estimated that the addition of a windrow turner could reduce the overall process time for finished compost to four to six months.

It is estimated that 15 active phase windrows and 15 maturation phase windrows would be required. Each windrow would measure 15-feet wide x 250-feet long x 7-feet high, and this would result in a total pad area required of approximately 4 to 6 acres. As one option, a Backhus A55 windrow turner (or equivalent) can be used which would be suitable for handling windrows of these dimensions. Other windrow turners are available, which can be further considered by Warren County.

Cornell University located in New York, uses turned windrow composting to turn over 4,000 tons of organic waste into high quality compost[1]. The waste is piled in windrows, each about 7 feet tall and approximately 300 feet long. The windrows are turned weekly from April to November. It takes about 6 to 9 months to produce finished organic compost, which is used by Cornell's agricultural operations and on campus landscape. There is typically enough finished compost to sell publicly, or they donate it to charitable organizations.

Figure 3-5 Backhus A55 Windrow Turner

Figure 3-6 Example of a turned-windrow composting operation

3.3.3.3 Extended Aerated Static Piles (Typical 3 – 4 Mo. Process Time)

An extended aerated static pile (E-ASP) is a method of ASP composting that introduces forced air to process compost to optimize the rate of aerobic decomposition. In this system, there is typically a slab-on-grade concrete foundation with a sparger aeration floor (or similar) and a system of process aeration blowers that either force air into the extended piles (positive pressure) or provide a slight negative pressure (reversing) that exhausts to a biofilter during

[1] https://cals.cornell.edu/agricultural-experiment-station/research-farms/farm-services-compost-facility/compost-facility

the primary stage of composting. These systems are most common in California with more stringent air emissions, or for biosolids composting facilities, although they have been demonstrated with food and yard waste composting.

For the facility conceptual sizing at 115 tons per day capacity, an E-ASP operation would require about 2 primary active zones and 2 secondary maturation zones. The overall footprint required would be 1.5 to 2 acres. Commonly, a center aisle configuration places the secondary maturation directly opposite (“mirrored”) of the primary active composting area of the facility. This has been shown to achieve efficient materials handling using a front-end loader and using a first-in / first-out method of materials management.

Figure 3-7 Example of Reversing Extended ASP Primary and Walled Secondary (80,000 tons per year capacity)

Source: Image courtesy of Engineered Composting Systems (ECS)

3.3.3.4 Aerated Static Pile (un-covered) (Typical 3 to 4 Mo. Process Time)

Uncovered Aerated Static Pile (ASP) composting is an outdoor composting process that uses positive aeration to maintain aerobic conditions of process compost. A finished layer of mulch or compost can be used to cover the process material and serve as a biofiltration layer. The typical process includes loading and unloading “bays” or “bunkers” with pre-processed material that has been blended using a mixer or a front-end loader. After the material is loaded into the bay/bunker it is static and unturned for a typical of 21 to 28 days. After the primary phase of composting, it is unloaded and placed into secondary composting which could include aeration or be on an outdoor pad and managed as turned windrows.

Considering the volumes of material that could be managed by Warren County, an estimated 6 active bays would be needed, each nominally 20-feet wide by 100-feet long, with pile height of 10-feet. A secondary curing pad would also be needed with 6 additional curing bays. The total site footprint required would be 1.5 to 2 acres.

The Onondaga County Resource Recovery Agency Amboy Compost Site was constructed in 2013 to 2014, it uses aerated static pile technology. This facility has a daily capacity of 80 wet tons per day. This site is open to residential and commercial customer to drop off unlimited yard waste.

Figure 3-8 Aerated Static Pile Composting

Source: Onondaga County Resource Recovery Agency (OCRRA) Amboy Compost Site

Figure 3-9 OCRRA Compost Bays Loaded by Front-end Loader

Source: newhousemilitary.syr.edu/2018/2018/04/27/old-waste-new-life/

3.3.3.5 Containerized In-Vessel Aerated Static Pile (Typical 2 – 3 Mo. Process Time)

One example of an in-vessel composting system uses a closed vessel, or container, and controls moisture addition and makeup air (oxygen) as required. The aerated static pile (ASP) composting process utilizes forced aeration systems, sometimes within a concrete enclosure around the process material. The benefit of the enclosure is that it reduces the air handling volumes and provides improved litter and odor control. These systems commonly have in-slab aeration systems, and the containers are under slight negative pressure with air captured and controlled to a biofilter (for treatment before being exhausted to the atmosphere).

The aeration floor commonly has a dual purpose and also serves for leachate collection; leachate is typically collected and consolidated to a point of storage for reuse or disposal. The primary advantage of these systems is that they allow the greatest processing controls to accelerate the overall composting process. An example facility is shown in Figure 3-10.

Conceptually, Warren County would need approximately 15 containerized bunkers measuring 80-feet long x 18-feet wide x 12-feet high, and about 10 aerated secondary phase windrows measuring 100-feet long x 20-feet wide x 12-feet high. The aerated secondary phase windrow could be outdoors and uncovered. The total estimated area required for the entire process is about 8.5 to 10.5 acres. GHD is in process of soliciting information from technology vendors on other sizing configurations and based on the feedstock envisioned.

As one example, Ohio University in Athens, Ohio, received a grant to purchase an in-vessel composting system with the capacity to 2 tons per day of food waste and other organics generated by the university. There is a 14-day composting process that is divided into the active composting stage and the drying stage then the compost cures for at least 90 days. The system produced nearly 430 cubic yards of compost, which was used as soil amendment by the campus grounds crew.[2]

Figure 3-10 Example Containerized In-Vessel Aerated Static Pile

Source: Image courtesy of Engineered Composting Systems (ECS)

3.3.3.6 Fabric-Membrane Covered Aerated Static Pile (2 – 3 Mo. Process Time)

A fabric-membrane covered aerated static pile (C-ASP) composting system process consists of mixing organics (food waste) with yard waste and placing the mixed feedstock on an aeration pad for processing.

This process utilizes positive aeration systems in conjunction with a fabric-membrane cover (i.e., the Gore™ cover system or equivalent) over the piles to control moisture content and to further limit the potential of fugitive emissions. These cover systems allow air to circulate and escape through the (breathable) fabric while retaining moisture and off-gases that are bound by moisture.

C-ASP systems are typically set up in bunkers or bays. The bunker consists of a perimeter concrete wall, and the aeration system is typically in-slab, although on-grade piping options are available for reduced capital cost. An example facility is shown in Figure 3-11; however, we note that the covered ASP system at Warren County would likely be twelve bunkers in total, and the below image shows sixteen bunkers.

Figure 3-11 Example Covered Aerated Static Pile (C-ASP) Facility

Source: Walker Industries Inc., GORE Cover System (Niagara Falls, Ontario)

[2] **https://www.biocycle.net/site-large-scale-food-waste-composting/**

GHD solicited input from Sustainable Generation / GORE (GORE) in preparation of this Technical Memorandum. Based on the projected annual quantity of organic waste and an incoming feedstock of 115 tons per day, GORE estimated the need for six bunkers measuring 100-feet long x 20-feet wide x 10-feet high. Six bunkers would be used for the active phase, three bunkers would be used for the curing phase, and three bunkers would be used for the finishing phase (uncovered). The active and curing phase bunkers would utilize GORE cover systems and the finishing phase would be uncovered. An optional piece of equipment was suggested by GORE that is designed to wind the cover on a spool for efficient placement and removal over the bunkers for loading and unloading of compost. In the management of covers, the winding machine has demonstrated improved cover handling that achieves operational efficiencies. The total estimated footprint required for all three phases of the composting process is 1.0 to 1.5 acres.

3.3.3.7 Horizontal Rotary Drum / Bioreactor (2 – 3 Mo. Process Time)

Horizontal rotary drum, or bioreactor, composting is a method of in-vessel composting that employs continuous mixing and agitation of organic waste during the active phase of composting. In this method of composting, the active phase is completely enclosed inside the drum, which in usual operational experience may afford improved environmental control through consistent temperature profiles in the bioreactor, while reducing the potential for un-mixed zones compared to other static methods of in-vessel composting. Typically, there is a pre-processing step required, where the organic wastes are mixed, and/or reduced in size, and then fed into the bioreactor. The initial mixing step commonly consists of a horizontal auger mixer (or vertical agricultural mixer), to prepare feedstock to adequate size and consistency for feeding into the bioreactor over an inclined in-feed conveyor. The drum functions in a conventional plug flow method on a first-in, first-out basis as process material is moved from the inlet to the outlet over the retention time.

Feedstock parameters remain essential to the effective performance of a bioreactor. Moisture content of the incoming feedstock, carbon-to-nitrogen ratio, and the loading rate (tons per hour) are critical to the performance. Moisture contents can be particularly cumbersome, as a feedstock that is too wet can impact the rotational performance of the bioreactor and create a perimeter sludge reducing aerobic conditions in the vessel. Compared to other in-vessel methods of aerated static pile composting, the retention time during the active phase of composting for a bioreactor is usually less. This results from the development of a more consistent / homogenous temperature profile through the bioreactor, and the continuously mixed process as the drum rotates. As a completely enclosed system, odorous emissions during the active phase can actively be recovered and exhausted to a biofilter, depending on the site context and owner requirements. Given the scale of a potential composting facility in Warren County, a bioreactor system is not envisioned at this time.

The Town of Newcomb in Essex County, New York, received a high flow drum composter as part of a USDA Rural Business Development Grant. The 20 feet x 4 feet drum composter is capable of transforming hundreds of pounds of food scraps per week into rich soil.[3]

An example bioreactor is shown in Figure 3.12.

[3] **https://www.newyorkalmanack.com/2023/02/adirondack-town-gets-community-composter/**

Figure 3-12 Typical Bioreactor

Source: Food Waste Experts, DT Environmental, Miami Zoo (Florida)

3.3.3.8 Agitated Bed (2 – 3 Mo. Process Time) "Fully Enclosed" Facility

The agitated bed composting system was evaluated as a feasible option for based on the feedstock tonnage projections. Agitated bed composting systems are economically feasible for large scale composting operations at greater than 100 tons processed per day and are typically conducted in an enclosed building. Agitated bed composting systems can produce the highest quality compost in the shortest time and make the most efficient use of indoor composting space. The agitated bed composting technology incorporated composting in long concrete channels, and a fully automated compost turner traveling on top of the walls of the channels. The Turners can move from one channel to the next on a transfer dolly at the completion of each cycle. The turner makes a pass through each channel typically five to seven times a week. The conceptual sizing for an agitated bed composting system has not been completed because Warren County has expressed interest in an outdoor operation.

Rikers Island Composting located in New York is a fully enclosed facility. Special agitating equipment is used to mix the compost material and move it through the bays as it decomposes. After approximately 20 days the compost reaches the end of the bays then it takes several months to cure before being screened and used for landscaping.[4]

3.4 Composting Alternatives Comparison

A basic summary of key advantages and disadvantages for each alternative considered to be feasible for Warren County is presented below. A summary for each option is provided in the following Table.

Table 3.10 Qualitative Comparison of Composting Alternatives (Advantages and Disadvantages)

Option	Advantages	Disadvantages
Turned Windrow	– No additional technology requirements, besides turner – Low electrical requirements for the facility (i.e., no stationary motors for compost process) – Mixing typically results in improved product quality – Less need for additional bulking / amendment for porosity in feedstock mix	– Lower level of litter and odor control – Lower environmental control for leachate / stormwater runoff – Trained operator required for windrow turner – Longer processing time compared with in-vessel composting, results in more site area required

[4] https://www.opengreenmap.org/greenmap/nyc-energy/rikers-island-food-waste-composting-facility-26849

Option	Advantages	Disadvantages
Containerized In-Vessel ASP	– Highest level of perceived environmental control for leachate reduction and control, odor management and litter control – Odors can be exhausted to a wood chip media biofilter – No pile turning required during active and secondary stages – Daily operations are minimal for ASP in-containers, reducing FTE requirements	– Likely highest capital / new infrastructure costs – Maintenance of blower system requires trained/skilled staff – Electrical service to site needed (three phase suggested, if available) – Limited known performance data for compostable goods/products
Fabric-Membrane Covered ASP (C-ASP)	– Level of environmental control is improved for litter and odor management compared to windrow operations – Potential to reduce leachate as the cover system diverts stormwater from process waste – No pile turning required during active and secondary stages – Post-consumer biodegradation of compostable containers has been performance tested in several facilities – Provides modularity with the ability to expand bunkers to account for future throughput tonnages	– Deployment of cover requires the potential of a cover winding machine – Replacement of covers every six to eight years (depending on weather conditions) may increase life cycle cost
Bioreactor	– Potential for reduced carbon footprint for operations if the power source for the electrical motors of the bioreactor is sustainable sourced (e.g., renewable energy such as solar) – Consistent temperature profile in active phase of composting – Mixing promotes aerobic decomposition (odor mitigation) – Agitation provided by bioreactor allows mixing ratio to be less exact – Leachate encapsulated and controlled inside bioreactor – Provides modularity with the ability to add bioreactor to account for future throughput tonnages	– With a single bioreactor, no process redundancy – Maintenance of bioreactor may require skilled labor – Canopy / roof structure over bioreactor needed – Cold climate installation may require freeze protection during equipment shutdown / downtime to mitigate freezing – 5-day residence time in primary composting phase, resulting in uncertain performance for compostable goods – Susceptible to moisture issues for unheated outdoor installations
Extended Aerated Static Pile (E-ASP)	– Reduced operating footprint compared to other ASP methods – Potential for a reversing flow in primary composting with exhausted air treated by a biofilter – Level pad results in an easier load-in/load-out operation – Can achieve efficient air handling	– Commonly less redundancy in HVAC system components (wear and tear)
Agitated Bed	– Ensures constant porous, aerobic conditions allowing for a wide range of feed material – Alleviates the need for thorough pre-mixing of feed material by repeatedly mixing the material	– Maintenance of the compost agitator and other systems are complex and need a skilled mechanic or electrician – More costly than other composting technologies – Need for electricity on site

Option	Advantages	Disadvantages
	– Automatically does all the material handling while in the active compost phase so there is not a need for labor to manually mix the compost via a loader – Fully enclosed building with a biofilter to maximize odor control	– Typically operated inside a fully enclosed facility with air handling systems

3.4.1 Compost Facility Objectives and Relative Ranking

To facilitate Warren County's selection of the preferred composting technology, a two-part evaluation process was conducted.

Summary of the two-step process:

– Step 1 - The County and the Advisory Committee review and provided input on a list of compost facility objectives which is presented below. Relative weights of importance were assigned to each project objective, 1 being the lowest and 6 being the highest.
– Step 2 - Based on the County's and Advisory Committee's feedback, the relative importance ("ranking") was be established for each objective, and GHD performed an analysis that compares alternatives against a numeric score.

The list of compost facility objectives and the relative rankings are presented in Table 3.11 below.

Table 3.11 Compost Facility Objectives

Objective	Overall Relative Ranking of Importance
Achieve process flexibility in terms of adaptability to a variety of organic waste inputs to the composting facility, this might include the ability for phased development / future expansion when/if needed.	4.75
Reduce the initial capital cost of construction even if it means selecting an alternative with lesser process flexibility, or marginal environmental control (i.e., cost is very important).	3.6
Reduce operational risk of downtime by simplifying the process operation with less equipment and/or providing more operational redundancy.	4.6
Achieve an appropriate level of environmental control, at least meeting minimum permit requirements, and producing a high-quality finished compost product for market sale and distribution.	5.0
Integrate the composting facility within the context of an existing site such as a municipal yard, seek a reduced operational footprint to be within site constraints.	4.6
Minimize the number of Full Time Equivalents (FTEs) required in the operation and maintenance of the compost facility.	3.5
Achieve an operating cost that is less than or equal to the current cost per ton for landfill disposal or incineration.	5.25

Appendix C includes a summary table of the listed project objectives and assigns relative scores to each composting alternative relative to typical perceptions of technology performance, taking into consideration Warren County priorities. A score of 1 (less effective or desirable), 2 or 3 (more effective or desirable) was given to the various criteria. The highest score revealed the best performing alternative.

The calculated overall weighted score for each composting alternative is provided in Table 3.12 below. The maximum available score is 88 points. As shown in the table, ASP, fabric-membrane covered ASP, and bioreactor composting systems resulted in comparable overall weighted scores. Containerized in-vessel and agitated bed technologies

scored lower because of the added facility cost and complexity of the systems. The turned windrow option resulted in a lower score due to the drawbacks associated with increased processing time and lack of environmental controls.

Table 3.12 Summary of Alternatives Comparison

Option	Preliminary Overall Score
Turned Windrow	**56**
Uncovered ASP	**59**
Container In-Vessel	58
Covered ASP	**63**
Bioreactor	62
Agitated Bed	52

Based on the results of this evaluation, aerated static pile, and covered aerated static pile were chosen to be analyzed further in this report. Although the bioreactor technology scored second highest in this evaluation, the required number of bioreactors for the anticipated throughput tonnages make this technology cost prohibitive. Turned windrow composting scored second lowest in this evaluation but may be an appropriate initial step into composting for the County due to the relatively low capital investment. This initial step could afford the County the opportunity to gauge community participation and could be modified into ASP or C-ASP in the future depending on actual throughput tonnages received. For this reason, turned windrow was also included in the evaluation.

3.5 Task 4: Evaluate Pilot Program Feasibility

Warren County recognized that long-term program sustainability is a key factor that can be informed through results and feedback gained through pilot programs. The outcome of pilot programs could suggest that the project being tested may not be feasible, and alternative options may want to be explored. Consistent and ongoing public education and outreach, along with community and stakeholder feedback is critical in the design and implementation of any new program, and a key indicator for a program's long-term success.

Pilot Programs can help spark community interest, engagement, and awareness, inform the costs of full-scale implementation, and provide valuable lessons learned. The pilot program(s) could operate in parallel with the construction of a centralized composting facility, or other composting initiatives in the County.

3.5.1 Methods of Information Gathering

As input to this framework, GHD completed a desktop review of both operational and pilot-scale community-based household composting programs, including municipally sponsored approaches with a focus on programs operating in jurisdictions with similar characteristics as Warren County and located throughout New York State.

The following sections summarize different program approaches, highlights system strengths, limitations, best practices, case studies, high level program costs, and concept feasibility within Warren County.

3.5.2 Review of Residential Organics Programs

Composting of household organic waste can be undertaken in a variety of ways. The most suitable approach is largely influenced by a jurisdiction's unique characteristics, such as population size, distribution of households, seasonal fluctuations, local availability of processing options, etc. The most common residential organics programs used throughout New York State include:

1. Backyard composting
2. Residential drop-off at a centralized location
3. Curbside collection

Each program approach has specific strengths and challenges, and requires varying levels of roles and responsibilities, financial commitment, and impacts on waste diversion.

3.5.3 Pilot Programs

Generally, a pilot program is used to test a practice and determine if the program is feasible before scaling up. Pilot programs help identify unforeseen challenges that may need to be addressed before a larger scale project is implemented. They allow for changes and refinement before full-scale roll out, which may incur more risk and cost for a municipality or private operator. Pilot programs are also useful for gaining public feedback, informing project costs, and financial planning.

3.5.3.1 Backyard Composting

Backyard composting is a common approach to household composting in which households process fruit and vegetable scraps and leaf and yard waste using backyard composting equipment. Residents are responsible for source separating their fruit and vegetable scraps and yard waste and adding it to the composter, where it requires regular turning, addition of water (depending on season and material inputs), and a balanced nitrogen (greens) and carbon (browns) ratio to ensure proper decomposition.

Backyard composting typically requires a smaller, 2-gallon kitchen bin, or “caddy”, in which residents collect source separated fruit and vegetable scraps, and some compostable paper, within the household and deposit into the composting machine on a regular basis. Backyard composters are not able to process compostable bags, and therefore these liners should not be used in household kitchen bins.

Common backyard composting equipment includes systems such as the Earth Machine, in which the resident must manually turn with a rake or shovel, or rotating/tumbling systems, such as the Jora composter, in which residents manually turn a drum. Backyard composting systems require regular turning by the household to maintain aerobic conditions and mitigate zones where materials are not undergoing aerobic decomposition. Backyard composting equipment is available in various sizes and can be selected depending on the expected volume of organics.

Figure 3-13 Earth Machine (left) & Jora Composter (right)

DIY backyard compost bins can be constructed using pallets, or even a more low-tech pile at the edge of the lawn.

These programs can be undertaken on a voluntary basis, in which the municipality can promote and encourage the sale of units to interested households for purchase at full or subsidized costs, or for free to encourage participation. This approach can be a low commitment for a municipality, aside from the coordination of unit sale and distribution, outreach, and education should the municipality choose to undertake this component themselves, and not partner with a local environmental organization.

Backyard composting can be done in both urban and rural settings and is a common option for rural municipalities where households are distributed throughout a large geographical area, and away from a town/city center. Households of this nature typically have the space to host a backyard composting unit and eliminates the need for longer and potentially challenging collection routes by hauler, in turn reducing potential greenhouse gas (GHG) emissions associated with hauling.

The rate of waste diversion may be lower in municipalities with backyard composting programs, as the program is voluntary based, and requires commitment and time, which may become a barrier for some users. In addition, backyard composting programs accept fewer categories of organics, and cannot process dairy, meat, fish, bones, oils, and fats. In addition, backyard composters do not typically accept certified compostable plastics, such as bags or cutlery. Coffee filters, soiled napkins, and paper towels can also be included.

Figure 3-14 Broome County Earth Machine Brochure

Backyard composting requires a level of household responsibility, such as attention to the carbon and nitrogen ratios, and turning, and if not tended to properly, could lead to ineffective composting. There is a risk of odor and pests should the resident not comply with the guidelines of the equipment, such as the addition of additional "brown" material, or carbon, to balance the nitrogen ratio. This consideration is important as residents will be less inclined to continue with the program if it is not successful or inconvenient.

Winter conditions may present challenges to backyard composting. The County experiences winters with below freezing temperatures, though backyard composters can still be used, the food waste will freeze in the bin and once warmer temperatures return become biologically active. Some residents may find they prefer not to compost over these months and instead dispose of organics within the garbage over the winter months. Some residents may stockpile food waste in a garage or shed until spring.

3.5.3.1.1 Case Studies

Broome County

At the time of this study, backyard composting was currently being undertaken by Broome County, where the County offers the Earth Machine composter for sale year-round at the Broome County Landfill for $45, along with educational materials on how to use it. Broome County is located approximately 200 miles from Warren County. With a population of 200,000, the County offers Earth Machine composters at cost to residents for $45. Broome County purchases 1,000 Earth Flow composters for sale per year.

Broome County partners with local non-profits such as the Cornell Cooperative Extension, to provide educational resources for composting. The Cornell Cooperative Extension provides residents with educational workshops and demonstrations.

City of Albany

In 2021, the City of Albany, with a population of approximately 98,000, announced a unique three-pronged approach to household composting, where residents have the option to participate in any of the three types of composting programs. For the residents who elect for backyard composting, the city provides households with a free Earth Machine backyard composter, a kitchen scraps bin, wood chips, and educational materials. Residents who opt for this option are required to watch a video and take a quiz which will teach them what should and should not go in the backyard compost bin. Albany is working in partnership with the Radix Ecological Sustainability Center, a local non-profit, to educate and deliver the programs to residents.

Capital Region (Albany, Rensselaer, Schenectady counties and beyond)

The Zero Waste Capital District (ZWCD) is a coalition of organizations in New York State's Capital Region that deliver zero waste education and outreach. The Capital Region partners with ZWCD to promote a variety of community-based composting programs, such as backyard composting, and ShareWaste, an online international grassroots volunteer-run initiative which connects households and cafes to other nearby households with backyard composting operations, such as Earth Machines, vermicomposting, or animal feed. This provides households who may not be interested in operating a backyard composter themselves with an opportunity to compost their organics.

The Capital Region also partners with the local non-profit, Cornell Cooperative Extension, to promote composting education, materials, and composting equipment (e.g., backyard composters) to residents who are interested in composting at home.

Ulster County Resource Recovery Agency

Ulster County Resource Recovery Agency (UCRRA) is a solid waste authority and public benefit corporation that manages solid waste generated in Ulster County. UCRRA holds an annual Compost Week sale in which a variety of composting equipment is procured in bulk and sold to Ulster County residents at reduced prices. Incentives such as free kitchen bins alongside Earth Machine backyard composters are used to promote participation. To support the backyard composting initiative, the UCRRA has a dedicated webpage with a variety of instructional videos, tutorials, and educational materials.

3.5.3.1.2 Lessons Learned

- Backyard composting can be undertaken for little cost.
- Backyard composting is an effective way to compost and reduce the amount of municipal solid waste being disposed of in a landfill.
- It is important that compost is finished before use in home gardens with edible products.
- If composting is done incorrectly, there is risk of odor and pest (vector) attraction.
- There is limited data collection available, and hard to track the success of the program.
- Backyard composting requires time and commitment in which some households may not be interested in investing.

3.5.3.2 Residential Drop-Off at Centralized Location

Counties may choose to coordinate or support residential organics drop-off sites, where residents are responsible for source separating their household organics and self-hauling to a centralized location that accepts the materials for composting, typically dropped-off for free or a small fee. The host or coordinator of the drop-off locations can vary, run by the municipality, local business, or non-profit, and locations can range from local farms, community gardens, markets, municipal transfer stations, recycling and reuse centers, libraries, community centers, or non-profit buildings. Locations can be managed by paid staff, volunteers, non-staffed, or even monitored remotely.

These locations may choose to compost on-site using in-vessel systems (e.g., rotating drum machines, Earth Machine, etc.), windrow systems, or other active or passive composting methods. The organization may also choose to consolidate the organics for transport to an off-site organics processing facility.

Households typically require a smaller, 2-gallon kitchen bins, or “caddy”, in which residents collect organics within the household, and later consolidate into a larger bucket, typically ranging from 5-13 gallons, which can be self-hauled to a location for drop-off. It should be clearly communicated to the household whether or not compostable bags are accepted in the program, and recommend households use paper liners in their kitchen bins. The types of materials accepted must also be clearly communicated and actively managed through ongoing outreach and education to households.

The County may wish to provide households with subsidized household kitchen bins, and educational materials and resources on acceptable/non-acceptable materials, and proper organics storage. Partnerships with local non-profits may also be explored in the delivery and distribution of educational information and household buckets. Most self-haul programs have a one-time or an annual enrolment fee which allows residents to deliver their food scraps to the drop-off program all year round, this is an additional benefit in cold climate areas because some residents discontinue backyard composting due to cold temperatures, snow, and freezing.

There were no County managed or centralized commercial organic waste composting facilities in Warren County. However, there was a variety of organic management programs in and around the County accepting residential and commercial organics that may have potential for a pilot self-haul program partnership, they include the following:

Transfer Stations: During the time of this study there was twelve municipally owned and operated transfer stations located throughout Warren County. Four of the twelve transfer stations accepted yard waste which is stockpiled and chipped into mulch. These transfer stations present an opportunity for municipal partnership in coordinating an on-site collection of residential organics and potential on-site composting program through windrows, in-vessel systems, aerated static pile, or other forms of composting. A benefit of smaller scale composting near existing transfer stations is that the facility is already permitted as an existing solid waste management facility.

Adirondack Worm Farm: The Adirondack Worm Farm is located in Kingsbury, Washington County, and it provides residents in Fort Edward, Fort Ann, Glen Falls, Hudson Falls, Lake George, Queensbury, South Glen Falls/ Moreau with weekly or bi-weekly curbside collection of organics. Organics are processed on site through vermicomposting and standard composting operations and they have the potential to form partnerships with the County as a residential drop-off site, or though the collection of pre-consolidated organics dropped off at a County owned location. The Adirondack Worm Farm has a free drop off location at the Greenwich Free Library, and partners with the library to provide public education, such as webinars with Q&A.

Other composting programs are operating in and around the County, such as SUNY Adirondack farm composting operation and Tamarack Compost (including large animal composting) in Washington County and present potential partnership opportunities for the processing of consolidated organics dropped off by residents. The Tamarack Composting operation currently accepts only farm mortalities and may require system adjustments or reconfiguration to process food scraps.

3.5.3.2.1 Case Studies

Town of Newcomb

In 2023, the Town of Newcomb in Essex County, was selected as the location for a new in-vessel, high flow drum composter as part of a USDA Rural Business Development Grant. The grant was awarded to Compost for Good and AdkAction to promote community scale compost business development in the North Country. There are currently four other community scale drum composters operating in the North Country.

Figure 3-15 In-vessel Drum Composter in the Town of Newcomb

The drum composter is located on site at the Town's transfer station and can accept hundreds of pounds of food and yard waste for processing within 14 to 28 days. The project accepts food waste from local businesses and institutions, such as the Newcomb Central School District and the SUNY College of Environmental Science and Forestry, as well as residential drop off. The drum is a relatively low cost in-vessel system and the composter's design is available on AdkAction's Compost for Good website for free and is able to be replicated by various local manufacturers. The first unit was installed at North County School in Lake Placid and is located in a building to facilitate year-round operation. See article from BioCycle.

City of Albany

The City of Albany has partnered with the Friends of Tivoli Preserve and the Radix Ecological Sustainability Center to provide two drop-off locations where residents can bring their food scraps for composting. At the locations, residents will find clearly labelled containers to collect organic materials with a City of Albany drop-off location sign. The sites include signage with instructions as to how to deposit scraps into the bins, and a listing of acceptable and non-acceptable materials.

Capital Region

The ZWCD promotes self-haul compost drop off sites, and coordinates volunteers. The Capital Region promotes the ZWCD's initiatives, including promotion of the free residential drop off programs at local community-based receiving facilities. There are currently nine organizations collecting residential food scraps for composting at conveniently located sites ranging from local farms, gardens, markets, and libraries.

The ZWCD also supports municipalities, such as the City of Albany, in writing and securing waste reduction grant funding, and secured funding of $225,000 from the Food Waste Reduction grant from the NYS Department of Environmental Conservation.

New York City

The GrowNYC Compost Program established in 2011, currently operates 50 of the 200 food scrap drop-off sites in New York City. These locations serve approximately seven thousand regularly weekly customers and divert over 25 tons of organics from landfills each week. Most community drop off systems do not accept meat, dairy, or bones. GrowNYC created a website for customers with information on acceptable materials via flyers, with the opening hours at each location. This program is free, with an option to donate to the program.

Figure 3-16 Smart Compost Bin in New York City

In addition, in 2023, the New York City Department of Sanitation installed 250 Smart Composting Bins throughout underserved areas of New York City, which accept all food scraps, plant waste, and food soiled paper. The installation of the new fleet came after a successful year long pilot in 2021-2022. An interactive map is available online, where residents can find drop-off Smart Composting Bins closes to them. The Smart Composting Bins are accessible 24 hours a day, 7 days a week, using a free app available on smart phone devices. The Smart Bins are picked up on a regular basis and sent to various processing facilities, such as Staten Island Compost Facility, Nature's Choice in New Jersey, Newtown Creek Wastewater Treatment Plant for anaerobic digestion and Pine Island Farm digester in Massachusetts.

Onondaga County Resource Recovery Agency

The Onondaga County Resource Recovery Agency (OCRRA) operates two compost drop-off locations open to residents, landscapers, small-businesses, and commercial haulers that accepts food waste and yard waste. Residents are required to purchase a site pass to drop off compost and are required to unload the compost themselves into the correct areas. The site pass is an annual fee of $25 and allows unlimited drop-off of yard waste and food scraps at the two compost sites, along with two free bags of premium compost.

Ulster County Resource Recovery Agency

Ulster County currently has eight community drop off locations throughout the County, including farmers markets and municipal transfer stations and recycling and reuse centers. The UCRRA promotes these services to Ulster County residents and provides a consolidated list with links to additional information on their website, along with a variety of composting educational resources.

The UCRRA owns and operates a large scale aerated static pile composting operation in Kingston, called the *Partners in Composting Program*, where they accept food scraps from large food generators, such as commercial and institutional facilities, and local municipalities. The program started as a pilot in 2012 and has since expanded. Businesses and municipalities are required to drop their organic waste at the site for processing.

Tompkins County

In Tompkins County, there are 15 existing drop-off sites, most of which are located in and around Ithaca, NY. Users can bring up to 10 gallons of food scraps, including paper napkins and towels, per day. The service is free of charge. Caddies and compostable bags are available free of charge from the Department or Recycling and Materials Management office, or at any drop-off site. Transportation containers are sold at the Recycling and Materials Management office for $12. Drop-off sites are typically attended. The materials are brought to Cayuga Compost for processing using a turned windrow operation.

3.5.3.3 Lessons Learned

– Dedicated, trained staff are required to facilitate drop-off and operate the self-haul sites.
– Robust program promotion is needed that clearly communicates the benefits of composting to promote participation.
– Ensure drop-off location(s) are located centrally, and co-located with other services (e.g., library, market, transfer station, etc.) for increased access and convenience.
– Monitor program performance in each location and ensure sites can be easily moved. If a site is being underutilized, consider changing the location of the drop-off.
– Consult the public through online surveys and engagement to gain feedback and adjust program as required.
– If implementing an on-site composting system at a drop off location, ensure system is scalable, and can be adjusted to process more or less organics, as incoming quantity is being tracked so it could be referenced for a future compost facility.

3.5.4 Curbside Collection Pilot Program

The curbside collection of organics is explored at several municipalities throughout New York State. A community-based curbside organics collection program is a voluntary program in which a household enrolls with a local business or non-profit for weekly or biweekly collection. Household compost buckets are typically provided to the household for a minimal fee by the organization, or for free by the municipality to promote participation.

Curbside programs have the benefit in that they are convenient and require little time and no system maintenance. However, operational costs, monthly fees, and GHG emissions associated with the collection and transportation are often higher.

3.5.4.1 Case Studies

City of Albany

The City of Albany is working in partnership with the Radix Ecological Sustainability Center (Radix) to deliver a curbside compost collection program to residents. Radix picks up compost from households on a weekly basis via solar-charged electric cargo bicycle and tricycle, to eliminate GHG emissions associated with household collection. Households pay a monthly fee of $20 to enroll in the curbside collection, and with support from several full-service food waste composting services. The City of Albany is able to provide the household collection bins free of charge. Each additional container is $5 per month. Residents are responsible for their own bins and are required to clean the bin between pickups.

Collected food waste is transported to different locations within the City to be processed into compost, including the one-acre Radix educational farm in Albany's South End.

The City of Albany also provides free household compost bins to households enrolled in curbside pickup from the local business, FoodScraps360, which services the Capital Region ranging from $22-$33/month. FoodScraps360 also provides customers with one free 40lb. bag of compost to encourage participation.

City of Troy

In 2021, the City was awarded with $88,425 from the USDA and the National Conservation Service's Community and Food Waste Reduction Project initiative. The City of Troy provides their residents with free curbside collection services from FoodScraps360 through funding acquired from a U.S. Department of Agriculture (USDA) grant. All composting costs, including set-up fees, bin and bag fees, and ongoing subscription costs are covered by the City for a two-year pilot program period.

City of Boston

In 2022, announced a curbside collection program that will include a maximum of 10,000 households, that is municipally funded. The food waste will be collected through a partnership between Garbage to Garden and Save That Stuff. The curbside collection will align with residents' scheduled trash and recycling collection days. Compost bin "starter kits" were delivered to residents that enrolled online. The starter kits include an onboarding manual, a roll of liners, kitchen bin, collection bin, and a magnet outlining what food scraps are and are not accepted in the program.

Adirondack Worm Farm

The Adirondack Worm Farm is located in Kingsbury, Washington County, and provides residents of the Towns of Glens Falls, Hudson Falls, Queensbury, Fort Edward, South Glens Falls/Moreau, Lake George, and Fort Ann with weekly ($43/month) or bi-weekly ($21.50/month) curbside collection of organics for a monthly fee. The service provides interested households with a 5-gallon compost bin, and organics are collected and swapped with a clean bin and transported back to the Worm Farm for processing via vermicomposting.

New York City

New York City currently has a curbside collection program that is voluntary and only available in select Community Boards in the Bronx, Brooklyn, and Manhattan. In 2023 and 2024, curbside collection will expand to all New York City residents in Brooklyn, Bronx, Staten Island, and Manhattan. There will be no sign-up required for the expansion of this curbside compost collection program. The compost will be collected on the same day as recycling.

Brattleboro, Vermont

The Town of 12,000 residents has offered curbside collection of food waste since 2013 and diverts 700 tons per year to a composting facility operated by Windham Solid Waste Management District. A pilot program of 150 households was conducted in 2012 and included a variety of collection containers donated by container manufacturers. Trash is collected every other week, and recyclables and food waste are collected weekly. The town utilizes pay-as-you-throw which requires that trash be put into 32-gallon bags that are purchased for $3 per bag. There is no charge for collection of recyclables and food waste. The town has a residential recycling rate of approximately 65% and saves approximately $40,000 per year due to the lower cost for composting than for trash disposal. Compost is donated to schools and community gardens. All schools in Brattleboro have food waste diversion programs.

3.5.4.1.1 Lessons Learned

- Incentives though discounted or a free month trial of collection services or free household bins to encourage residents to participate in the curbside collection program.
- Start in dense urban areas with more residential interest in composting then expand to additional areas.
- Ask for hauler input on potential routes for pilot programs.
- Communicate information clearly to avoid contamination.
- Provide convenient access to information.

3.5.5 Program Strengths and Limitations

The following tables below provide a summary of program strengths and limitations pertaining to each of the three programs.

Table 3.13 Strengths and Limitations of Backyard Composting

Strengths	Limitations
Minimal capital cost and operating costs by the County. The County is able to sell the units at cost or discounted, and distribute the educational materials provided by the equipment manufacturer.	Backyard composting requires ongoing care and system maintenance by the user.
No transportation is required, therefore there is no GHG emissions associated with backyard composting.	Household data on annual tonnage diverted is generally unavailable for backyard composting. Feedback surveys are given to residents after a certain amount of time to gather information.
Residents can use the compost produced in household gardens and landscaping.	Backyard composters cannot process meat, dairy, bones, and fats, and therefore these materials continue to be landfilled.

Table 3.14 Strengths and Limitations of Drop-off Locations

Strengths	Limitations
Co-located drop off locations, such as a community center, transfer station or market, may be more convenient and require no system maintenance by the user.	If processing will occur on site at a drop off location, the technology will require higher capital costs and ongoing system operation and maintenance, should the County choose to construct and operate a composting site.
Some level of collection data may be collected for self-haul sites, depending on the equipment used on site.	Self-haul systems have GHG emissions associated with the individual transport required to bring organics to the drop-off locations.
Drop-off sites support partnerships with local non-profits and small businesses, and may produce local employment opportunities.	Some self-haul systems cannot accept meat, dairy, bones, and fats, and therefore these materials continue to be landfilled.

Table 3.15 Strengths and Limitations of Curbside Collection

Strengths	Limitations
Curbside collection may suit residents who have limited time, space and interest in tending to a backyard composter. It is more convenient, requires less time and there is no system maintenance by the user.	Monthly fees for service can range from $22 to $45 per month which may be inaccessible to some households.
Curbside data is typically tracked at a household level by the collection agency, and therefore data may be more available to the County for ongoing tracking and metrics to determine waste diversion rates and monitor program performance.	Curbside collection may have GHG emissions associated with the collection and transport of organics.
Curbside collection typically accepts a wider range of materials, such as meat, dairy, bone and fats, and sometimes compostable bags and plastics, and therefore have higher rates of waste diversion.	High operational costs to the County.
Curbside collection supports partnerships with local non-profits and small businesses and may produce local employment opportunities.	Currently there are multiple waste haulers for the County.

3.5.6 Best Practices

A best practices review was performed to examine various approaches to household composting within New York State to identify key program elements for consideration in the County's future planning. Best practices have been categorized into program design, funding mechanisms, and education and awareness.

Program Design & Implementation

- Undertake community and stakeholder consultation in the design stage to understand community needs and barriers.
- Public consultation after the program is deployed might be helpful to gain feedback, raise awareness and answer any questions or squash misconceptions (odor, pests, etc.) at the onset.
- Design a robust education and awareness campaign prior to program launch and ongoing after program roll out.
- Join an existing program operated by local non-profits, businesses, or agencies.
- Partner with local non-profits, businesses or agencies in the design and delivery of new programs.
- Promote additional food waste prevention education and initiatives alongside pilot program.
- Launch program corresponding with other celebrations and events, such as Earth Day or Compost Awareness Week.
- For backyard composting, provide an in person educational session with live Q&A.
- Provide incentives to participation, such as free household compost bins, free bags of compost, or subsidized monthly collection fees.
- For self-haul programs, co-locate drop off sites with other events or services (e.g., market, transfer station, etc.)
- Deploy survey to participants after six months to gain feedback and evaluate performance.
- Create a complaint hotline to quickly resolve issues or concerns.

Funding Mechanisms

- Secure state and federal grants to support operational and capital costs for pilot.
- Implement a one-time or an annual enrolment fee for self-haul drop-off all year round.
- Municipality provides free household bins or caddies.

Education and Awareness

- Provide physical educational materials (e.g., brochure, fridge magnets, stickers, etc.).
- Communicate information using graphics, photos and when words are used, it should be in languages most spoken in the community.
- Design a dedicated County webpage with FAQ, instructional videos, quizzes, and printable materials. For self-haul programs, provide a consolidated list of drop off locations with a map, and links to additional information.
- Provide public access to a dedicated email address or hotline for ongoing composting information and support, typically undertaken by a non-profit agency.
- Partner with local non-profits to facilitate public workshops and webinars.
- Program progress should be communicated on an ongoing basis to keep people interested and engaged.

3.5.7 Estimated Cost of Backyard Composting

Two potential pathways to implement a backyard composting pilot program were explored in this study.

Backyard Composting Pathway 1: County-Led

The County could purchase backyard composters and household kitchen bins in bulk for sale to residents. The County could promote the program and hold an online sale of equipment. Distribute equipment at centralized location for resident pickup. This option should include one to two in-person workshops that are streamed and recorded online, educating residents on source separation, and instructing residents on how to set up equipment and ongoing system maintenance. The workshops should have a Q&A session.

Using Broome County as a proxy, the estimated cost of one backyard Earth Flow composter is $45, when purchased in bulk (e.g., 1,000 units). The county may wish to start off with a pilot program of 1,000 households in the first year, and purchase 1,000 units at a time, costing approximately $45,000.

Counties typically provide household kitchen bins for free to promote program participation. A 2-gallon kitchen caddy is approximately $10 at cost. Should the County proceed with a pilot with 1,000 households in the first year, and purchase 1,000 units at a time, the estimated cost to provide free kitchen bins is $10,000.

The Earth Flow machine comes with educational and instructional materials which can be distributed alongside the units at no cost to the County.

At the scale of a pilot program for 1,000 households, the County-wide promotion of the pilot program could be implemented by existing DPW team members supported by local organizations and therefore not require additional labor or full-time equivalents to administer the program. In addition, it is best practice to have an online platform, such as a website with FAQ, as well as a dedicated hotline or email address in which residents can reach out with questions, comments, and support, incurring additional labor. The estimated costs are conceptual, and there may be grant funding opportunities available for the pilot program.

Table 3.16 below presents the estimated capital costs of a backyard pilot composting program.

Table 3.16 Estimated Costs of Pilot Program

Materials	Total Cost
Backyard Composter	$45-$75
Kitchen Bin	$10-$20
Educational Materials	Free
Estimated Cost Per Household	**$55-$95**
Estimated Cost for 1,000 Households	**$55,000-$95,000**

Backyard Composting Pathway 2: Facilitated through Partnerships

The County seeks out local or neighboring non-profits such as the Adirondack Compost Education Council or the Zero Waste Warren County, who are already undertaking similar programs. These organizations will already have existing relationships with equipment vendors, online platforms for sale, and educational resources and plans in place. The County may be required to provide financial support to subsidize the equipment or provide household kitchen bins for free if grant funding is not available. Some local private entities might also be willing to contribute to the program in support of the community and their corporate sustainability initiatives.

3.5.8 Estimated Cost of Drop-off Locations

Two potential pathways to implement a self-haul to drop-off site pilot program were explored in this study.

Pathway 1: County Owned and Operated Drop-off Location(s)

The County may wish to establish County-owned and operated drop off location(s) at a site on county owned land, or in partnership with local municipal transfer station(s) already accepting leaf and yard waste. The self-haul program would be open to all residents in Warren County.

There were several assumptions when estimating the cost of the drop-off location pilot program:

– 360 L rolling carts, or 5 yard roll off bins and instructional signage, where residents drop off organics for temporary storage. The roll off bins or carts may then be collected by private hauler, or County staff, and transported to a local composting site or industrial organics processing facility.
– Residents may have to pay a small fee to drop-off their organics at the location.

– One part time operator to supervise the site, provide education, and coordinate the hauler pick up and transportation. It is assumed that the employee would work a 6-hour day with an hourly rate of $20, the daily cost to employ one staff member would be $120 per day for the 3-month duration of the pilot program.
– The County would be required to pay tipping fees associated with organics processing.
– The cost estimate assumes a 3-month pilot duration, pick up would occur weekly.

Table 3.17 presents the estimated cost of one County-owned and operated drop-off location.

Table 3.17 Estimated Costs of Pilot Program

Equipment	Total Cost (1)
(5-10) 360L rolling carts OR (1) 5 yard roll off bin	$750-$1,500 OR $2,500
5-Gallon Collection Bin	$10-$15
Education Material	Free
Cost to Resident for Drop-Off	$0 to $15-25 annual pass
Employee	$7,200
Hauler Fee	$200/haul off-site
Tipping Fee[1.]	$0/ton (County owned) to $60/ton
Total Cost	**$11,000-$23,000 (360L Rolling Carts)** **$10,000 (5 Yard Roll-off Bin)**

1. Tipping fees and 5-Gallon Collection Bin costs not included in total cost.

As a second step, the County may wish to trial an on-site composting system at the drop-off location(s), such as County owned land or a municipal transfer station. A feasibility study would be recommended to determine the estimated quantity of incoming organics, the waste characterization, level of contamination (and pre-processing required), and the most appropriate technology/system to process materials on-site.

Systems could consider in-vessel machines such as Green Mountain Technologies Earth Flow, or other rotating drums, passive windrows, or aerated static pile composting. This pathway would require the proposed site to be reviewed to determine any barriers and regulatory requirements. The County would be required to develop an end use plan for the finished compost, which has potential to generate revenue should the product be sold.

The County may wish to provide drop-off services for free to all County residents with proof of residency or implement an annual drop-off pass ranging from $15-25 that slows for unlimited drop offs to generate revenue to support the composting system.

Pathway 2: Drop-Off Site(s) Facilitated through Partnerships

The County may wish to engage in partnership with a member municipality, neighboring County, non-profit or businesses who are already undertaking self-haul drop off sites in other areas, to coordinate a self-haul drop off site within the County. These resources can be used to develop webpages and consolidated lists of drop-off sites and educational information. If the County partnered with an organization that has an interest in composting, they might be able to provide volunteers to run the drop-off location. All other assumptions remain presented above in Pathway 1 remain the same.

Table 3.18 presents the estimated cost of a partnered drop-off site.

Table 3.18 Estimated Costs of Pilot Program

Equipment	Total Cost (1)
(5-10) 360L rolling carts OR (1) 5 yard roll off bin	$750-$1500 OR $2500
5-Gallon Collection Bin	$10-$15

Equipment	Total Cost [(1)]
Education Material	Free
(1-2) Employees	$0
Hauler Fee	$200/haul off-site
Tipping Fee[1.]	$0/ton (County owned) to $60/ton
Total Cost	**$2,000-$10,000 (360L Rolling Carts)** **$2,500 (5 Yard Roll-off Bin)**

1. Tipping fees and 5-Gallon Collection Bin costs not included in total cost.

3.5.9 Estimated Cost of Curbside Collection

The County has two potential pathways for implementing a curbside collection pilot program:

Pathway 1: County-Led Curbside Collection

The County could implement a curbside program where they would manage and collect organics via curbside collection.

There were several assumptions when estimating the cost of the curbside collection pilot program:

– This program would likely be voluntary. For this example and cost assumptions, it was assumed that the program would be offered to residents in Queensbury, but other locations may be found more suited for the pilot program implementation. It was assumed that the max participants for this pilot would be 2,000 households.
– The County would need to purchase their own collection vehicle or contact a universal private hauler to collect the organics.
– Each resident would need to be provided with a kitchen bin, curbside bin, and education materials.
– This pilot program was assumed to have the duration on 6 months. It is assumed that two employees would work a 8-hour day with an hourly rate of $20, the daily cost to employ 2 staff members would be $320 per day.
– There would be one day a week for collection.

This program would amount to the highest capital cost of all the programs mentioned. Considering the example of Troy, NY, the cost of the pilot could be about $90,000 potentially reimbursed by a New York State grant.

Table 3.19 presents the estimated cost of a County-led Curbside Program with 2,000 households.

Table 3.19 Estimated Cost of Pilot Program

Materials	Unit Cost	Total Cost
Collection Vehicle (Rental)	$500 per day	$12,000 (one day a week collection)
Curbside Bins (5-gallon bin)	$10-$15	$20,000 - $30,000
Kitchen Bins	$10-$20	$20,000 - $40,000
Education Materials	Free	Free
1-2 Employees	$7,700	$7,700
Tipping Fees	$0/ton (County owned)	$0/ton (County owned)
Total Cost	**$8,300**	**$60,000-$90,000**

Pathway 2: Collection through Partnerships

The County may wish to engage in partnership with an organics hauler and pay a tipping fee. The County could supply kitchen bins to the participating residents and subsidize the cost to participate in the program. This would reduce the cost of a curbside collection program because the county would not have to purchase a collection vehicle or hire employees for collection.

Table 3.20 presents the estimated cost of a County-led Curbside Program with 2,000 households.

Table 3.20 Partnership - Curbside Collection Pilot Program

Materials	Unit Cost	Cost
Curbside Bins (5-gallon bin)	$10-$15	$20,000 - $30,000
Kitchen Bins	$10-$20	$20,000 - $40,000
Education Materials	Free	Free
Hauling Fee[1.]	$200/haul	$200/haul
Tipping Fee[1.]	$60/ton	$60/ton
Total Cost	**$20-$35**	**$40,000-$50,000**

1. Hauling and tipping fees not included in total cost.

Pathway 2: Collection through Partnerships

The County may wish to engage in partnership with non-profits or businesses, this option would be open to all business and non-profits in the County. The Adirondack Worm Farm currently offers a curbside collection program to residents in the County for a monthly or annual fee. The Adirondack Warm Farm supplies each resident with a kitchen bin and curbside bin, the curbside bins are replaced with a clean bin upon pick up. The County could meet with the Adirondack Worm Farm to see if they would be interested in expanding the curbside collection to more residents and the County could assist in expanding this program. Expanding the current operation may include the addition of a collection vehicle, kitchen bins, curbside bins, and additional staff for the operations.

3.5.10 Potential Partners

The County may wish to engage with the following non-profits, organizations, and businesses to explore potential pilot program partnerships. The County would need to contact the non-profits, organizations, and businesses to see if they would have interest in providing funding, advertising, or assisting in educating the community of future compost pilot programs.

3.5.11 Funding Opportunities

Gaining resources through grant program funding is an effective method to provide supplemental support and ease the burden of costs required to pilot new organics programs. There are various community grant programs available in New York State to support local governments and organizations in their efforts to reduce and divert waste. Below presents some grant opportunities that the County could consider following this study.

The **New York State Pollution Prevention Institute (NYSP21) Food Waste Reduction and Reimbursement Program** is a reimbursement grant program for NYS businesses or non-profits that generate, haul or recycle large amounts of wasted food and scraps with the goal of reducing the amount of wasted food and food scraps sent for disposal at a landfill or incinerator.

The NYSP21 Community Grants Program is available for non-profits, institutions, and local governments in NYS. It will be used to fund community-based pollution prevention programs including research, education, outreach, implementation, and training.

The **NYS Department of Environmental Conservation** (DEC) has municipal funding for Food Scraps Recycling Initiatives. The goal of this grant program is to assist municipalities in starting or expanding municipal food scrap recycling programs. Approximately 2 million dollars is available for funding of municipal food scraps recycling initiatives. The first 1 million dollars will prioritize eligible projects that dedicate at least 50 percent of the total requested funding to serving environmental justice communities.

The **NYS DEC Municipal Waste Reduction and Recycling (MWRR) State Assistance program** is a state assistance program for waste reduction, recycling, and household hazardous waste. For eligible costs, there is a 50 percent reimbursement rate. Organic Management Projects are under this state assistance program.

The **United States Department of Agriculture (USDA) Office of Urban Agriculture and Innovative Production** (OUAIP) offers funding under the Compost and Food Waste Reduction Cooperative Agreements (CFWR). This funding will be used to fund pilot projects that develop and implement strategies for food waste reduction and compost plans.

– In addition, the USDA recently announced the availability of up to $9.5 million for Compost and Food Waste Reduction (CFWR) pilot projects for fiscal year 2023. The deadline to apply was June 15, 2023.

3.5.12 Pilot Program Summary

Backyard composting could be a good fit for some of the remote rural communities in Warren County where the hauling distance may create barrier and deter participation. Warren County should continue to support the use of backyard composters in the community.

Implementing a pilot that requires the source separation of the same categories of organics that will be accepted at the potential future facility is recommended, so residents understand what can and cannot be accepted.

Given the County's current waste management practices, curbside collection of organics would be difficult due to the availability of local haulers with the ability to provide this service. During this study there were six private haulers in the County. A curbside pilot program could be subsidized through grant funding, but the long-term maintenance of the program would require changes to the current fees paid by households.

Curbside collection provides greater access and participation to a wider range of residents, therefore, higher rates of contamination may result, which the County would like to avoid in order to produce high quality compost. A County-led curbside collection system has the greatest capital cost for the County, and managing cost is a main concern for the County.

After discussing with the County and Advisory Committee, as well as taking into consideration the survey results, it appears that the most suitable pilot program for the County would consist of a self-haul program to one to four centralized drop-off sites. The County may wish to develop an on-site composting system at one site following some initial data on organics received (quality and quantity). Locations for drop-off sites that seem viable include a Glen Falls Farmers Market or a suitable municipal transfer station, which could also receive organics collected from other smaller sites (e.g., markets, libraries, other transfer stations, etc.) for processing.

Aerated static pile composting, or containerized in-vessel composting, are relatively simple applications that can usually be scaled up or down. The County could implement a pilot-scale composting facility in addition to the drop-off location at an existing solid waste transfer station under the Registration criteria of 6NYCRR Part 361. In addition, the County may consider partnerships with local organizations already providing compost education and awareness.

In preparation of a pilot program, the County should pursue grant funding and develop a plan for the pilot program. This is a recommended action of this OMP.

3.6 Task 5: Evaluate Composting Facility Feasibility

Based on the County's feedback on the assessment of compost technologies, GHD further evaluated the feasibility for a centralized composting facility. The County and the Advisory Committee chose three potential technology alternatives for the County, Turned Windrow, Uncovered Aerated Static Pile (ASP), or Covered Aerated Static Pile (C-ASP), the potential cost of these alternatives was determined. Additionally, the regulatory requirements for a solid waste facility, potential project delivery methods, and business models for a compost facility are presented in the following sections.

3.6.1 Facility Size

Based on the estimated organics that could be composted, GHD evaluated a phased approach for the sizing of the composting facility for the County to optimize initial capital investment and take advantage of the modularity of composting technology. Therefore, two "Design Points" were considered, and each point represents a phase of the composting facility development. Design Point 1 represented an initial investment that will be sized to handle approximately 10,000 tons of organic wastes per year. This estimate was based on the 2022 landfill disposal data provided by the County and includes the additional waste from large generators within 25 miles of the proposed facility locations. In 2022, private haulers disposed of approximately 73,000 tons of waste to landfills or the Hudson Falls waste-to-energy Facility. Of the total waste disposed, it is estimated that nearly 30% is compostable, which is approximately 22,000 tons of compostable waste. GHD assumed that 35% of the total compostable MSW would be disposed at a composting facility to account for variable community participation, which equates to a total capacity of 10,000 tons per year.

Using the New York State Pollution Prevention Institutes (NYP2I) Organics Locator online platform, the large generators within 25-miles of the proposed site locations were identified in reference to the New York State Food Donation and Scraps Recycling Law, effective January 1, 2022, under which businesses and institutions that generate an annual average of two or more tons of food scraps per week must: (1) donate excess edible food, and (2) recycle all remaining food scraps if they are within 25 miles of an organics recycler with excess capacity. The locator provides the facility name, location, and estimated tons of waste per week. There were 27 locations identified for location 1 and 32 locations identified for location 2 within 25 miles of each site that produced over two tons per week. The attached Figure 1 shows the large generators surrounding each proposed site location. The estimated quantities were added to the estimated total compostable waste from the 2022 hauler data to estimate the total tons per year (i.e., Design Point 1).

As presented in the Existing Conditions Report, the estimated quantity of organics wastes that might be available for composting in Warren County was estimated to be approximately 115 tons per day. This quantity was based on the 2021 Local Solid Waste Management Plan (LSWMP) prepared by the County. The County has not performed any waste characterizations at the transfer stations; therefore, the estimate was based solely on the New York Department of Environmental Conservation (NYSDEC) future waste generation estimates. The estimated waste quantity of approximately 115 tons per day will act as Design Point 2, this value does not include large generators. Design Point 2 represented the total estimated compostable waste within Warren County with every resident composting their organic waste. This was a potential future condition, and therefore not evaluated in this OMP.

Table 3.21 presents the organic waste estimates for each Design Point.

Table 3.21 Estimated Quantity of Organic Wastes to a Centralized Composting Facility in Warren County

Organic Waste Type to Compost	Design Point 1 Est. Quantity[1]	Design Point 2 Est. Quantity[1]
Food Waste	2,100 tons per year	6,000[2] tons per year
Yard Waste	1,600 tons per year	4,600 tons per year
Wood	1,000 tons per year	2,600 tons per year
Other Compostable Paper	1,900 tons per year	5,400 tons per year
Additional Woody Amendment (estimated for bulky food waste)[3]	1,900 tons per year	5,400 tons per year
Water to be added to feedstock	1,400 tons per year	4,000 tons per year
Estimated Potential Composted Organic Waste (tons/year)	**10,000 tons per year**	**24,000 tons per year**
Estimated Potential Composted Organic Waste[4] (tons/day)	**~48 tons per day**	**~115 tons per day**

1. Estimated Quantities were rounded for simplicity.
2. NYSDEC estimated 12,000 tons per year of food waste generated, it was assumed that 50% is diverted to a compost facility.
3. Depends on bulk density and moisture content of other feedstocks.
4. 4 days per week, 52 weeks per year

Design Point 1 was chosen for the conceptual system sizing and site layout, to best align with Warren County's project objectives. Design Point 1 would result in a smaller facility and lower initial capital investment. Due to the uncertainty of residential participation in composting, Design Point 1 considers approximately 35 percent of the total compostable MSW to be received at a compost facility. Design Point 2 may be further evaluated in the future, and will allow for the opportunity to size the technology expansion according to future waste management needs and community participation in the composting program. This would also allow for the future expansion to take advantage of improvements to composting technology that are developed over the next several years.

3.6.2 Potential Facility Locations

The DPW identified two potential site locations for the composting facility which are identified on Figure 1. Site suitability at the conceptual stage was evaluated based on desktop review. Should the County elect to move forward with a composting facility at any of the below locations, additional environmental review would be completed as part of the State Environmental Quality Review Act (SEQRA).

1. Location 1 is a residential commercial area, there are a few residential homes with undeveloped forested land surrounding the site. Additionally, there are commercial facilities located North of the proposed site. It is located within zoning section for Residential Commercial Medium Density-1 (RCM-1) in the Town of Lake George. Using the NYSDEC Environmental Resource Mapper (ERM, or "mapper") the waterbodies, wetlands, rare plants or animals, etc. could not be identified for the area. It was determined using the mapper that there were no site constraints due to environmental resources.
2. Location 2 is in the town of Queensbury, in a commercial and industrial area. This location is under the zoning section Commercial Light Industrial (CLI) for the Town of Queensbury. To the East of the site location is residential housing, South of the site is commercial and industrial businesses. There is unused, forested land to the Northwest of the site. This site location was used to determine the 25-mile radius for the large generators, this location is a centralized location within the County and captures the greatest number of large generators, compared to Location 1 and Location 2. Using the mapper, it was determined that there are no apparent site constraints resulting from NYSDEC mapped environmental resources at this location.

DPW will engage the input of the local planning boards with respect to zoning and planning approvals associated with the development of a possible composting facility at the above locations.

3.6.3 Compost Facility Overview

All three composting technologies alternatives follow the same general composting process as depicted in the block diagram below. The feedstock annual tonnages are included below each feedstock material and correspond to the Design Point 1 total annual tonnage (10,000 tpy). Daily finished compost quantity is estimated at 70 CY/day for all three composting technologies. Each stage of the composting process included an anticipated duration and associated volumetric loss, as the material experiences decomposition under the various processing steps. The primary volumetric loss is attributed to screening of non-processed organics from finished compost, after it has been through the composting process. The screened organics can be reintroduced at the beginning of the process as bulking/amendment material or disposed of at a landfill along with the screened-out inorganics.

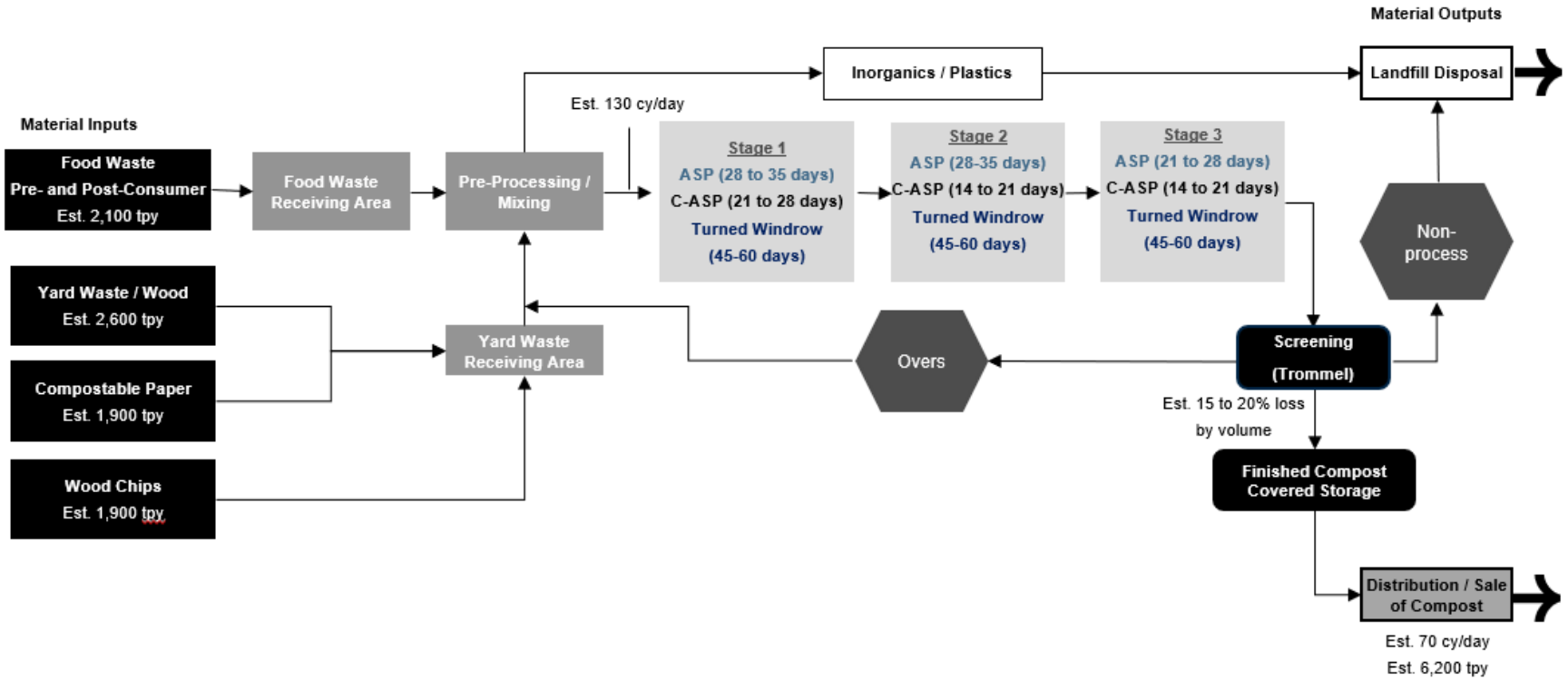


Figure 3-17 Block Flow Diagram for Composting Technologies

3.6.4 Conceptual Site Layouts

Two sites were identified as potential locations for the compost facility within Warren County (see Section 3.6.1.1 above, and Figure 1). The County suggested that the site location not be selected during this study to maintain open options and continue evaluation of preferred alternatives for the County.

Due to the uncertainty of which site may be preferred, a generic site layout was prepared for the facility and included in the attached Figure 2. This generic site layout could be tailored to whichever site is eventually chosen and is meant to illustrate the general facility layout.

ASP and C-ASP composting technologies are similar in process, and therefore the site layout presented only differs slightly between the two. The ASP technology is anticipated to require two additional bunkers then the C-ASP due to slightly slower processing times of feedstock into compost.

The turned windrow option requires no technology outside of a front-end loader or windrow turner (suggested) which are used for turning the piles. No electricity is required, so a turned windrow site could be implemented at open areas available to the County and sized based on quantities of feedstock received. Windrow piles are typically 4 to 8 feet in height with a width of 14 to 16 feet. Based on Design Point 1 throughput tonnages (i.e., 10,000 tons per year), it is estimated that 12 windrows would be required at 7-feet tall by 15-feet wide.

3.6.5 Site Utilities and Features

For planning purposes, the required site utilities and features for the composting facility are identified below. Following selection of the preferred site location for the composting facility, the details of utility connections and stormwater management strategies can be further evaluated.

Electric Service

Both ASP and C-ASP would require electrical service to run the blower systems and the facility scales and office trailer would also require electricity. The facility development plan would include a new electrical service via an overhead service to a main electrical panel. Separate sub-panels would be utilized to extend electrical distribution to the blower systems at the aeration pad, the scale and office trailer, and site security lighting via buried conduits. The intent is to minimize overhead interferences and electrical poles on site.

Water Service

Water service would be required for the facility for water addition to the feedstock to achieve the desired bulk density. The town of Lake George has a limited water distribution network that is not within the vicinity of the proposed sites. Therefore, it is envisioned that a water supply well would be required to be installed for the facility.

Sanitary

Site sanitary could be managed by a septic tank and leach field, or portable sanitary facilities.

Leachate Management

For ASP and C-ASP systems, leachate is collected from the bunkers in trenches and directed to an underground storage tank via piping. The leachate storage tank would be vacuum pumped out as required with leachate being disposed of at a wastewater treatment plant. C-ASP is anticipated to generate less leachate than the ASP option because the covers provide a barrier which diverts stormwater off the piles.

Stormwater Management

Operations would need to comply with a stormwater management plan for the site. A site-specific Stormwater Pollution Prevention Plan (SWPPP) would need to be prepared for the construction phase to outline erosion and sediment control measures to be implemented during construction activities. The SWPPP would identify stormwater

management features that would be required to account for the increase in impervious area and to meet the requirements of the SPDES General Permit for construction discharges.

Scale System

A scale system would be included with the facility for tracking customer weights and transactions. An automated system is envisioned for this facility that would dispense tickets to the customers at the scale and record the transaction data to a computer system in the office trailer.

Office Trailer

The facility would include an office trailer located near the entrance and scale systems. The office would serve for administrative purposes associated with the facility.

3.6.6 Cost Considerations

At a conceptual level of detail provided for this report, potential constructed quantities were assumed from typical expectations in reference to projects of similar size, scale, and complexity. Costs were referenced to typical local price indices given the project location and previous project experience.

As the design is conceptual at this stage, detailed construction and operating cost estimates have not been prepared. Even still, the costs presented below may support budget planning efforts and are meant to provide a range of expected costs for comparing the different composting technologies. Vendor input was received for the conceptual costs of both in-vessel technologies presented.

Cost estimates were developed based on the Design Point 1 throughput tonnages (10,000 tpy). All three of the composting technologies presented in this report provide modularity and the ability to expand their capacity size as required in the future. A summary of the conceptual capital and operating costs for the different composting alternatives are presented in Table 3.22.

A detailed breakdown of the costs presented in Table 3.22 are included in Appendix D.

Table 3.22 Budget Costs Summary

Composting Method	Capital Costs (USD, 2023)	Operating Costs (USD / Year)	Operating Costs (USD / Ton)
Turned Windrow	$600k - $1.5M (turner)	$390,000 - $500,000	$39 - $50 per ton
ASP	$2M - $4.6M[1]	$450,000 - $560,000	$45 - $56 per ton
C-ASP	$3M - $4.8M[1]	$490,000 - $600,000	$49 - $60 per ton

1. Estimated cost range depending on level of technology selected.
2. Equipment costs are excluded from the capital estimate.
3. Costs include 20% contingency (conceptual).
4. Capital cost does not include other equipment.
5. Not based on a specific site, site was not selected during the study.

3.6.7 Conclusions on Suitability of Compost Technology

The turned windrow option presented the lowest capital investment but offered limited environmental control and had slower processing times; The slower processing times demand additional windrows and a larger site footprint compared to ASP or C-ASP. This option could be taken as an initial low investment step to gauge community participation in composting and could be introduced in a relatively small area to begin with.

Both ASP and C-ASP systems have demonstrated success at processing compost at and above the anticipated throughput tonnages for Warren County and could be integrated into the proposed site locations. The major drawback with the ASP system is the reduced environmental control over odor and blown litter, which is a primary concern for the County. Given the incremental increase in capital and operating costs, the C-ASP system is the preferred option for the facility. C-ASP systems are widely used for composting across a variety of feedstock waste streams including

post-consumer compostable goods. C-ASP systems have reliable performance due to the optimized composting conditions provided by the combination of aeration, moisture retention, and heat entrapment by the cover. Environmental control is provided by leachate collection, fugitive emission and odor control, and litter containment beneath the cover.

3.6.8 Permitting

The proposed Compost Facility shall be in compliance with all applicable Federal, State, and Local codes. In addition, the proposed Compost Facility shall be in compliance with all applicable NYSDEC 6 NYCRR part 360 Solid Waste Management Regulations. Given that the site development will exceed one acre, it is anticipated that coverage will be needed under the SPDES General Permit for Stormwater Discharges from Construction Activity.

Permitting for this facility would specifically fall under 6 NYCRR Part 361-3 regulations for Composting and Other Organics Recycling Facilities and require a permit application to NYSDEC. The permit includes design and operating requirements largely related to environmental controls such as protection of water, leachate management, odor management, and source control for accepted feedstocks. The permit also includes requirements for finished compost quality. Both technologies evaluated in this report are capable of being operated in a manner to meet the permit requirements and produce acceptable finished compost quality.

3.6.9 Business Models

Business models help in making marketing decisions and projecting expenses and revenues for a facility. There are several aspects to a business model that Warren County should consider when developing a business model for a compost facility in the County, a good business model would ensure the success of the facility.

Partnerships

The County may wish to explore potential partnerships with the following non-profits, organizations, and businesses that are currently involved in composting initiatives or those that are interested in composting efforts. Other municipalities in New York State have realized benefits of partnering with local community entities. These organizations may be able to help encourage community participation by marketing and providing public outreach and education opportunities.

The County may wish to explore potential public-private partnerships, the county could provide the land for the compost facility and a private developer could finance and operate a compost facility on the property provided by the County. The County could release a request for proposals for a composting facility and determine a partnership with a business or organization that responds with a proposal to design, construct, and operate the facility.

Materials Accepted

Many compost facilities only accept certain materials, this helps ensure the quality of compost and reduce contamination at the facility. Many facilities accept food scrap material such as fruit, beans, coffee grinds, coffee filters, bread, eggs, dairy, fish, grains, vegetables, etc. and yard waste material such as garden waste, sticks, small tree limbs, etc. Some accept compostable products and paper products, but many facilities choose not to accept these items to minimize the chance of contamination, plastics, or non-compostable items entering the facility, resulting in a high-quality compost. High quality compost will interest local farmers, landscapers, businesses, residents, etc. to purchase the finish compost, bringing revenue to the facility.

Expenses

There are many expenses when constructing a compost facility. Initial investment will be needed for land cost, equipment, tools required for maintenance, trucks, heavy machinery, labor costs, fuel consumption costs, etc. After the facility is operational there will be ongoing expenses to operate the facility such as, fuel consumption, marketing, labor, utilities, maintenance, etc. to ensure the facility is operating as designed. The County will need to apply for grants to cover some of the initial investment, but the additional costs and maintenance cost will need to be obtained

by additional sources of revenue. Expenses will need to be considered by the County when determining the technology for the design and construction of the facility and an assessment on how to cover operational expenses in future years will need to be included in a business model for the facility.

Potential Revenues

The business model will need to include rates for residential drop-off, commercial drop-off tipping fees. These rates will be determined based on the revenue needed to keep the facility operational and cover capital costs. Most compost facilities charge a separate fee for residential verse commercial users. Some facilities allow free drop-off to residents while others charge a small annual fee for residents to bring an unlimited amount of food scraps and yard waste to the facility for $20 to $30 per year. Commercial rates vary depending on material brough to the facility, food scraps tipping fees are approximately $25 to $30 per ton and yard waste is approximately $40 to $50 per ton. These fees will need to be evaluated after the facility is designed and the overall operational cost is determined.

An additional source of revenue is the composted material, facilities may wish to sell bagged compost, bulk compost, or mulch. There is typically a residential rate and a commercial or non-residential rate for the products. Facilities may allow residents a certain amount of compost or mulch for free if the resident shovels the materials themselves or it may be included in the annual pass the resident purchases every year. If the residents want additional compost or mulch or for the material to be loaded into their vehicles, they typically are charged a fee of $15 to $20 per yard for compost, $5 per bag of compost, and $15 to $20 per yard of mulch. Commercial or non-residential rates are approximately $20 to $25 per yard of compost, $5 per bag of compost, $20 to $25 per yard of mulch. Bulk quantities of the materials are loaded by the facility into the vehicle and the customer must purchase typically more than 100 yards of compost or mulch within 30 days. Bulk rates are approximately $15 to $20 per yard for compost and $15 to $20 per yard of mulch. It is essential for a compost facility to sell their materials to generate revenue for operational costs of the facility.

3.6.10 Project Delivery Methods

There are many project delivery methods that Warren County could consider when exploring potential partnerships. Below is a summary of potential project methods for the County to consider. There are others, too, which could be entertained based on the County's constraints and opportunities to own/operate their own facility.

Design-Bid-Build

Design-bid-build is one of the most widely used project delivery methods. This is a linear process where one phase is completed before the next. The owner contracts with separate entities for design and construction. The operations and maintenance for the project is contracted separately or completed by the owner.

Table 3.23 presents the advantages and disadvantages of design-bid-build project delivery method.

Table 3.23 Advantages and Disadvantages of Design-Bid-Build

Advantages	Disadvantages
Best for traditional projects with low risk	Procurement of designer, contractor, contract administration
Owner maintains input on design	Lack of scope definition or changes may incur cost variations
Defined construction scope and schedule	

Build-Own-Operate

In this project delivery method, the owner sells to a private sector party the right to construct a project according to agreed design specifications and to operate the project and maintain the capital infrastructure. The private party owns the project and would not have to transfer back to the owner unless it was agreed upon.

Table 3.24 presents the advantages and disadvantages of build-own-operate project delivery method.

Table 3.24 Advantages and Disadvantages of Build-Own-Operate

Advantages	Disadvantages
Early fixed cost certainty	Lack of scope definition or changes may incur cost variations
Design and execution risk transferred to Contractor	Loss of design control- may result in operational compromise
Interface with contractor only, interface with designer minimized	Risk premium cost
Potential to have Contractor arrange for funding	If financing arranged by Contractor, additional premium

Design-Build-Finance-Operate

This is an example of a design-build-finance and operate model which is a public-private-partnership (P3). The owner contracts with a single entity for design, construction, and operation and maintenance of capital infrastructure. A contractor would be responsible of the facility for a designated period, which is usually during the construction phase of a project. Then the control would be transferred to the owner or subsequent operator to operate the facility.

Table 3.25 presents the advantages and disadvantages of design-build-finance-operate project delivery method.

Table 3.25 Advantages and Disadvantages of Design-Build-Finance-Operate

Advantages	Disadvantages
Early fixed cost certainty	Lack of scope definition or changes may incur cost variations
Design and execution risk to transferred	Loss of design control- may result in operational compromise
Interfere with contractor only, interfere with designer	Risk premium cost
Partial or full funding by contractor	Additional premium for financing arranged by contractor
Shorter term financing, potential for less cost	
Operations by owner or separate contract	

4. OMP Roadmap

GHD prepared a roadmap for the OMP, this roadmap in Figure 4.1 is an overall timeline for major activities that will need to be completed. This roadmap is based on a 3-year time interval but can be revised based on the County's progression and needs throughout the OMP and implementation of a compost facility. The Roadmap is to be viewed as a Living Document requiring frequent review and update as the program moves forward.

Preliminary Roadmap

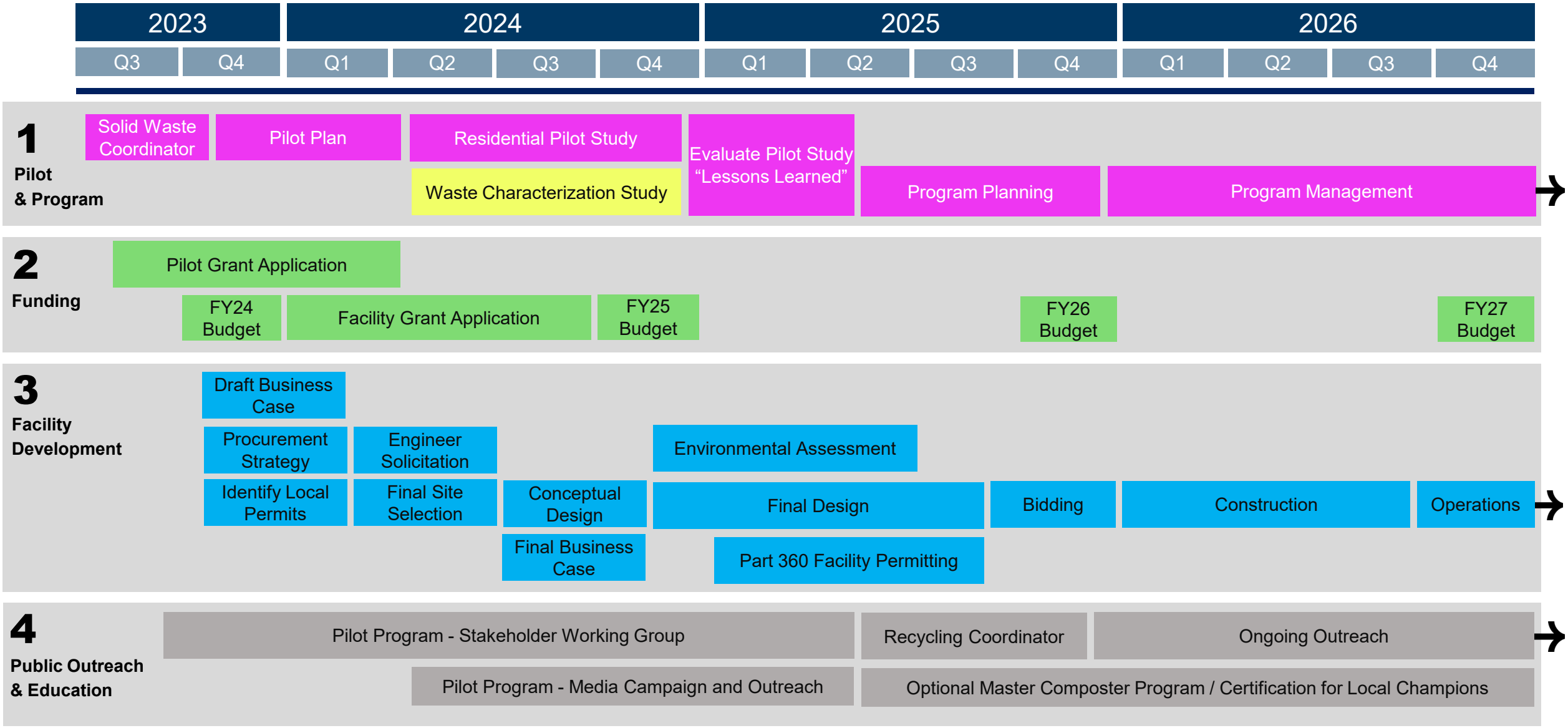


Figure 4-1 Preliminary Roadmap

5. Conclusions and Recommendations

This report, as an OMP, has outlined three composting technologies considered for a centralized composting facility. The options included (1) turned windrow, (2) aerated static pile, (3) covered aerated static pile. These technologies were chosen based on their potential to achieve the key project objectives established by discussions with Warren County and the Advisory Committee.

A Design Point 1 of 10,000 tons per year of total feedstock processed was utilized for conceptual system sizing. This design point considered 35 percent of the total compostable MSW for the County. This would result in lower initial investment from the County and the ability to maintain a smaller facility as residents begin composting initiatives. Design Point 2 would lead to an expansion of a facility, this represented a future estimate if all of residential MSW was brought to the facility.

The turned windrow option presented the lowest capital investment but offers limited environmental control and has the slowest processing time. Both ASP and C-ASP systems have demonstrated success at processing compost at and above the anticipated throughput tonnages for Warren County. C-ASP systems have a reliable performance and the most environmental controls due to the cover. This would be the recommended system for Warren County based on the objectives for the facility.

Prior to the construction of a centralized composting facility, Warren County will want to conduct a pilot program. There were three pilot programs discussed in this study, (1) backyard composting, (2) drop-off locations, (3) curbside collection programs. Based on the results of the community survey and discussions with the County and Advisory Committee it was determined that drop-off locations would be the best pilot program for the County. The County would choose 1 to 4 locations where residents could drop off their organic waste. The organic waste would then be brought to an operating compost facility, or the County could pilot a small-scale composting system on site to process the organic waste for residential use. The pilot program would help spark community interest, engagement, awareness, and inform the costs of a full-scale implementation, as well as provide the County with valuable lessons learned.

Considering the residents support for composting initiatives, the County could begin implementing the pilot programs within a year as they prepare for the implementation of a centralized facility. The roadmap presented in this report will aid the County in progressing the design and construction of a centralized facility within the next three years.

5.1 Preliminary Recommendations

As suggested next steps, GHD recommends Warren County:

– Hire a Solid Waste Coordinator, and a Recycling coordinator is recommended by fiscal year 2025
– Pursue grant applications for the 6-month pilot (estimated to be <$270k) and infrastructure (estimated to be $2M to $4.5M)
– Implement the pilot program in 2024, including a waste characterization study
– Explore partnerships for privatized operations, e.g., a Request for Expression of Interest or Request for Qualifications (RFQ) and/or Request for Proposals (RFP)
– Finalize the municipal business case, including market assessment for finished compost
– Consider expanding County support of local composting initiatives (e.g., outreach and engagement)

Attachments

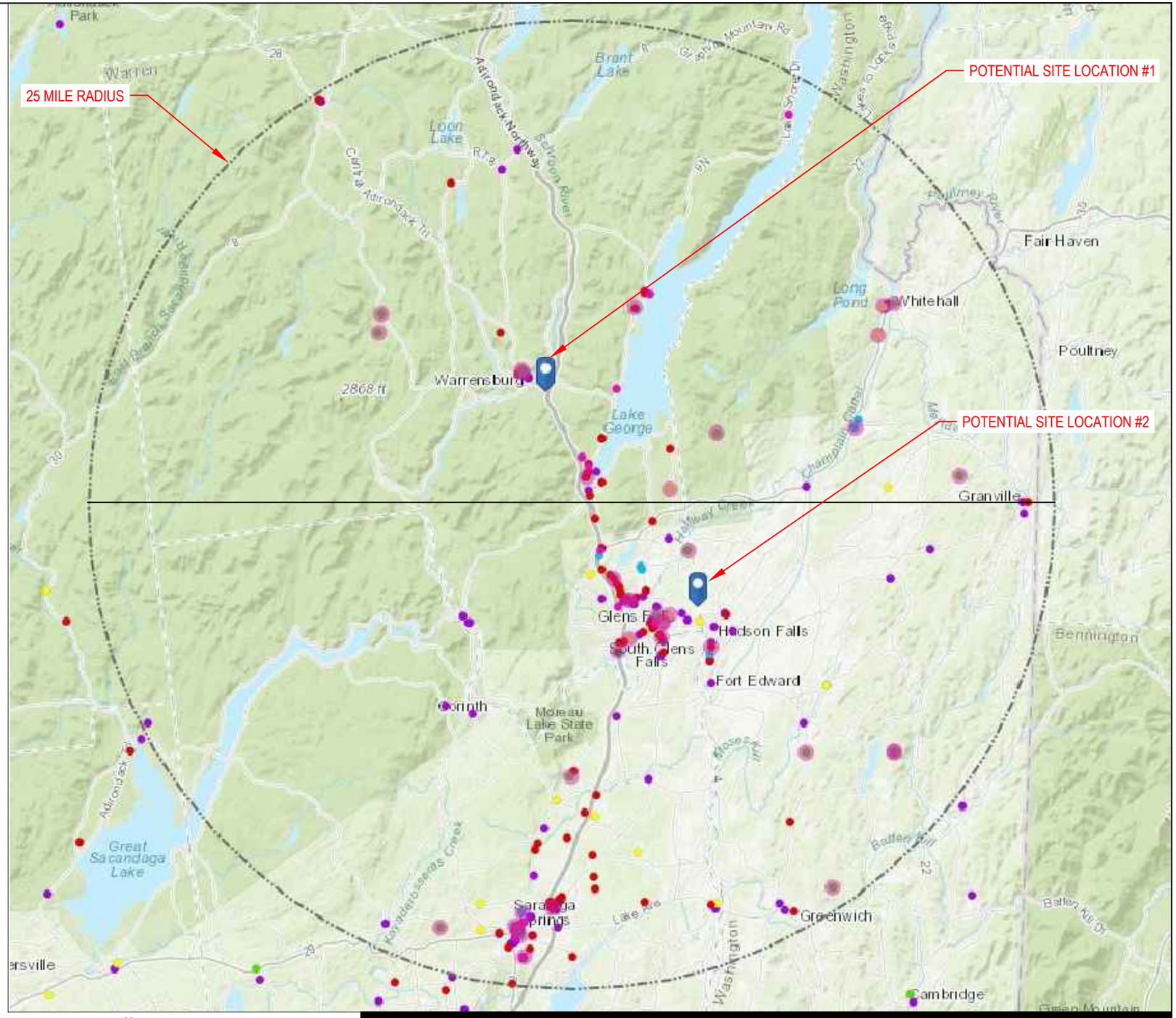
Attachment 1

Figure 1

LARGE ORGANIC WASTE GENERATOR TYPE

- CAFOs
- Hospitality
- Manufacturing
  - Food Manufacturing
  - Beverage Manufacturing
- Food Service
- Institutions
- Food Wholesale & Distribution
- Food Retail
- Organics Recycling
  - Anaerobic Digestion
  - Compost Sites
  - Other
- Food Donation
- Miscellaneous

SOURCE: NEW YORK STATE POLLUTION PREVENTION INSTITUTE, ORGANIC RESOURCE LOCATOR



N

PLAN

SCALE: 1" = 30,000'

0 30,000' 60,000'

1" = 30,000'

GHD

WARREN COUNTY
ORGANICS MANAGEMENT PLAN

LARGE ORGANIC WASTE GENERATORS WITHIN 25-MILE RADIUS

Project No. 12592974
Date MAY 2023

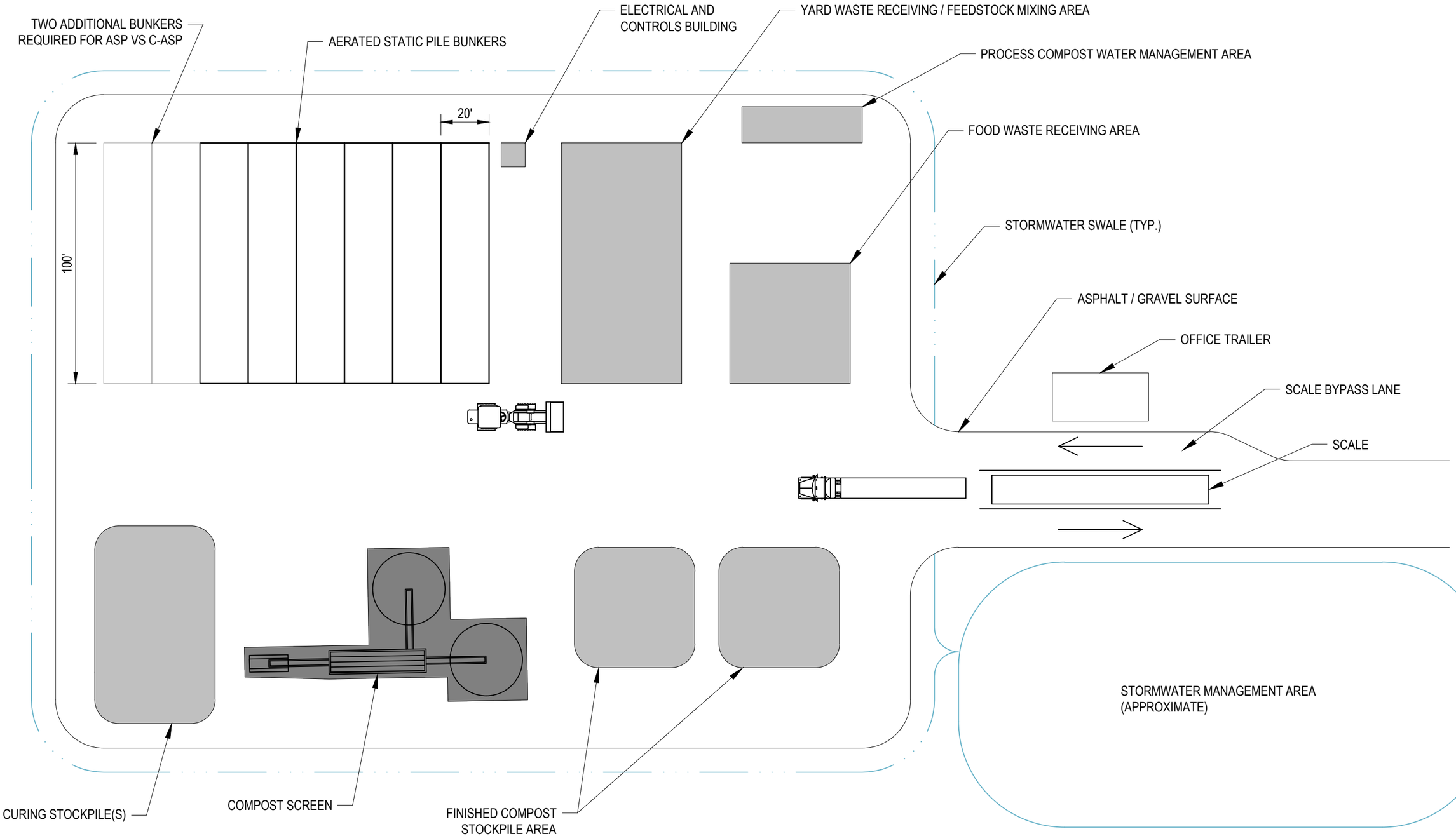
FIGURE 1

Filename: N:\US\Syracuse\Projects\564\12592974\Digital_Design\ACAD\Figures\Task 5\12592974-FIG 1.dwg
Plot Date: 18 May 2023 2:36 PM

Data Source

Attachment 2

Figure 2



PRELIMINARY

NOTES:

1. SITE PLAN SKETCH IS ILLUSTRATIVE AND PENDING SITE SELECTION BY WARREN COUNTY.
2. ORIENTATION OF BUILDINGS AND FACILITY SIZING PENDING FURTHER DESIGN REVIEW.
3. AREAS / SIZING OF SITE FEATURES ARE APPROXIMATE (FOR ILLUSTRATION ONLY).

PLAN

SCALE: 1" = 40'

1" = 40' 0 40' 80'

GHD

WARREN COUNTY
ORGANICS MANAGEMENT PLAN

CONCEPTUAL SITE LAYOUT

Project No. **12592974**
Date **MAY 2023**

FIGURE 2

Filename: N:\US\Syracuse\Projects\564\12592974\Digital_Design\ACAD\Figures\Task 5\12592974-FIG 2.dwg
Plot Date: 18 May 2023 2:20 PM

Data Source

Appendices

Appendix A

Community Survey Information

Warren County Wants Input on How We Manage Food and Yard Waste

Warren County produces about 25,000 tons of food and yard waste every year – that's enough to cover **more than half of the former Magic Forest Theme Park!**

So, we are preparing an *Organics Management Plan* to identify potential strategies to compost this waste and divert if from landfills.

We want your input on how we should manage food and yard waste in Warren County!

What are other communities doing?

- Several communities, including Town of Bethlehem, Ulster County and Onondaga County allow residents to bring food and yard waste to a drop off location or municipal composting facility. The finished compost is sold or given away to residents and businesses.
- Some communities with compost facilities have private haulers that provide curbside food waste collection.
- Some New York State communities operate curbside collection programs and support community initiatives such as community gardens.

What is compost?

A nutrient rich material that improves soil health.

Why compost?

Composting is a sustainable way to manage food and yard waste, keep it out of landfills, and reduce greenhouse gas emissions.

Did you know?

Businesses that generate large amounts of food scraps will soon be required to recycle food scraps if they are within 25 miles of an organic recycler (NYS Food Donation and Food Scraps Recycling Law).

Did you Know?

Warren County could compost over 30% of the garbage currently being sent to landfills.

This project has been funded by the Climate Smart Community Grant Program, Title 15 of the Environmental Protection Fund through the New York State Department of Environmental Conservation.

Visit our website to learn more
https://warrencountyny.gov

Complete the survey by March 31 to provide your input!

https://bit.ly/warrencountyorganics

Warren County Organics Management Survey

We want your input on how we manage food and yard waste!

Warren County produces about 24,000 tons of food and yard waste every year – that's enough to cover more than half of the former Magic Forest Theme Park!

Warren County is preparing an *Organics Management Plan* to identify strategies to compost this waste and divert it from landfills. The County retained GHD Consulting Services Inc. to support preparation of the Plan.

By filling out this survey you are providing valuable input on how we should manage food and yard waste in Warren County. Thank you for your participation!

Completed surveys can be sent to **Katrina.Mccullough@ghd.com** or dropped off at the Warren County Municipal Centre (1340 State Rt. 9 in Lake George).

*Required

Tell us About Yourself

1. Which town or city are you located in? *
   - ☐ City of Glens Falls
   - ☐ Town of Bolton
   - ☐ Town of Chester
   - ☐ Town of Hague
   - ☐ Town of Horicon
   - ☐ Town of Johnsburg
   - ☐ Town of Lake George
   - ☐ Village of Lake George
   - ☐ Town of Lake Luzerne
   - ☐ Town of Queensbury
   - ☐ Town of Stony Creek
   - ☐ Town of Thurman
   - ☐ Town of Warrensburg

2. Are you a resident, business owner or representative of a public or private institution in Warren County? *
   - ☐ Resident
   - ☐ Business Owner
   - ☐ Representing an Institution
   - ☐ I do not reside in Warren County
   - ☐ Other

3. If you are representing a business owner or institution, please provide the name

4. How much garbage (not including recycling) does your household generate weekly (e.g standard green/black 13 gallon garbage bags)?
   - ☐ Less than 1 bag
   - ☐ 1-2 bags
   - ☐ 3-4 bags
   - ☐ 5-6 bags
   - ☐ More than 6 bags

5. How do you currently dispose of waste and recycling?
   - ☐ I hire a private hauler to collect my waste
   - ☐ I bring it in to the transfer station myself
   - ☐ Other

6. If you bring your waste and recycling to a transfer station yourself, which transfer station do you use?
   - ☐ Town of Bolton Transfer Station
   - ☐ Chestertown Transfer Station
   - ☐ The Hague Transfer Station
   - ☐ Town of Horicon Transfer and Recycling
   - ☐ Town of Johnsburg Recycling Center Transfer Station
   - ☐ Town of Lake George Transfer Station
   - ☐ Lake Luzerne Transfer Station
   - ☐ Ridge Road Transfer Station
   - ☐ Stony Creek Transfer Station
   - ☐ Thurman Transfer Station
   - ☐ Warrensburg Transfer Station
   - ☐ None – I use a private curbside hauler

7. Do you compost yard clipping, leaves and food scraps yourself or through one of the following programs (select all that apply)?
   - ☐ I compost my own food waste
   - ☐ I compost my own yard waste
   - ☐ I take yard waste to my local transfer station
   - ☐ Adirondack Worm Farm
   - ☐ Rotary Club of Glens Falls
   - ☐ Town of Queensbury Transfer Station
   - ☐ SUNY Adirondack
   - ☐ Tamarack (Argyle)
   - ☐ I do not compost food or yard waste
   - ☐ Other

8. If you do not compost on your own or participate in a composting program, please tell us why (select all that apply)?
   - ☐ It's not convenient
   - ☐ I forget
   - ☐ It takes too much time to sort waste
   - ☐ I don't have the space
   - ☐ It's smelly or gross
   - ☐ It costs too much
   - ☐ I'm concerned about rats and vermin
   - ☐ I'm not interested in composting
   - ☐ I'm not sure what can be composted
   - ☐ I was not aware of composting programs
   - ☐ I don't believe in composting
   - ☐ N/A – I compost my food and yard waste
   - ☐ Other

9. Which of the following statements most applies to you?
   - ☐ I compost all my food and yard waste at home using a backyard composter
   - ☐ I compost all my food and yard waste via a third party
   - ☐ I compost most of the time
   - ☐ I compost about half of the time
   - ☐ I compost less than half of the time
   - ☐ I don't compost at all

Your Opinion on Waste and Composting

10. Please rate your agreement with the following statements

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Recycling is important to me					
Reducing food waste is important to me					
Composting is important to me					
I am willing to put in extra effort to protect the environment, like separate food waste or compost in my backyard					
I am willing to pay extra if it means I'm protecting the environment					
Recycling and waste diversion has to be convenient for me to participate					
Warren County should strive to be a "zero waste" County					
I don't think recycling and composting programs do much to help the environment					

11. Would you be interested in purchasing locally produced compost? Compost is a fertilizer and soil enhancer that is produced from processing food and yard waste.
    - ☐ Yes
    - ☐ No

12. In your opinion, does Warren County do enough to divert food and yard waste from landfill?
    - ☐ Yes
    - ☐ No

13. How likely are you to take your food and yard waste to a nearby drop-off station?
    - ☐ Very likely
    - ☐ Somewhat likely
    - ☐ Neither likely nor unlikely
    - ☐ Somewhat unlikely
    - ☐ Very unlikely

14. How likely are you to try a backyard composter?
    - ☐ Very likely
    - ☐ Somewhat likely
    - ☐ Neither likely nor unlikely
    - ☐ Somewhat unlikely
    - ☐ Very unlikely

15. Collection of food and yard waste and backyard composters are examples of composting programs. Would the cost of a composting program influence your participation?

    1 means cost is **not important** to me; **5** means cost is **very important** to me

1	2	3	4	5

16. Do you represent a business or institution that generates food or yard waste? *
    - ☐ Yes
    - ☐ No (Skip to question 22)

17. Would your business or institution be interested in partnering with Warren County to process your organic wastes into compost? *
    - ☐ Yes
    - ☐ No

18. Thank you for your interest!

    Please indicate which type of generator you represent
    - ☐ Commercial
    - ☐ Institutional
    - ☐ Manufacturing
    - ☐ Other

19. Your name

20. Name of your business/institution

21. Email Address

22. Do you have any other comments or thoughts you would like to share with the project team about managing food and yard waste in Warren County?

Warren County, NY
Organics Management Survey

→ Summary of Stakeholder Survey
March, 2023

About the Survey

Warren County produces about 24,000 tons of food and yard waste every year – that's enough to cover more than half of the former Magic Forest Theme Park!

Warren County is preparing an *Organics Management Plan* to identify strategies to compost this waste and divert it from landfills. The County retained GHD Consulting Services Inc. to support preparation of the Plan.

In March 2023 GHD, on behalf of Warren County, conducted a survey to solicit feedback from the residents and business owners on how food and yard waste should be managed in Warren County.

Results will inform recommendations for the Warren County Organics Management Plan

178 **survey respondents**

Executive Summary

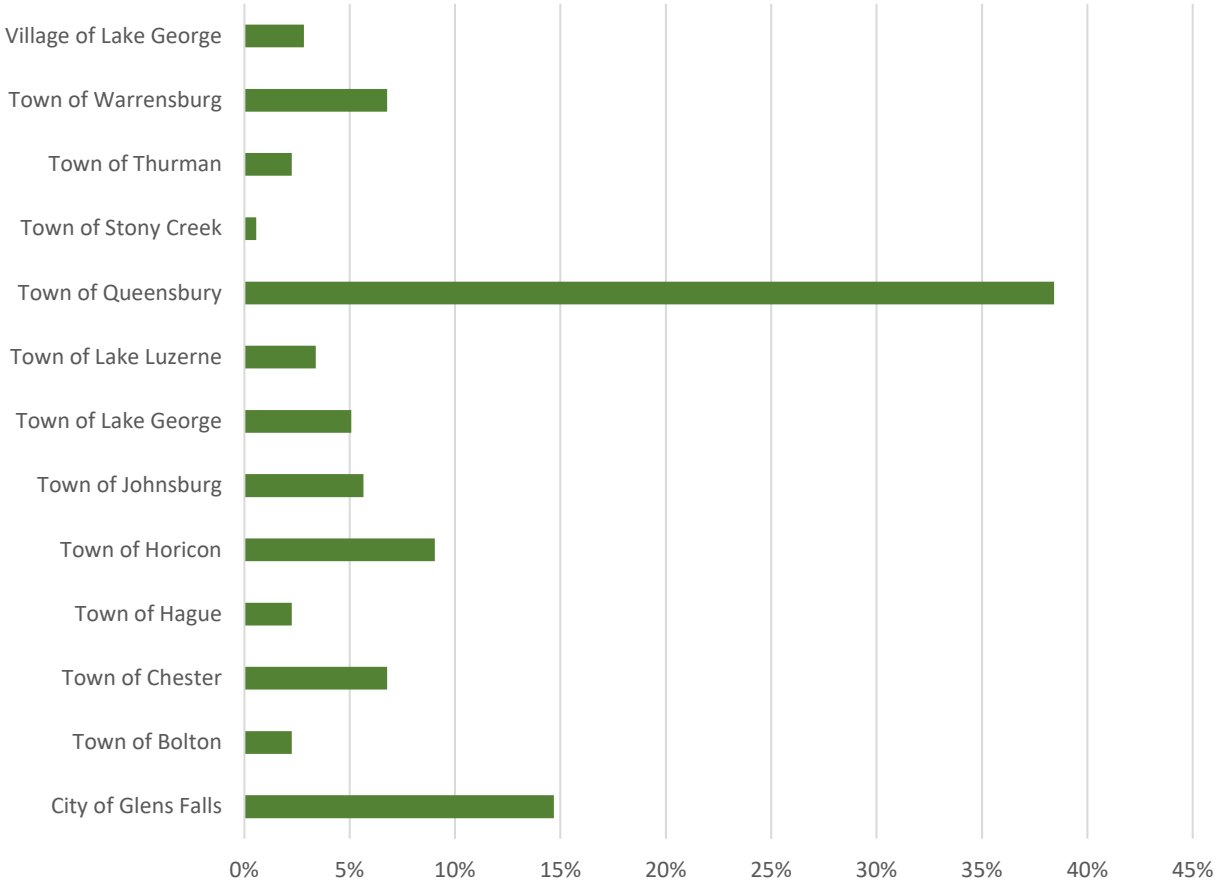
The survey was conducted for 31 days in the month of March 2023 using MS Forms and a total of 178 responses were received. Upon survey results analysis, it was found that three quarters of the total respondents already compost and majority of them compost their food and yard waste all the time. A quarter of these respondents do not currently compost but would like to participate in a composting program. The most common reasons for not composting were determined to be the lack of awareness of composting programs and inconvenience.

The results also shows that majority of respondents who do not currently compost would prefer to take their food and yard waste to a nearby drop-off station as compared to using a backyard composter. This population also believes that Warren County should do more in terms of organic waste management. The results indicate that there is an overall support among the residents and businesses, which shows that there is a market and demand for an organics management program in Warren County.

The residents are in support of composting programs if Warren County would consider cost, convenience and broad promotion for its implementation.

About The Survey Respondents

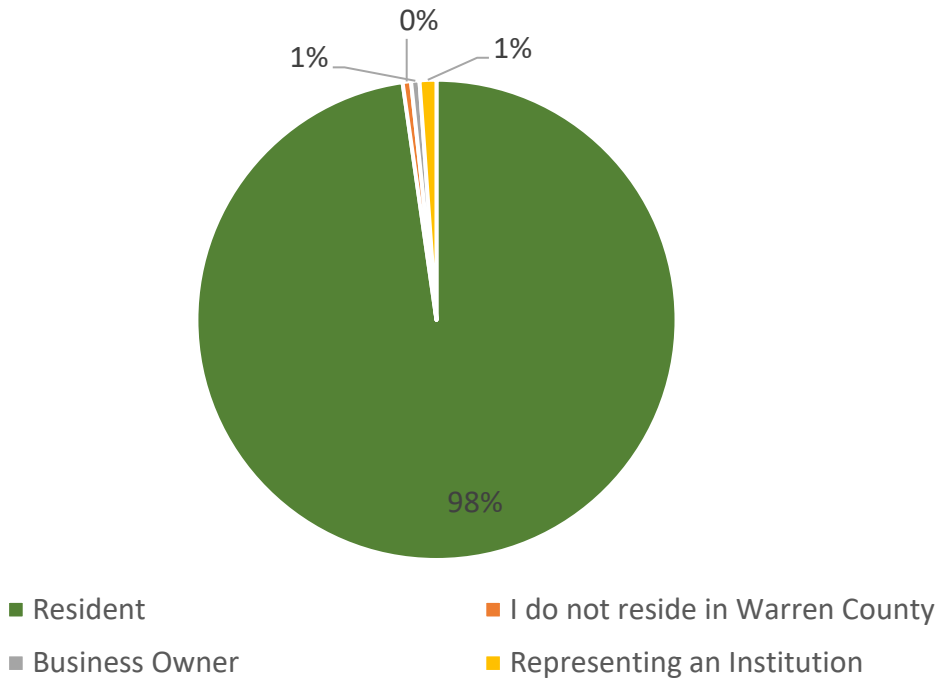
Q1. Which town are you located in?



Majority of the respondent are from the Town of Queensbury and City of Glen Falls

About The Survey Respondents

Q2. Are you a resident, business owner or representative of a public or private institution in Warren County?

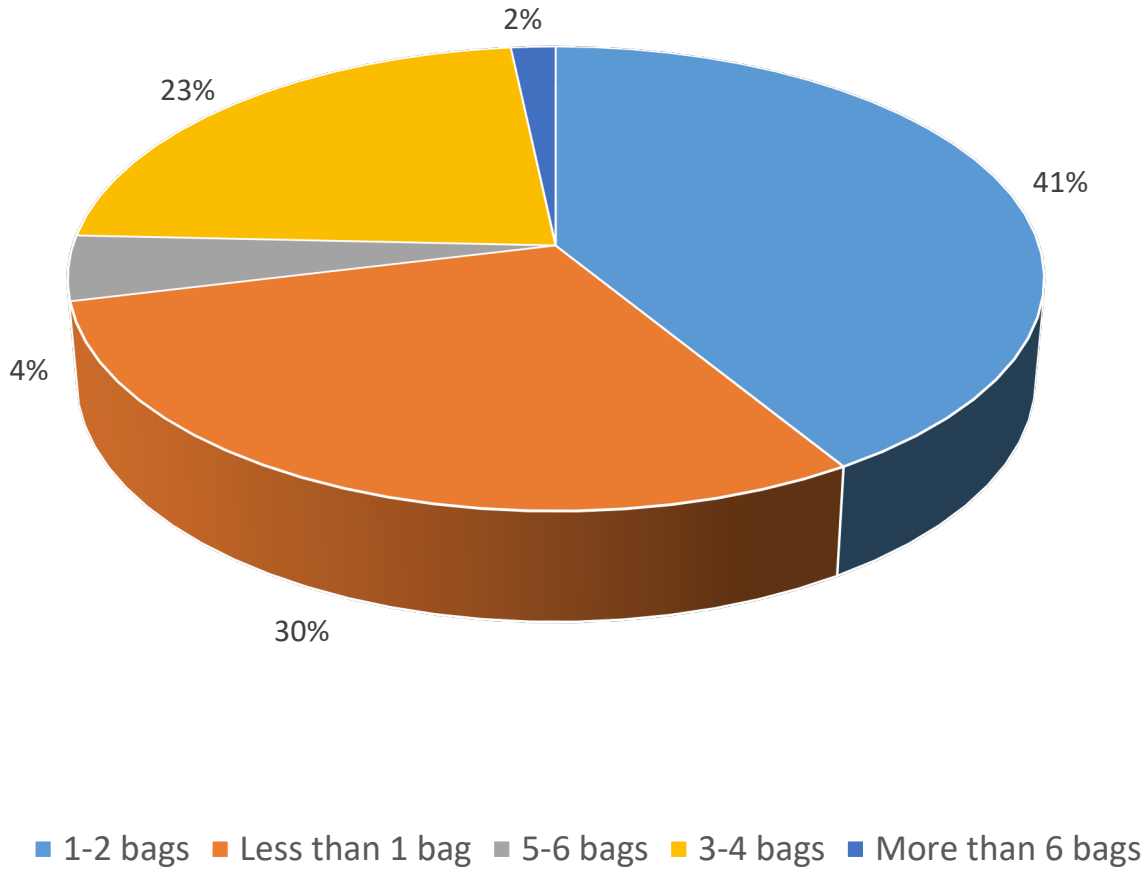


Q3. If you are representing a business owner or institution, Please provide name.

- 2 Business Owners
- 1 Institution

Understanding Waste Behavior of Survey Respondents

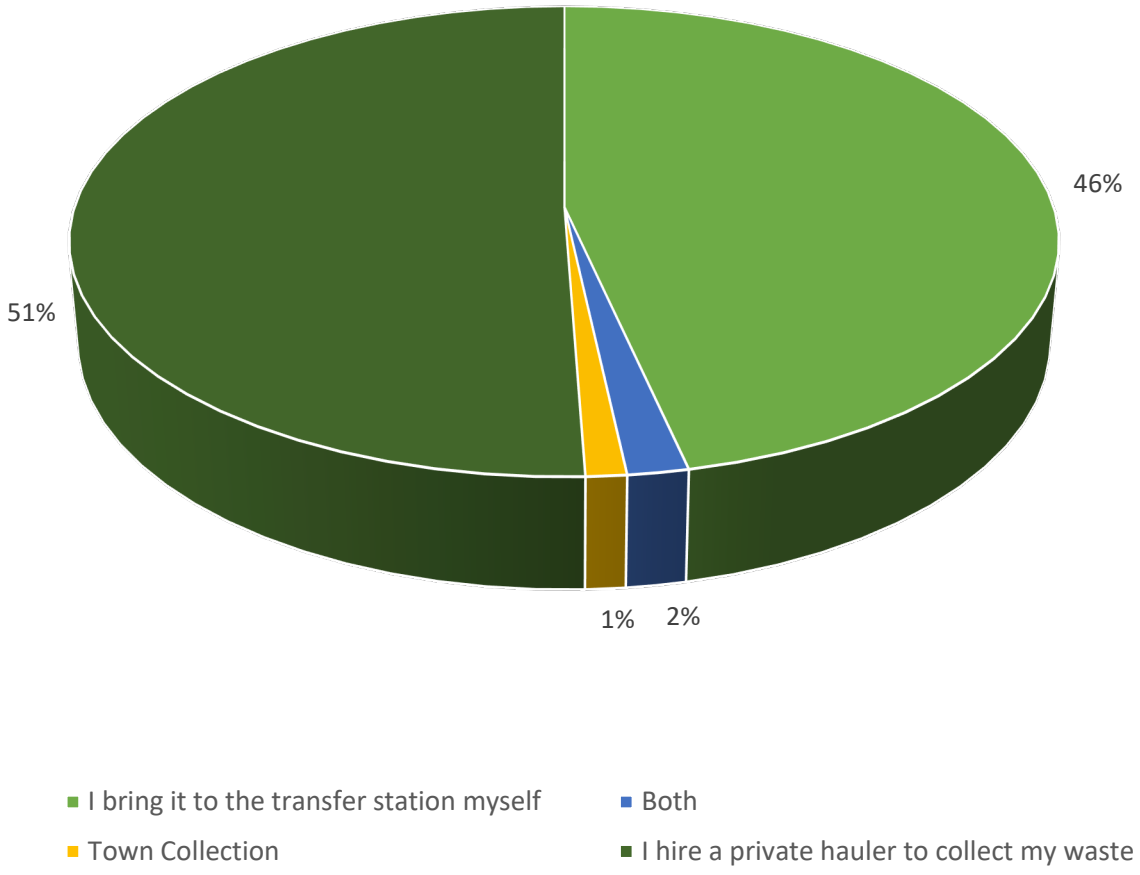
Q4. How much garbage (not including recycling) does your household generate weekly?



About 75% of the respondents generates between less than 1 to 2 bags of garbage.

Understanding Waste Behavior of Survey Respondents

Q5. How do you currently dispose of waste and recycling?

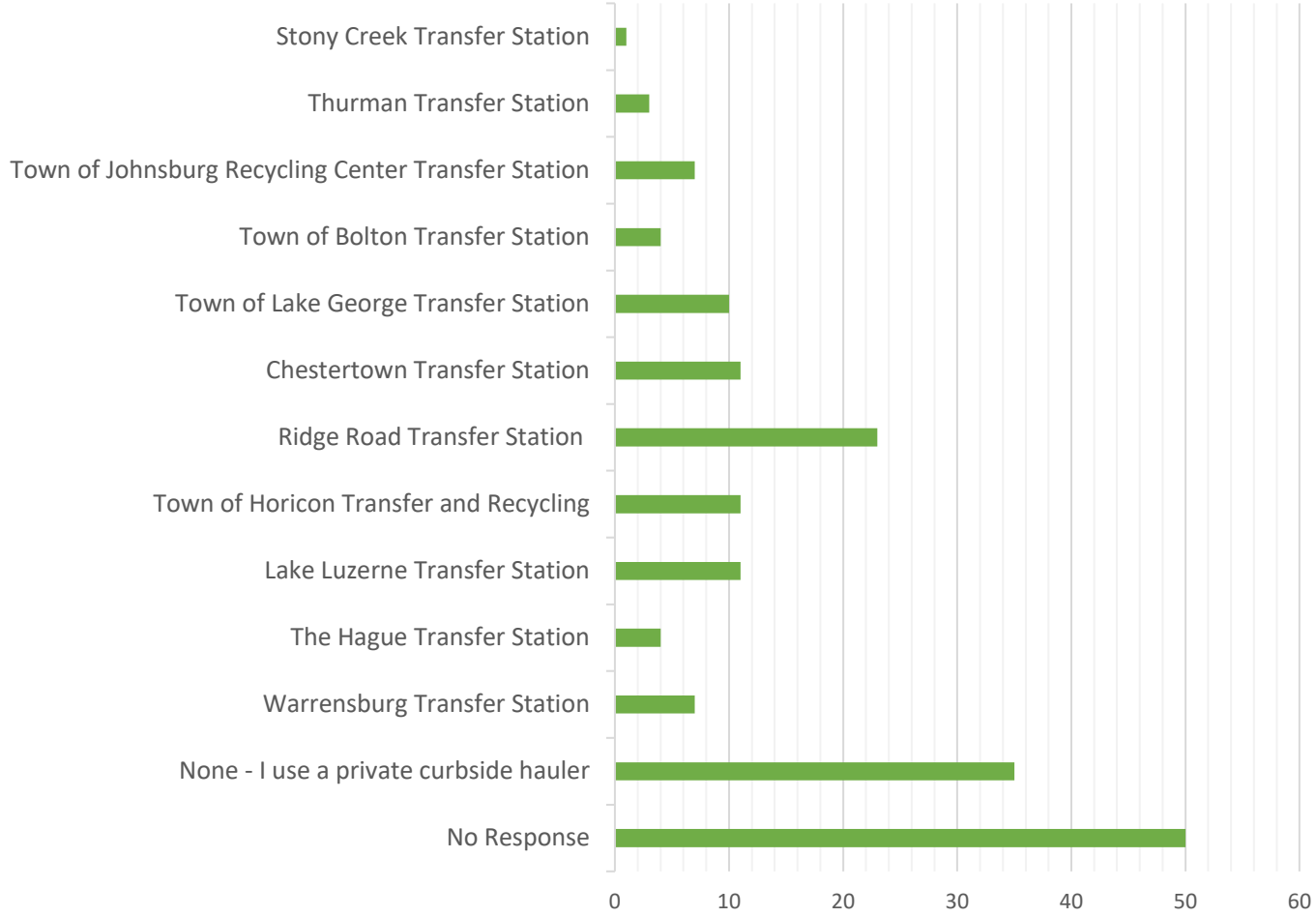


There is almost an equal split between respondents using a private hauler and those bringing to the transfer station.

Understanding Waste Behavior of Survey Respondents

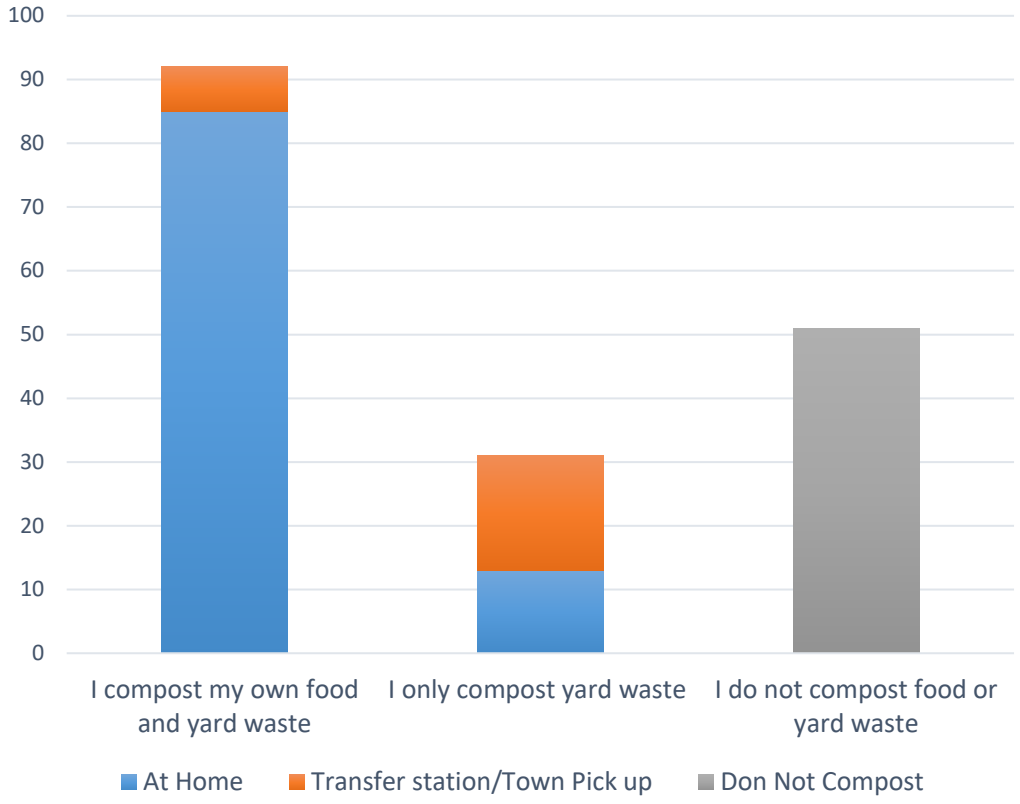
Q6. If you bring your waste and recycling to a transfer station yourself, which transfer station do you use?

- Half of the respondents do not use transfer station or did not respond to this question.
- Ridge Road Transfer station in Queensbury is used by majority of the respondents.



Understanding Waste Behavior of Survey Respondents

Q7. Do you compost yard clippings, leaves and food scraps yourself or through one of the following programs?

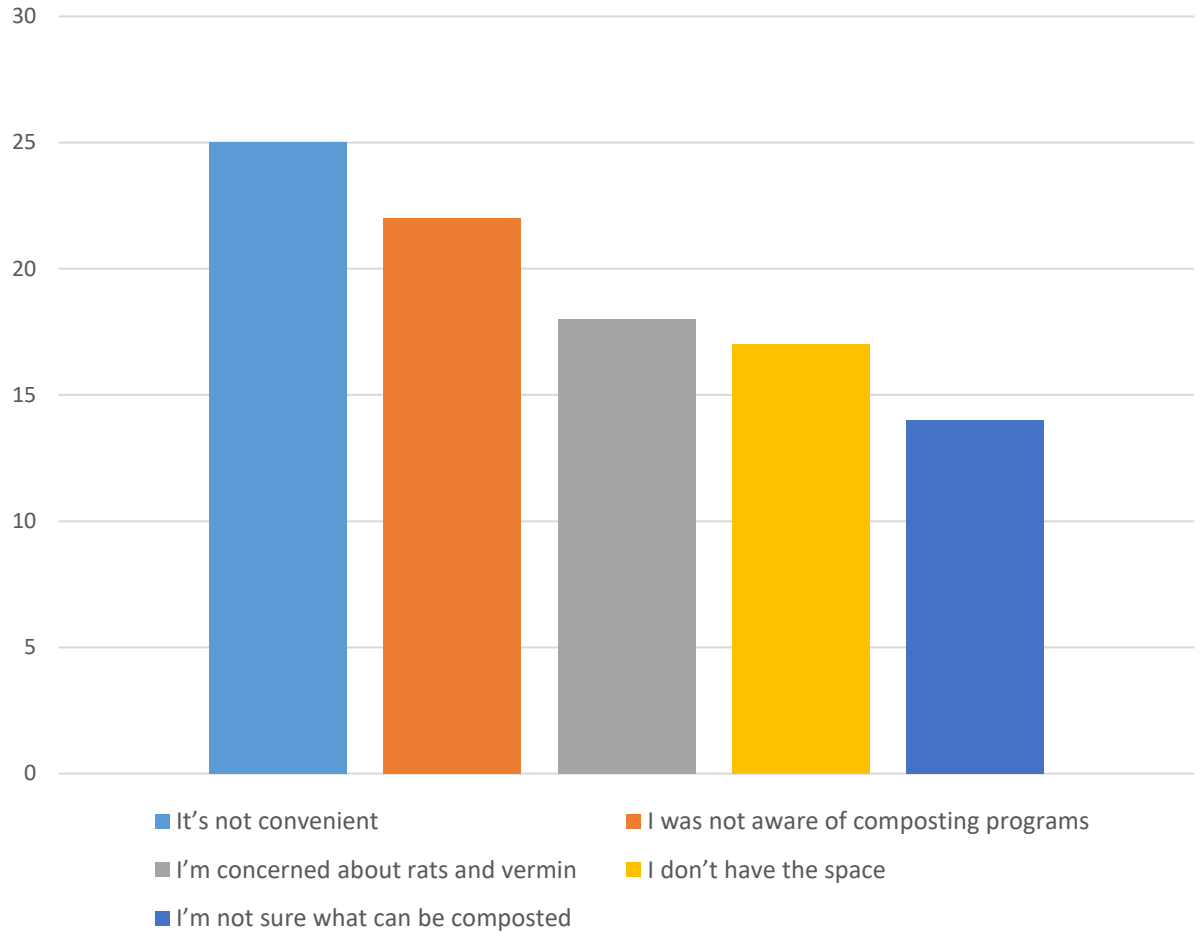


- The results show that there are residents in Warren County who do not compost, and they would likely be the target audience for a composting program.
- Three quarters of respondents' already compost, and most of them do it at home using a backyard composter.

Understanding Waste Behavior of Survey Respondents

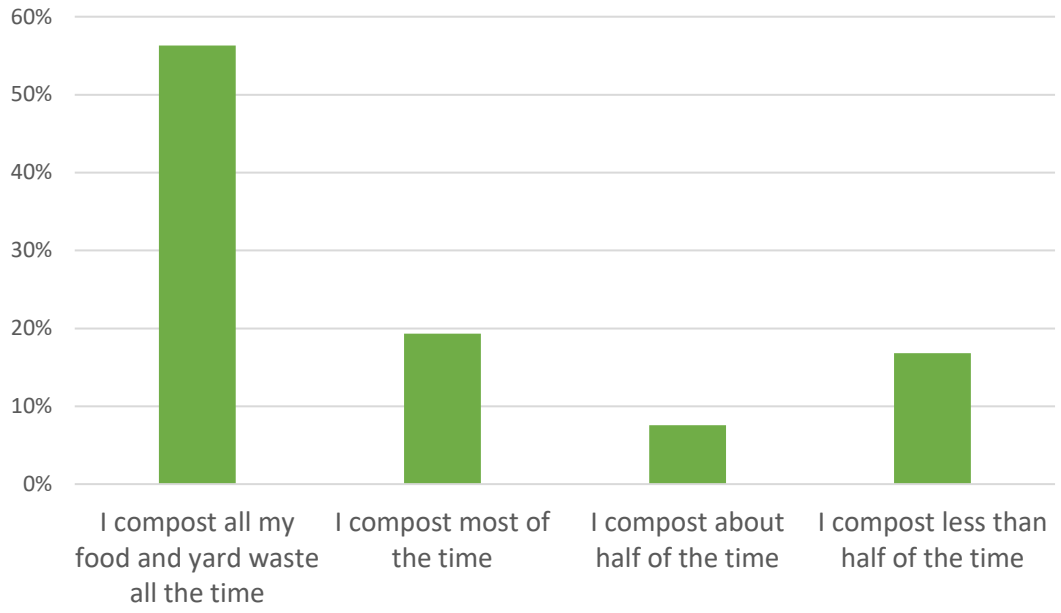
Q8. If you do not compost on your own or participate in a composting program, please tell us why?

- 80 out of 177 respondents answered this question.
- The most common reasons for not composting are that its not convenient or they are not aware of composting programs
- Other responses includes concerns from bear and wildlife and for some its physically challenging.



Understanding Waste Behavior of Survey Respondents

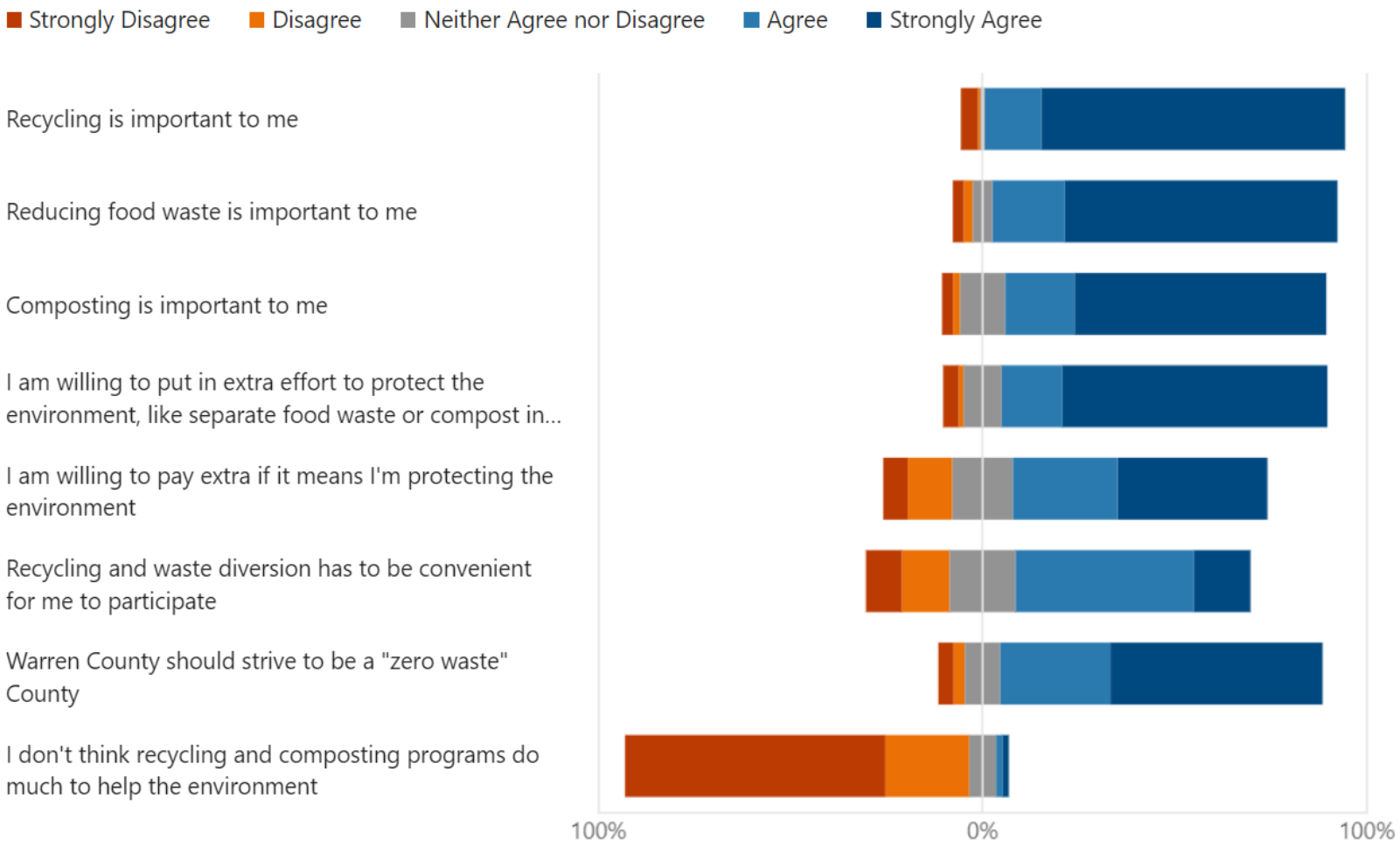
Q9. Which of the following statements most applies to you?



– The vast majority of the people who compost, compost all their food and yard waste

Opinion of Survey Respondents on Waste & Composting

Q10. Please rate your agreement with the following statements

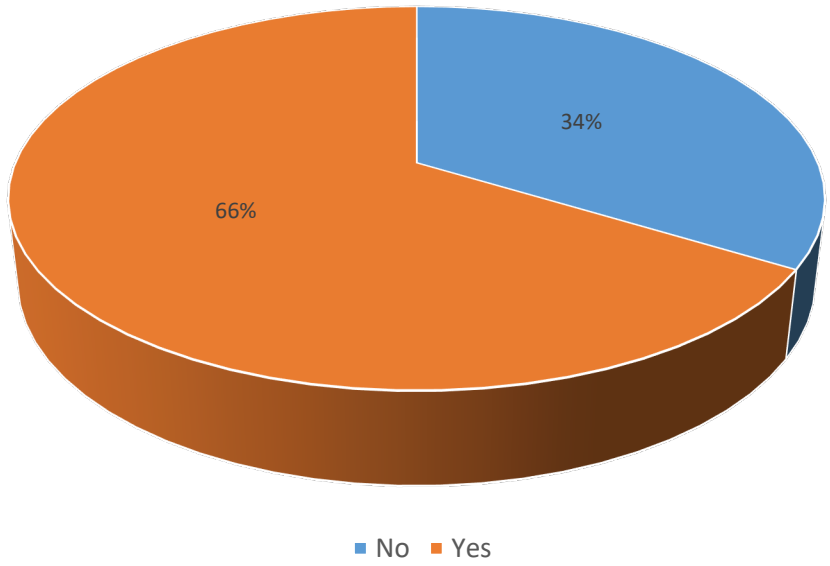


- Respondents place a strong value on recycling and waste diversion
- They are willing to put an extra effort towards diversion
- Cost and convenience is a factor for some
- Overall, there is strong support for diversion and organics programs

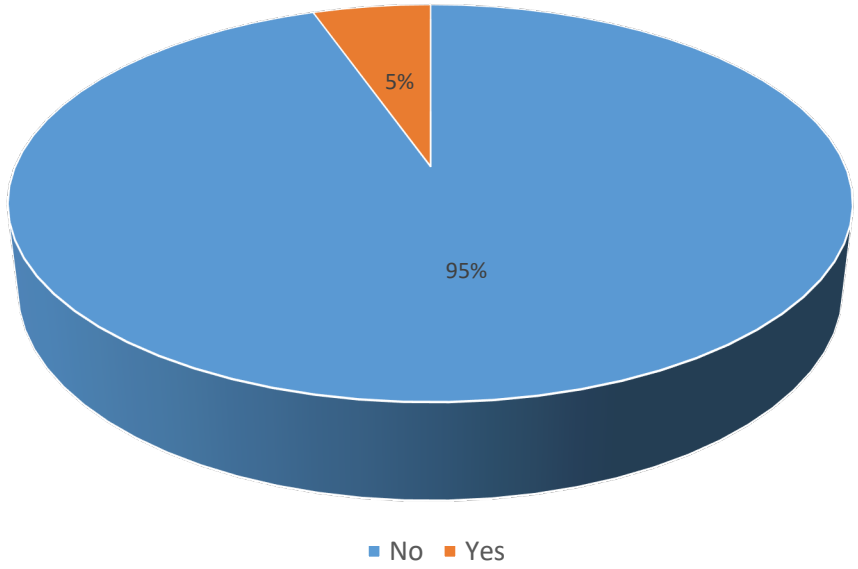
Opinion of Survey Respondents on Waste & Composting

Respondents who do not compost at all

Q11. Would you be interested in purchasing locally produced compost?



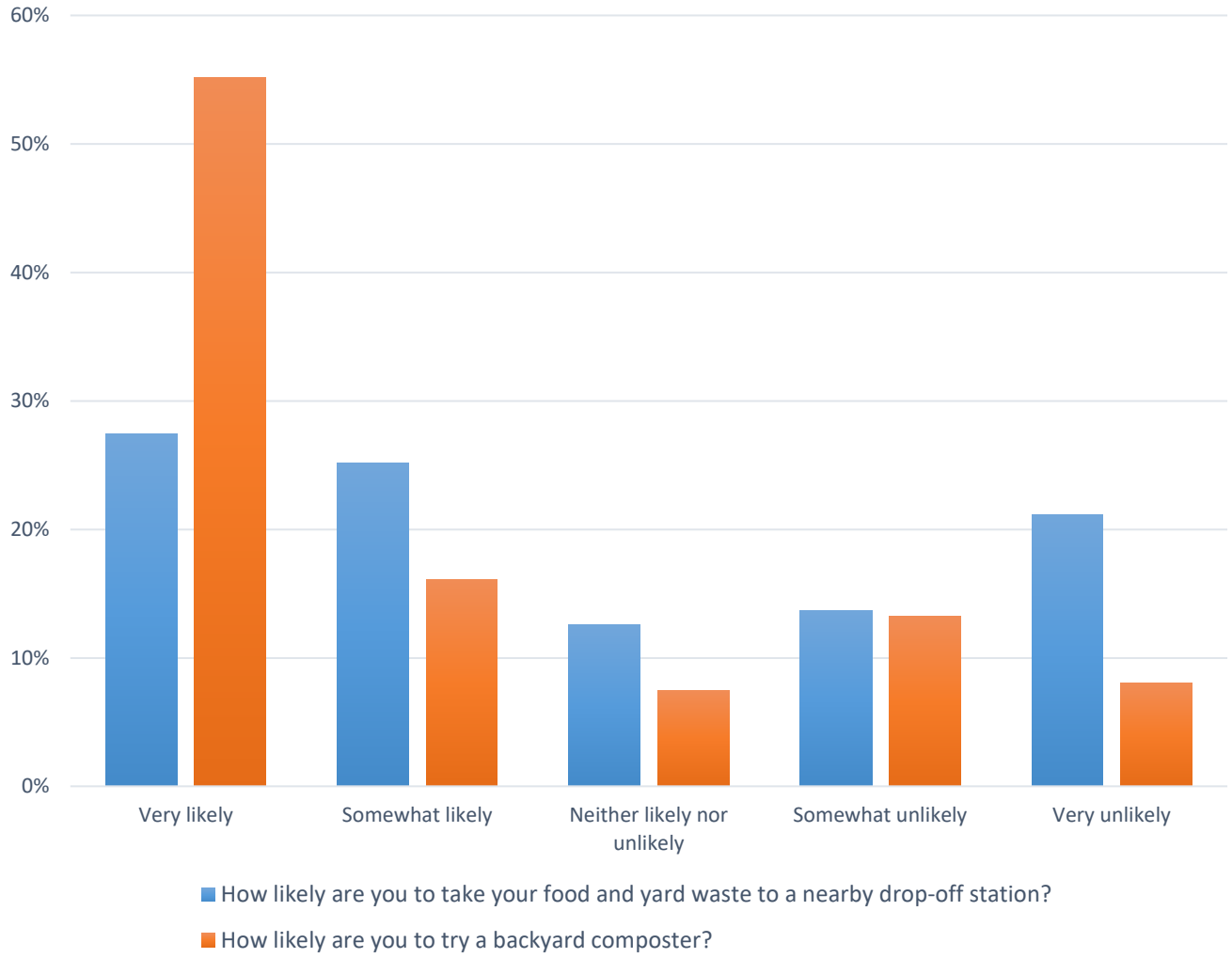
Q12. In your opinion, does Warren County do enough to divert food and yard waste from landfills?



These responses show that there would be support for the program since 95% of the respondents think Warren County do not do enough to divert food and yard waste and 66% of the people are willing to purchase locally produced compost.

Opinion of Survey Respondents on Waste & Composting

Q13 and Q14. How likely are you to take your food and yard waste to a nearby drop-off station and How likely are you to try a backyard composter?



While there is support for both drop-off stations and backyard composters, there is stronger support for backyard composters:

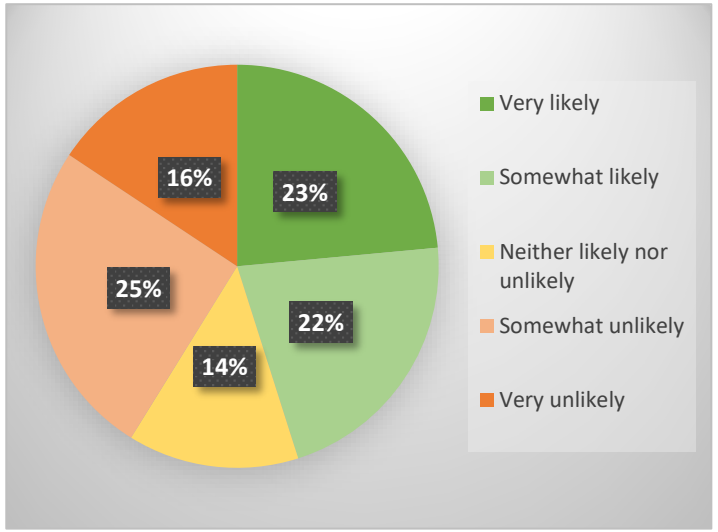
- 71% of the respondents are somewhat or very likely to try a backyard composter
- 53% of the respondents are somewhat or very likely to take their food and yard waste to a nearby drop-off station

Note responses include those who already use a backyard composter

Opinion of Survey Respondents on Waste & Composting

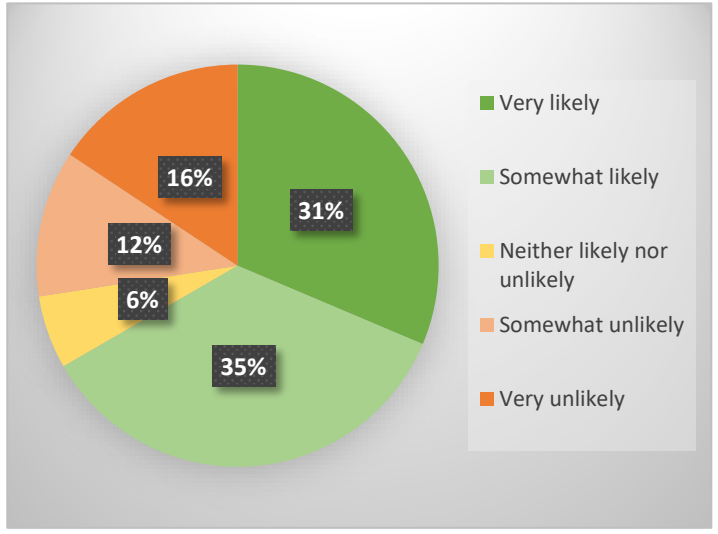
Respondents who do not compost at all

How likely are you to use a backyard composter?



– **45%** of respondents are very or somewhat likely to use a backyard composter.

How likely are you to take your food and yard waste to a nearby drop-off station?



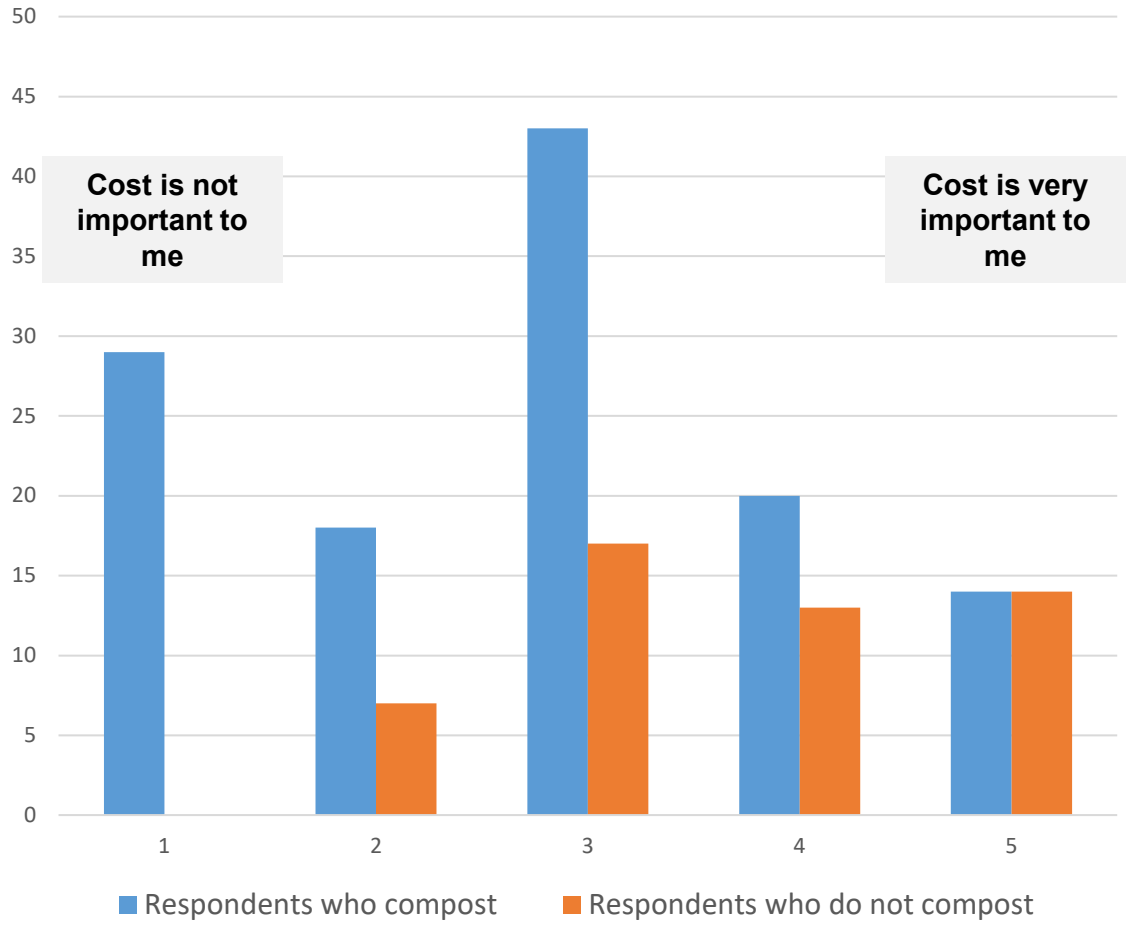
– **66%** of respondents are very or somewhat likely to use a nearby drop-off station

Opinion of Survey Respondents on Waste & Composting

Q15. Would the cost of a composting program influence your participation? (1 means cost is not important to me; 5 means cost is very important to me)

While cost is not important for all respondents, in general it is given more importance by those who do not currently compost:

- 53% of the respondents who do not compost, believes cost will influence their participation, ranking cost 4 or 5
- 38% of the respondents who compost, believes that cost is an important factor in their participation



Opinion of Survey Respondents on Waste & Composting

Q22. Do you have any other comments or thoughts you would like to share with the project team about managing food and yard waste in Warren County? (Open ended question)

66 respondents answered this question. Summary of some these answers -

- Overall support for composting programs
- Consider using existing transfer stations as drop-off point
- Education program on composting
- Composting needs to be inexpensive and convenient
- Composting difficult in winter
- Education around composting is required
- Composting in schools and restaurants is necessary

Opinion of Survey Respondents on Waste & Composting

Q16. Do you represent a business or institution that generates food or yard waste?

Yes, Giavano's Pizza & Styles Hair Salon

Q17. Would your business or institution be interested in partnering with Warren County to process your organic wastes into compost?

Yes

Q18. Please indicate which type of generator you represent

Commercial

Respondent did not provide contact information

Thank You

ghd.com

Appendix B

Community Engagement Session Meeting Highlights

Technical Memorandum

June 15, 2023

To	Kevin Hajos, DPW	**Contact No.**	+1 315 802-0350
Copy to	Brad Smith, GHD Katrina McCullough, GHD Makenna Knapp, GHD	**Email**	david.wright@ghd.com
From	David Wright, GHD	**Project No.**	12592974
Project Name	Warren Co. Organics Management Plan		
Subject	Community Engagement Session #1		

On March 15, 2023, at 6:00 PM, Warren County Department of Public Works and GHD Consulting Services Inc. (GHD) hosted a Community Engagement Session #1 for residents of Warren County. The community engagement session was held in person at the Warren County Municipal Center in Lake George, New York, virtually via Zoom, and live streamed on YouTube. Twenty-three attendees attended virtually with multiple attendees in person at the community engagement session.

The purpose of Community Engagement Session #1 was to gauge interest from residents on an organics management program in Warren County, and obtain feedback on what Warren County and GHD should consider as part of preparing an Organics Management Plan. Feedback from this session was considered in conjunction with feedback from an Organics Management Plan Advisory Committee by GHD and Warren County as part of preparing the Organics Management Plan.

As part of the community engagement session, GHD provided a presentation to provide the participants with project background and context, including:

– Why is Warren County considering a Compost Program?
– Project Team
– About the Study
– Food and Yard Waste in Warren County
– Existing Compost Programs
– Compost Programs in Other Communities

Following the presentation, GHD facilitated a community discussion. Participants were asked to think about:

– Do you compost your food or yard waste right now? Why or why not?
– Would you and your neighbors consider participating in a compost program?
– What did you like/dislike about the composting programs in other communities?
– Do you have any questions or concerns about composting programs?

Overall, Participants were supportive of a composting program. Below is a summary of the comments and questions during the community engagement session:

– Suggestion to ensure the Plan addresses food waste from large generators, pointing to recently passed New York State Food Donation and Food Scraps Recycling Law for large food waste generators.

- Concerns about contamination and pesticides in compost and an interest in high quality compost product
- Interest in cost and revenue estimates of an organics management program and in potential partnership models
- Interest from some participants in curbside collection or drop-off facility since they are unable to compost themselves
- Question about how the survey was advertised
- Question about what kind of yard waste would be collected, and if program would be year round

Technical Memorandum

June 15, 2023

To	Kevin Hajos, DPW	**Contact No.**	+1 315 802-0350
Copy to	Brad Smith, GHD Katrina McCullough, GHD Makenna Knapp, GHD	**Email**	david.wright@ghd.com
From	David Wright, GHD	**Project No.**	12592974
Project Name	Warren Co. Organics Management Plan		
Subject	Community Engagement Session #2		

On June 6, 2023, at 6:00 PM, Warren County Department of Public Works and GHD Consulting Services Inc. (GHD) hosted a Community Engagement Session #2 for residents of Warren County. The community engagement session was held in person at the Warren County Municipal Center in Lake George, New York and virtually via Zoom and live streamed on YouTube. Several attendees attended in person with an additional ten attendees virtually attending the community engagement session.

The purpose of Community Engagement Session #2 was to present the preliminary findings and recommendations for the Organics Management Plan for Warren County and obtain feedback from the community that GHD will consider as part of the final Organics Management Plan. GHD presented that feedback from the session, and it will be considered in conjunction with feedback from the project Advisory Committee and DPW Committee.

As part of the community engagement session, GHD provided a presentation to provide the participants with project summary and context, including:

– Why is Warren County considering a Compost Program?
– Project Team
– About the Study
– How was the Plan developed?
– Existing Conditions in Warren County
– Compost Facilities in Other Communities
– Community Engagement Session #1
– Community Survey Results
– Pilot Program Overview
– Composting Facility Feasibility
– Composting Technology Alternatives
– Grant Opportunities
– Pilot Program Conceptual Costs
– Composting Facility Conceptual Costs and Assumptions
– Conceptual Composting Facility Site Layout
– Strategic Value of a Composting Facility
– Preliminary Recommendations
– Preliminary Roadmap

Following the presentation, GHD and DPW facilitated a community discussion. Below is a summary of the questions asked during the second engagement session:

– Of the two sites identified, would each site allow enough space for the composting facility with an estimated footprint of 4 to 6 acres? GHD confirmed that both sites would have sufficient space but could require reconfiguration.
– Can the County start with a lower cost technology and later expand or invest in a more advanced technology with higher cost and higher revenue potential? GHD clarified that the different technology options did not have different revenue potential as the revenues are typically related to compost that is sold. GHD confirmed that the technology approach can be modified overtime with yard waste composting facilities typically requiring less technology, and when food waste is introduced, additional technology such as aerated static pile composting could be introduced. GHD further noted that a turned windrow composting method requires more space because it takes longer for organics to process compared to the status pile methods.
– Why were the Transfer Stations (e.g., Ridge Road) not considered for site locations? The County DPW responded that they only considered County-owned facilities vs. Town owned facilities and that Ridge Road would not have sufficient space. The County DPW also noted that existing transfer stations would be suitable drop off locations for residential food scraps and could be evaluated during a pilot.
– What happens to yard waste in the County currently? The County responded that some yard waste is composted however the compost is very well utilized by the community.

Appendix C

Composting Alternatives Summary Table

Table 3 *Alternatives Ranking*

RANKING	Process	4.75	Capital Budget		3.6	Operations	4.6	Process / Environmental Control			5	Site Integration	2.6	O&M Labor	3.5	O&M Cost	5.25
Option	**Composting Process / Duration[1]**		**Technology / Composting Equipment Supply**	**Balance of Plant / Additional Site Improvements Cost[2]**		**Operational Risks**		**Leachate Management**	**Level of Perceived Litter Control**	**Level of Perceived Odor Control**		**Estimated Total Area Required**		**Estimated FTEs**		**Maintenance Costs**	
Turned Windrow	4 to 6 months	1	Windrow Turner ($750,000 est.)	<$1.0M (assumes Installation of approximately 1-acre concrete pad)	3	Low	3	Need to install means of collecting runoff from concrete pad.	Low	Low	1	4.0 – 6.0 acres	1	2 to 3 FTEs	1	Low	3
Uncovered ASP	3 to 4 months	2	<$1M	$1.5M - $3.0M	2.5	Medium	2	Leachate collected from bunkers and managed to tank.	Low	Low	1.5	1.5 – 2.0 acres	2	1.5 to 2.5 FTEs	2	Low to Medium	2.5
Container In-Vessel ASP	2 to 3 months	3	<$6.0M	$2.5M - $4.0M	1	High	1	Leachate collected from bunkers and managed to tank.	High	High	3	<1.5 acres	2	1.5 to 2 FTEs	3	High – Complex equipment requiring skilled labor for maintenance.	1
Covered ASP	2 to 3 months	3	<$2.0M	$2.0M - $3.0M	2	Medium	2	Leachate collected from bunkers and managed to tank.	Medium	Medium	2	1.5 - 2.0 acres	2	1.5 to 2.5 FTEs	2	Medium – Fabric membrane cover replaced every 6 – 8 years.	2
Bioreactor	2 to 3 months	3	<$6.0M	$2.5M - $4.0M	2	Medium	2	Leachate recirculated in bioreactor. Runoff from curing stages managed off concrete pad.	Medium to High	Medium	2	1.5 – 2.0 acres	2	1.5 to 2.5 FTEs	2	Medium – Bioreactor and containment structure maintenance.	2
Agitated Bed	2 to 3 months	3	<$6.0M	$3.0M - $5.0M	1	High	1	Leachate collected from agitated bad channels and managed to tank.	High	High	3	<4.0 acres	2	1.5 to 2.5 FTEs	2	High – Complex equipment requiring skilled labor for maintenance.	1
Table Notes	1. Processing times depend on feedstock quality and consistency. Therefore, presented as a range.< 2. Rough order magnitude costs (±30%) presented as a range of probable cost for construction.																

Appendix D

Centralized Compost Facility Cost Estimate

Warren County Composting Facility
Turned Windrow

CAPITAL COST SUMMARY

Item	Description	Unit	Estimated	Unit Cost	Estimated Subtotal
1	Earthwork and Rough Grading (Site development over 5-acre footprint)	LS	1	$45,000	$45,000
2	Asphalt pavement	SY	500	$175	$87,500
3	Scale (Including shallow foundations)	LS	1	$120,000	$120,000
4	Office Trailer	LS	1	$50,000	$50,000
5	Water supply (well or connection to water main)	LS	1	$20,000	$20,000
6	Allowance for Miscellaneous Construction	LS	1	$25,000	$25,000
	Front-end loader	Estimated range $100,000 - $250,000			Not in cost
	Grinder / Chipper	Estimated range $125,000 - $250,000			Not in cost
	Trommel Screen	Estimated range $250,000 - $500,000			Not in cost
	Construction Cost Subtotal				**$350,000**
	Additional Project Requirements				
	Project Permitting		2%		$7,000
	Mobilization and Demobilization		4%		$14,000
	General Conditions for Construction		12%		$42,000
	Engineering Design Phase Services		6%		$21,000
	Engineering Construction Phase Services		8%		$28,000
	Fiscal, Legal & Administrative		2%		$7,000
	Commissioning and start-up		1%		$4,000
	Project Contingency		20%		$70,000
	Subtotal				**$543,000**
	Engineer's Opinion of Probable Project Cost			***rounded***	**$600,000**

OPERATING COST SUMMARY

				Annual Cost
Direct Labor		2.5 FTEs		$200,000
Fuel		50,000	L	$78,413
Residual Disposal		300	tons	$18,000
Maintenance		Equipment / system preventative maintenance		$5,000
Water Supply				$5,000
Sanitary				$5,000
Communications				$3,000
Office/Administrative				$5,000
Insurance				$20,000
Product Marketing and Sales				$2,500
Contract / Consultant Services				$5,000
Safety and Training				$3,500
			Subtotal	$350,413
			Contingency	10%
			Total	**$390,000**

Notes:
1. Estimates in 2023 USD based on 10,000 tons per year of feedstock.
2. Residuals assumed to be 3.0% by weight of total feedstock quantities.
3. Assumes no amendment supply is required for operations.
4. Assumes no private operator agreement costs.
5. Assumes no revenue generated from compost sales.

Rate Assumptions:

Power Rate	$0.10	per KWH
Fuel Rate	$1.64	per L
Residual Disposal at Landfill	$60	per ton
Leachate Disposal	$20,000	annual allowance
Fuel Consumption -		
Front-end Loader	12.5	L per hour
Tractor	36	L per hour
Trommel Screen	5	L per hour

**Fuel consumption rates assumed based on typical values for similar equipment*

Warren County Composting Facility
Aerated Static Pile

CAPITAL COST SUMMARY

Item	Description	Unit	Estimated	Unit Cost	Estimated Subtotal
1	Full ASP System Supply (8 bunker system, including instrumentation, fans, and air/leachate piping)	LS	1	$400,000	$400,000
2	Concrete Slab	CY	1000	$1,200	$1,200,000
3	Concrete Bunker Walls	CY	700	$1,200	$840,000
4	Leachate and Air Supply Piping Installation	LS	1	$60,000	$60,000
5	Electrical Service Upgrade - 3-phase, 480-volt, 500-Amp Service	LS	1	$45,000	$45,000
6	Leachate Storage and Conveyance Modifications	LS	1	$30,000	$30,000
7	Scale (Including shallow foundations)	LS	1	$120,000	$120,000
8	Office Trailer	LS	1	$50,000	$50,000
9	Earthwork and Rough Grading (Site development over 2-acre footprint)	LS	1	$15,000	$15,000
10	Asphalt pavement	SY	500	$175	$87,500
11	Water supply (well or connection to water main)	LS	1	$20,000	$20,000
12	Allowance for Topographic Survey (Compost technology footprint only)	LS	1	$12,000	$12,000
13	Allowance for Miscellaneous Construction	LS	1	$25,000	$25,000
	Front-end loader	Estimated range $100,000 - $250,000			Not in cost
	Grinder / Chipper	Estimated range $125,000 - $250,000			Not in cost
	Trommel Screen	Estimated range $250,000 - $500,000			Not in cost
	Construction Cost Subtotal				**$2,910,000**
	Additional Project Requirements				
	Project Permitting		2%		$59,000
	Mobilization and Demobilization		4%		$117,000
	General Conditions for Construction		12%		$350,000
	Engineering Design Phase Services		6%		$175,000
	Engineering Construction Phase Services (6-month assumed construction duration)		8%		$233,000
	Fiscal, Legal & Administrative		2%		$59,000
	Commissioning and start-up		1%		$30,000
	Project Contingency		20%		$582,000
	Subtotal				**$4,515,000**
	Engineer's Opinion of Probable Project Cost			***rounded***	**$4,600,000**

OPERATING COST SUMMARY

			Annual Cost
Direct Labor	2.5 FTEs		$200,000
Fuel	42,000	L	$68,880
Electricity - Aeration Fans	84,000	KWh	$16,800
Electricity - Processing Equipment	25,000	KWh	$5,000
Residual Disposal	300	tons	$18,000
Leachate Disposal			$35,000
Maintenance	Equipment / system preventative maintenance		$10,000
Water Supply			$5,000
Sanitary			$5,000
Communications			$3,000
Office/Administrative			$5,000
Insurance			$20,000
Product Marketing and Sales			$2,500
Contract / Consultant Services			$5,000
Safety and Training			$3,500
		Subtotal	$402,680
		Contingency	10%
		Total	**$450,000**

Notes:
1. Estimates in 2023 USD based on 10,000 tons per year of feedstock.
2. Residuals assumed to be 3.0% by weight of total feedstock quantities.
3. Assumes no amendment supply is required for operations.
4. Assumes no private operator agreement costs.
5. Assumes no revenue generated from compost sales.

Rate Assumptions:

Power Rate	$0.20	per KWH
Fuel Rate	$1.64	per L
Residual Disposal at Landfill	$60	per ton
Leachate Disposal	$35,000	annual allowance
Fuel Consumption -		
Front-end Loader	12.5	L per hour
Tractor	36	L per hour
Trommel Screen	5	L per hour

**Fuel consumption rates assumed based on typical values for similar equipment*

Warren County Compost Facility
Covered Aerated Static Pile

CAPITAL COST SUMMARY

Item	Description	Unit	Estimated	Unit Cost	Estimated Subtotal
1	Full C-ASP System Supply (6 bunker system, including covers, instrumentation, fans, and air/leachate piping)	LS	1	$1,100,000	$1,100,000
2	Bunker Cover System Installation	LS	1	$50,000	$50,000
3	Concrete Slab	CY	900	$1,200	$1,080,000
4	Concrete Bunker Walls	CY	300	$1,200	$360,000
5	Leachate and Air Supply Piping Installation	LS	1	$45,000	$45,000
6	Electrical Service Upgrade - 3-phase, 480-volt, 500-Amp Service	LS	1	$45,000	$45,000
7	Leachate Storage and Conveyance Modifications	LS	1	$30,000	$30,000
8	Scale (Including shallow foundations)	LS	1	$120,000	$120,000
9	Office Trailer	LS	1	$50,000	$50,000
10	Earthwork and Rough Grading (Site development over 2-acre footprint)	LS	1	$15,000	$15,000
11	Asphalt pavement	SY	500	$175	$87,500
12	Water supply (well or connection to water main)	LS	1	$20,000	$20,000
13	Allowance for Topographic Survey (Compost technology footprint only)	LS	1	$12,000	$12,000
14	Allowance for Miscellaneous Construction	LS	1	$25,000	$25,000
	Cover Winder Machine (optional)	Estimated range $120,000 - $200,000			Not in cost
	Front-end loader	Estimated range $100,000 - $250,000			Not in cost
	Grinder / Chipper	Estimated range $125,000 - $250,000			Not in cost
	Trommel Screen	Estimated range $250,000 - $500,000			Not in cost
	Construction Cost Subtotal (rounded)				**$3,040,000**
	Additional Project Requirements				
	Project Permitting		2%		$61,000
	Mobilization and Demobilization		4%		$122,000
	General Conditions for Construction		12%		$365,000
	Engineering Design Phase Services		6%		$183,000
	Engineering Construction Phase Services		8%		$244,000
	Fiscal, Legal & Administrative		2%		$61,000
	Commissioning and start-up		1%		$31,000
	Project Contingency		20%		$608,000
	Subtotal				**$4,715,000**
	Engineer's Opinion of Probable Project Cost			***rounded***	**$4,800,000**

OPERATING COST SUMMARY

			Annual Cost
Direct Labor	2.5 FTEs		$200,000
Fuel	42,000	L	$68,880
Electricity - Aeration Fans	62,710	KWh	$12,542
Electricity - Processing Equipment	25,000	KWh	$5,000
Residual Disposal	300	tons	$18,000
Leachate Disposal			$20,000
Fabric Membrane Cover Replacem	Replace 6 covers every 6 years, therefore replacement cover fund = 1 cover per year		$60,000
Maintenance	Equipment / system preventative maintenance		$10,000
Water supply			$5,000
Sanitary			$5,000
Communications			$3,000
Office/Administrative			$5,000
Insurance			$20,000
Product Marketing and Sales			$2,500
Contract / Consultant Services			$5,000
Safety and Training			$3,500
	Subtotal		$443,422
	Contingency		10%
	Total		**$490,000**

Notes:
1. Estimates in 2023 USD based on 10,000 tons per year of feedstock.
2. Residuals assumed to be 3.0% by weight of total feedstock quantities.
3. Assumes no amendment supply is required for operations.
4. Assumes no private operator agreement costs.
5. Assumes no revenue generated from compost sales.

Rate Assumptions:

Power Rate	$0.20	per KWH
Fuel Rate	$1.64	per L
Residual Disposal at Landfill	$60	per ton
Leachate Disposal	$20,000	annual allowance
Fuel Consumption -		
Front-end Loader	12.5	L per hour
Tractor	36	L per hour
Trommel Screen	5	L per hour
Cover Winder (gas)	5	L per hour

**Fuel consumption rates assumed based on typical values for similar equipment*


GHD