# *Municipal Solid Waste Quantification and Characterization of Burlington, Mercer & Passaic Counties*

**New Jersey Department of Environmental Protection**

Division of Sustainable Waste Management
Bureau of Planning and Licensing

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**Rutgers EcoComplex**

"Clean Energy Innovation Center"

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Tables used in main report and in the SCS Engineers report ( Appendix 1) present the average waste stream composition by the population density of the collection route from which the samples were collected, categorized into rural, suburban and urban streams. The confidence intervals are calculated at a 90 percent confidence level. Based on the collected samples, there is a 90-percent likelihood that the proportion of a given material in a future sample will fall between the confidence limits.

# I. INTRODUCTION

The State of New Jersey (The State) established yearly waste reduction and recycling goals that target recycling 50% of the Municipal Solid Waste (MSW) Type 10 (ID# 10) waste and 60% of the entire waste stream. In order to assist the State with meeting the waste reduction and recycling goals, the Rutgers EcoComplex performed a yearlong waste stream composition study, including physical inspection and assessment of the individual constituents, to create reliable, up-to-date ID #10 MSW data by a percentage of total MSW weight. Identifying the source of the waste stream as rural (population density less than 500 people/sq. mile), suburban (population density between 500 to 1999 people/sq. mile), urban (population density is 2000 or more people /sq. mile) is critical for understanding the waste generation trends of these residential areas. The project:

1- Assessed ID#10 MSW sourced from all three population sources of Burlington County, namely; rural, suburban and urban areas (Figure 1).

2- Assessed ID #10 MSW sourced from urban and suburban regions of Mercer County. With Princeton representing a suburban, and Trenton representing an urban, region of Mercer County.

3-Assessed ID#10 MSW sourced from urban regions of Passaic County.

4- Assessed the contamination levels in single stream recycling samples from the town of Princeton.


Figure 1. New Jersey Counties of Waste Characterizations

Although the EcoComplex was authorized to perform the project in the spring of 2020, because of the Covid-19 Pandemic and other related but unforeseen reasons, the team was able to start the sampling on August 16, 2021 with summer season waste audit. We performed the waste audit for the fall season, during the week October 25, 2021. This was followed with the winter season waste audit during the weeks of January 31st, 2022 and February 7th, 2022. The project team completed the spring season waste audit during the week of May 9th, 2022. We submitted the seasonal raw data along with our quarterly progress reports to the State.

During the waste audits, the EcoComplex collaborated with SCS Engineers, Burlington County Department of Solid Waste for its rural, suburban and urban waste, Mercer County Improvement Authority for their urban and suburban and also for the City of Princeton's recycling waste streams, and Covanta Energy for Passaic County's urban waste stream supplies. We also collaborated with Center for EcoTechnology (CET) to examine the data with respect to food waste and be able to extrapolate which sectors the state and other stakeholders should target for largest food waste reduction and diversion impact. Furthermore, we collaborated with New Jersey Corporation for Advanced Technologies (NJCAT) to identify technologies with verified performance that are emerging in the waste management industry.

This report includes all mentioned data in the main report and sub-awardee performance reports in the appendices.

# II. METHODOLGY

The EcoComplex collaborated with SCS Engineers Inc. to perform the waste sampling and analysis. The sorting project closely followed the test method of ASTMD5231-92 (2016) standards for sorting to determine the MSW composition. As ASTM recommended the team conducted the sorting operation over a continuous one-week period covering all four quarters of the year. Each sampling week represented a season of the year. With this sampling method, seasonal variations in the waste composition were accounted for in the overall results of the characterization. The team randomly selected 200 lbs. of mixed waste samples from the loads at the transfer station as prescribed by the ASTM specification. SCS Engineers (SCS) provided supervision of the waste sorting, the sorting team, equipment and personal protective gear. SCS also provided all quality control, including the required trainings to the sorting team for safety and health related matters.

***Waste Sampling:***

Waste samples weighing approximately 200 pounds were captured from residential and commercial waste streams subcategorized as either rural, suburban, or urban. The Counties could not provide separate streams for institutional waste. The team collected samples from both front-end and rear-load waste collection vehicles, and interviewed the drivers to determine the source of the waste. The recycling stream samples measured approximately one cubic yard for each sample. The team conducted sampling, sorting, and weighing of waste components as follows:

- Summer: August 2021 (Mercer County, Princeton Recycling, Burlington County, Passaic County)
- Fall: October 2021 (Burlington County, Passaic County)
- Winter: February 2022 (Mercer County, Princeton Recycling, Burlington County, Passaic County)
- Spring: May 2022 (Burlington County, Passaic County)

The team identified the material in each sample, sorted the waste into bins, and weighed each category separately (figures 2a, b, and c).

Figure 2.a. Inside Sorting

Figure 2.b. Waste Bins

Figure 2.c. Outside Sorting

Waste audit team utilized 4-day sampling, sorting and weighing periods at the Burlington County Resource Recovery Complex for four seasonal audits for the Burlington County and Passaic County waste streams. At the Mercer County Improvement Authority Transfer Station, the team utilized two 5-day audit periods for summer and winter seasons. The team categorized samples into recyclable, compostable, other divertible, and non-divertible main groups(Table 1). The team assessed 234 separate samples as follows:

- 108 samples of waste from rural, suburban, and urban streams in Burlington County
- 72 samples of waste from suburban and urban streams in Mercer County
- 18 samples of residential recyclables generated in Mercer County (Princeton)
- 36 samples of waste from urban residential streams in Passaic County

Table 1. Material Categories and Examples

| Material Type | | Examples |
|---|---|---|
| Recyclable | Newspaper | Newsprint, newspapers |
| | Corrugated Cardboard | Shipping or packing boxes |
| | White Office Paper | Copy paper, notebook paper, envelopes |
| | Box Board | Soda and beer cases, cereal boxes |
| | Magazines | Catalogs, subscription magazines |
| | Other Paper | Junk mail, receipts, envelopes, recyclable paper not otherwise categorized |
| | PET Containers | #1 plastic bottles, clear containers |
| | HDPE Containers | #2 opaque bottles, milk jugs |
| | Aluminum Cans | Soda cans |
| | Steel Cans | Food containers (canned soup/vegetables) |
| | Other Ferrous | Magnetic metal scrap, paint cans, clothing hangers |
| | Other Non-Ferrous | Other metal scraps (copper, brass, lead, zinc) |
| | Glass Containers | Glass bottles, containers |
| Compostable | Compostable Paper | Paper towels, napkins, tissues, food-contaminated paper |
| | Food Waste | Food scraps, liquids, packaged food |
| | Leaves | Fallen leaves, plant trimmings |
| | Grass | Lawn clippings |
| | Brush | Small woody branches, sticks, twigs, foliage |

| | Material Type | Examples |
|---|---|---|
| Other Divertibles | Textiles | Clothing textiles, blankets, tarps |
| | Rubber | Latex gloves, rubber bands, tires, hoses |
| | Leather | Leather textiles, shoes, wallets, belts, scraps |
| | Particle Board | Chipboard made from wood chips/sawdust |
| | Plywood | Wood scraps/C&D |
| | Batteries | Non-lithium batteries |
| | Paints | Paint cans, stains |
| | Pallets | Wood pallets, broken pallets |
| | Tree Parts | Large limbs, branches |
| | Other Wood | Wood waste not otherwise categorized |
| | Soil/Ash | Dirt, dusty debris, decomposed matter |
| | Electronic Waste | Computers, phones, power supplies |
| | Solvents/Corrosive/Flammable | Automobile fluids, gasoline, antifreeze |
| Non-Divertible | #3, 4 and 5 Containers | Plastic containers labeled #3-#5 |
| | Plastic Films | Thin plastics, grocery bags (#4,#5) |
| | Polystrene (#6) | Styrofoam packaging, solo cups/plates |
| | Rigid Plastic | Hard plastic furniture, buckets, toys |
| | Other Plastic | Plastic products not otherwise categorized |
| | Fines | Small commingled materials, straws, scraps |
| | Aerosol Containers | Hair spray, air freshener, deodorant |
| | Asphalt | Asphalt shingles, asphalt debris |
| | Masonry Materials | Bricks, clay shingles, terracotta |
| | Drywall/Gypsum Board | C&D drywall, clean or broken |
| | Ceiling Tiles | Fiberglass, gypsum, clay tiles |
| | Other Uncategorized | Other non-divertible materials |
| | Other Inorganic Fines | Other fine, unsortable materials |
| | Other C&D | Construction & Demolition debris |
| | Medical Waste | Needles, contaminated bandages |
| | Furniture | Couches, desks, chairs, bookshelves |
| | Mattresses | Bed mattresses, cushions |

# III. RESULTS

This report provides the waste assessment as follows:

I. County based results and assessments
II. Waste stream specific results and assessments by the project sub-awardee SCS Engineers. This report is provided in Attachment 1.

The Center for Eco Technology (CET) conducted a comparative analysis of two municipal waste characterization studies namely Natural Resources Defense Council (NRDC) and Westchester County study to contextualize this project. The CET study also provided recommendations for achieving food waste reduction and diversion from the commercial sectors. The CET report is provided in Attachment 2.

Additionally, New Jersey Corporation for Advanced Technologies (NJCAT) provided a report on MSW Waste streams separation & processing technologies. The report is provided in Attachment 3.

## III. 1. COUNTY–BASED RESULTS

### BURLINGTON COUNTY:

Burlington County has geographically the largest land area of New Jersey's 21 counties with boundaries that touch the Delaware River to the west and the Atlantic Ocean to the east. It is 820 square miles with a population of approximately 448,600 people, or 550 people per square mile. There are 40 municipalities located within the County that contain a wide mix of rural, suburban and urban regions. With the authority and responsibility given to it by the state, Burlington County also developed its District Solid Waste Management Plan. The solid waste generated in Burlington County is transported to the Burlington County Resource Recovery Complex in Florence and Mansfield Townships in northern Burlington County. The complex is the designated site for all solid waste processing and disposal activities undertaken by the County pursuant to the directives of the New Jersey Solid Waste Management Act. After the necessary sorting, the waste is disposed of at the landfill. Our study has been the first waste characterization study performed in the County.

We performed four seasonal waste characterization studies for Burlington County. We assessed two separate waste streams as residential and commercial waste streams. As mentioned in section II, during the seasonal waste audits, we noticed that there are recyclable, and compostable components in the waste streams. Furthermore, we also noticed other divertible and non-divertible components.

Burlington County's residential and commercial waste stream compositions represent variations based on where the waste is generated. Tables 2 & 3. Summarize commercial and residential waste compositions by generation location. Additionally, Burlington County's seasonal waste stream data is provided in the appendix.1.

Table 2. Burlington County Commercial Waste by Location

| Material Type | | Rural (%) | Suburban (%) | Urban (%) |
|---|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 0.7% | 0.7% |
| | Corrugated Cardboard | 4.6% | 4.7% | 2.6% |
| | White Office Paper | 1.7% | 2.3% | 2.6% |
| | Box Board | 3.4% | 2.7% | 2.2% |
| | Magazines | 0.7% | 0.5% | 0.8% |
| | Other Paper | 4.1% | 5.8% | 5.0% |
| | PET Containers | 1.9% | 2.0% | 2.7% |
| | HDPE Containers | 1.3% | 1.0% | 1.3% |
| | Aluminum Cans | 0.3% | 0.4% | 0.3% |
| | Steel Cans | 0.2% | 0.8% | 0.3% |
| | Other Ferrous | 0.8% | 0.6% | 0.5% |
| | Other Non-Ferrous | 0.2% | 0.3% | <0.1% |
| | Glass Containers | 1.2% | 1.1% | 2.4% |
| Compostable | Compostable Paper | 8.7% | 10.9% | 11.1% |
| | Food Waste | 18.8% | 21.6% | 25.7% |
| | Leaves | 0.9% | 1.1% | 0.8% |
| | Grass | 1.1% | 1.0% | 0.7% |
| | Brush | 0.5% | 2.9% | 0.4% |
| Other Divertibles | Textiles | 2.3% | 1.1% | 2.9% |
| | Rubber | 2.2% | 0.3% | <0.1% |
| | Leather | <0.1% | <0.1% | <0.1% |
| | Particle Board | 0.2% | <0.1% | 0.5% |
| | Plywood | <0.1% | <0.1% | 0.3% |
| | Batteries | <0.1% | <0.1% | <0.1% |
| | Paints | 0.4% | 0.4% | 0.2% |
| | Pallets | 2.5% | <0.1% | <0.1% |
| | Tree Parts | <0.1% | 0.3% | <0.1% |
| | Other Wood | 3.9% | 2.3% | 1.7% |
| | Soil/Ash | 1.4% | 0.8% | 1.7% |
| | Electronic Waste | 1.6% | 0.4% | 1.0% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | <0.1% |
| Non-Divertible | #3, 4 and 5 Containers | 0.6% | 0.4% | 0.7% |
| | Plastic Films | 9.8% | 9.4% | 11.5% |
| | Polystrene (#6) | 2.3% | 2.0% | 1.9% |
| | Rigid Plastic | 3.3% | 3.4% | 2.5% |

| | | | | |
|---|---|---|---|---|
| | Other Plastic | 0.2% | <0.1% | <0.1% |
| | Fines | 1.6% | 2.1% | 2.1% |
| | Aerosol Containers | 0.1% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | 0.5% |
| | Drywall/Gypsum Board | 1.0% | 0.2% | 0.5% |
| | Ceiling Tiles | 0.6% | <0.1% | 0.4% |
| | Other Uncategorized | 7.4% | 6.7% | 7.5% |
| | Other Inorganic Fines | 0.1% | 0.9% | <0.1% |
| | Other C&D | 3.7% | 5.4% | 2.8% |
| | Medical Waste | <0.1% | 0.6% | 0.7% |
| | Furniture | 1.1% | 2.8% | 1.4% |
| | Mattresses | 2.6% | <0.1% | <0.1% |

**Composition based on 18 samples.**

Table 3. Burlington County Residential Waste by Location

| Material Type | | Rural (%) | Suburban (%) | Urban (%) |
|---|---|---|---|---|
| Recyclable | Newspaper | 0.8% | 0.7% | 1.2% |
| | Corrugated Cardboard | 2.0% | 2.0% | 4.9% |
| | White Office Paper | 1.4% | 0.8% | 1.2% |
| | Box Board | 2.0% | 1.9% | 2.0% |
| | Magazines | 0.9% | 1.1% | 0.6% |
| | Other Paper | 3.2% | 4.2% | 3.8% |
| | PET Containers | 1.9% | 1.0% | 2.1% |
| | HDPE Containers | 1.0% | 1.0% | 1.4% |
| | Aluminum Cans | 0.4% | 0.2% | 0.6% |
| | Steel Cans | 0.5% | <0.1% | 0.7% |
| | Other Ferrous | 1.3% | 1.7% | 0.9% |
| | Other Non-Ferrous | 0.5% | 0.4% | 0.1% |
| | Glass Containers | 2.2% | 1.1% | 2.0% |
| Compostable | Compostable Paper | 9.7% | 8.0% | 9.5% |
| | Food Waste | 18.8% | 13.4% | 17.9% |
| | Leaves | 6.6% | 1.3% | 0.7% |
| | Grass | 5.0% | 1.1% | 1.1% |

| | | | | |
|---|---|---|---|---|
| | Brush | 1.6% | 0.5% | 1.3% |
| Other Divertibles | Textiles | 4.2% | 6.4% | 9.7% |
| | Rubber | 0.4% | 1.1% | <0.1% |
| | Leather | <0.1% | <0.1% | 0.4% |
| | Particle Board | <0.1% | 0.6% | 1.5% |
| | Plywood | 0.8% | 0.3% | 0.3% |
| | Batteries | <0.1% | <0.1% | <0.1% |
| | Paints | 0.3% | <0.1% | <0.1% |
| | Pallets | <0.1% | 0.5% | 1.8% |
| | Tree Parts | <0.1% | <0.1% | <0.1% |
| | Other Wood | 2.0% | 5.2% | 2.7% |
| | Soil/Ash | 1.3% | 1.0% | 1.0% |
| | Electronic Waste | 1.6% | 1.5% | 1.2% |
| | Solvents/Corrosive/Flammable | 0.2% | 0.1% | <0.1% |
| Non-Divertible | #3, 4 and 5 Containers | 0.9% | 0.5% | 0.8% |
| | Plastic Films | 9.6% | 7.8% | 8.9% |
| | Polystrene (#6) | 2.5% | 1.6% | 2.3% |
| | Rigid Plastic | 2.2% | 4.4% | 2.9% |
| | Other Plastic | <0.1% | 0.3% | <0.1% |
| | Fines | 2.7% | 1.8% | 2.0% |
| | Aerosol Containers | 0.1% | 0.2% | <0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | 0.9% | 0.2% |
| | Drywall/Gypsum Board | 0.6% | 4.0% | 0.8% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% |
| | Other Uncategorized | 7.6% | 7.9% | 6.7% |
| | Other Inorganic Fines | <0.1% | 0.4% | 1.0% |
| | Other C&D | 0.8% | 6.3% | 2.8% |
| | Medical Waste | <0.1% | <0.1% | <0.1% |
| | Furniture | 2.6% | 5.8% | 0.7% |
| | Mattresses | <0.1% | 0.9% | <0.1% |

**Composition based on 18 samples.**

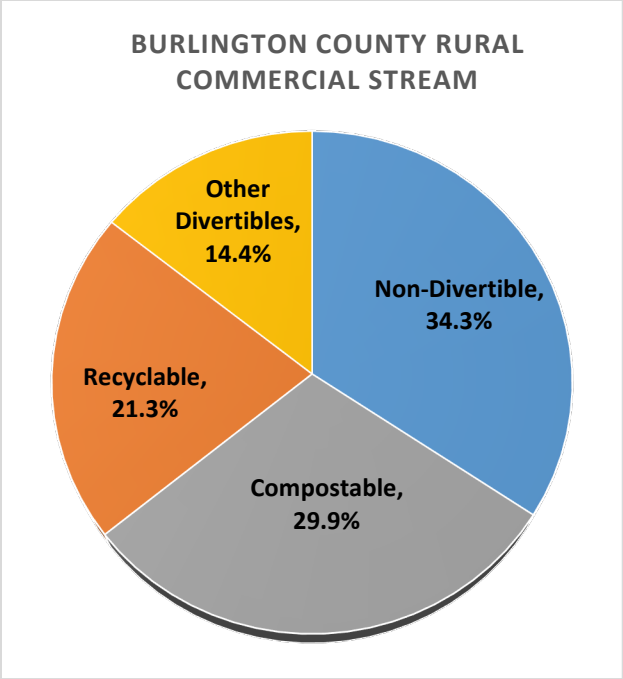


Figure 3. Burlington County Rural Commercial Waste Stream Components

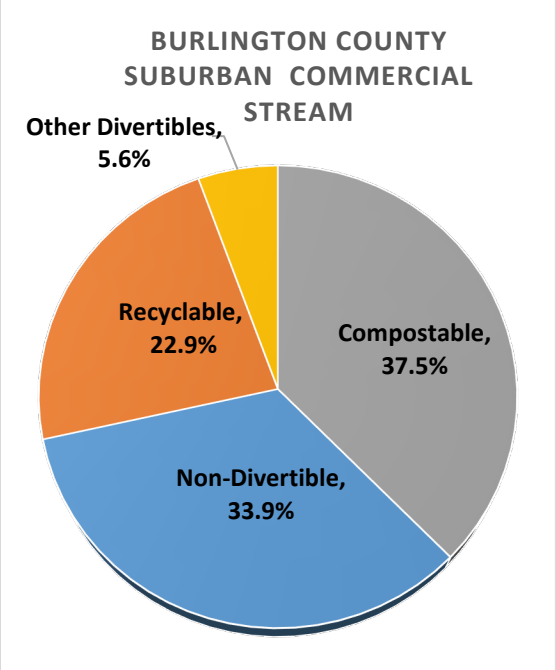


Figure 4. Burlington County SuburbanCommercial Waste Stream Components

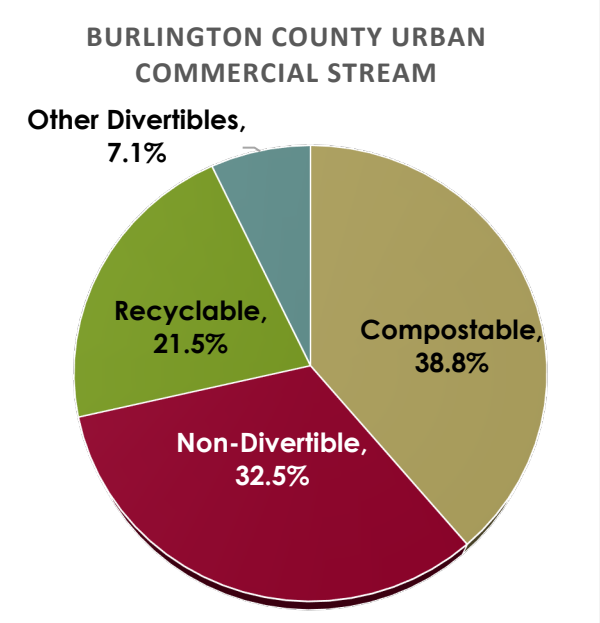


Figure 5. Burlington County Urban Commercial Waste Stream Components

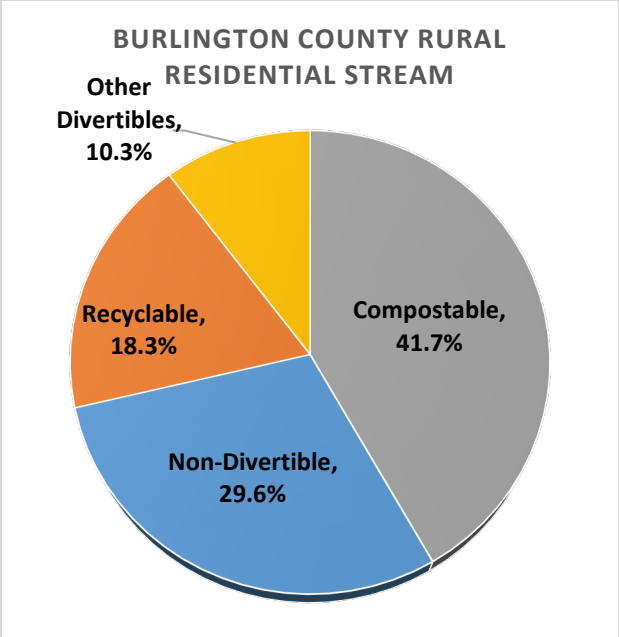


Figure 6. Burlington County Rural Residential Waste Stream Components

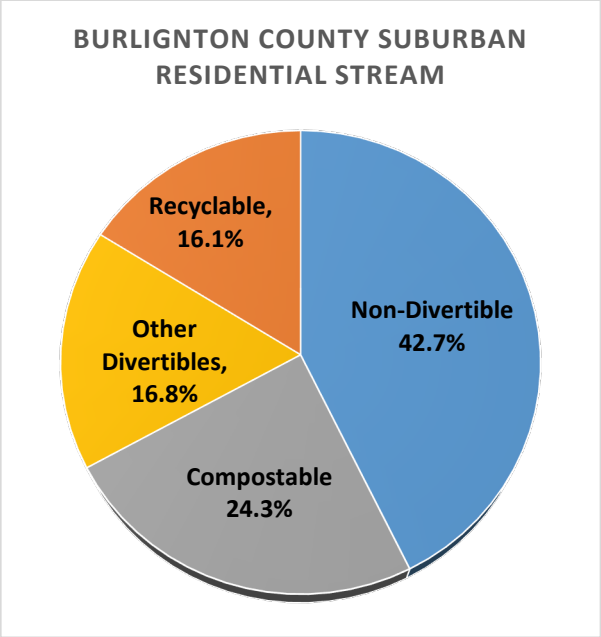


Figure 7. Burlington County Suburban Residential Waste Stream Components

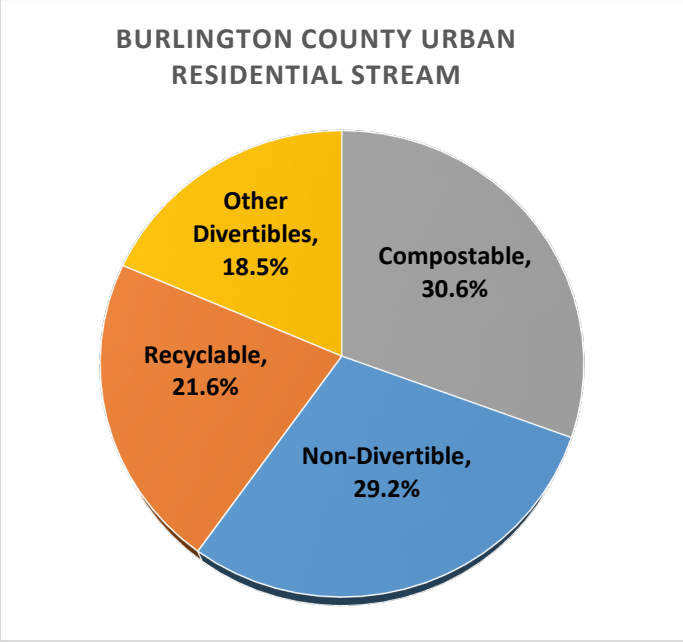


Figure 8. Burlington County Urban Residential Waste Stream Components

Burlington County's yearly average assessment of the commercial waste stream components revealed that compostable part of the waste was the lowest in the rural commercial stream (Figure 3, 4 and 5). Compostable components in commercial streams showed an increasing trend for the suburban and urban streams. The difference in commercial compostable results can be attributed to the rural commercial facilities are potentially more efficiently recycling organics, such as food waste. In contrast to compostable compounds, other-divertible components showed the highest amount in rural commercial stream. Other-divertible components appeared in suburban and urban streams at approximately half of the rural commercial stream. The Commercial waste stream showed similar trends for recyclable and non-divertible components in all rural, suburban and urban streams.

Burlington County's residential waste streams did not show a similar trend with commercial waste stream (Figures 6, 7 and 8). Interestingly, compostable components in residential streams showed higher percentages in rural and suburban streams as opposed to the urban residential stream. If we look closely into food waste quantities in the suburban waste stream residents, they are the lowest in disposal of food waste in the MSW. However, we still see relatively high levels of compostable organics ending up in the Burlington County residential and commercial waste streams. This trend is also similar with recyclables in the waste streams. Recyclable components are still found in both commercial and residential waste streams.

**MERCER COUNTY:**

Mercer County is 226 square miles and twelfth in size of the twenty-one New Jersey counties. It has a population of approximately 374,700 people, or 1,640 people per square mile (three times that of Burlington County). About 5.9 million people live within twenty-five miles of Mercer County and approximately one-tenth of the population of the United States lives within a seventy-five mile radius of the County. Mercer County consists of twelve municipalities, including Trenton, which serves as both State Capital and County seat. Mercer County's ID# 10 MSW is controlled by Mercer County Improvement Authority.

We performed two seasonal waste characterization studies for Mercer County. We assessed two separate waste streams as residential and commercial waste streams from its urban and suburban locations. We noticed that there are potentially recyclable, and compostable components in the waste streams and therefore we grouped waste types as recyclable, compostable, other- divertible and non-divertible categories.

Mercer County's residential and commercial waste stream compositions represent variations based on where the waste was generated. Tables 4 & 5 summarize commercial and residential waste compositions collected from the suburban and urban locations. Additionally, Mercer County's seasonal waste stream data is provided in the Appendix. 2.

Table 4. Mercer County Commercial Waste by Location

| | Material Type | Suburban | Urban |
|---|---|---|---|
| Recyclable | Newspaper | 1.1% | 0.9% |
| | Corrugated Cardboard | 5.1% | 12.5% |
| | White Office Paper | 1.4% | 2.2% |
| | Box Board | 2.6% | 1.6% |
| | Magazines | 0.5% | 0.6% |
| | PET Containers | 1.6% | 1.0% |
| | HDPE Containers | 1.6% | 1.0% |
| | Aluminum Cans | 0.5% | 0.3% |
| | Steel Cans | 0.3% | 0.2% |
| | Other Ferrous | 0.9% | 2.5% |
| | Other Non-Ferrous | 0.3% | <0.1% |
| | Glass Containers | 2.4% | 0.9% |
| Compostables | Compostable Paper | 8.4% | 7.3% |
| | Food Waste | 20.0% | 13.6% |
| | Leaves | <0.1% | <0.1% |
| | Grass | 2.6% | 1.0% |
| | Brush | 0.5% | 0.5% |
| | Soil/Ash | 1.1% | 0.6% |
| Other Diverti bles | Cloth | 3.7% | 2.0% |
| | Rubber | 0.6% | 0.9% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | 0.3% | 0.8% |
| | Plywood | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% |
| | Paints | 0.3% | <0.1% |
| | Pallets | <0.1% | 4.3% |
| | Tree Parts | 1.0% | 0.1% |
| | Other Wood | 3.2% | 5.6% |
| | Electronic Waste | 0.8% | 1.7% |
| | Solvents/Corrosive/Flammable | <0.1 | <0.1 |
| Non- | Other Paper (receipts) | 2.1% | 1.4% |
| | #3, 4 and 5 Containers | 0.7% | 0.6% |

| | | | |
|---|---|---|---|
| | Plastic Films | 9.9% | 9.3% |
| | Polystrene (#6) | 2.1% | 3.5% |
| | Rigid Plastic | 3.2% | 2.7% |
| | Other Plastic | 0.3% | 0.2% |
| | Fines | 3.0% | 2.0% |
| | Aerosol Containers | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | 0.8% |
| | Drywall/Gypsum Board | 1.6% | 2.3% |
| | Ceiling Tiles | <0.1% | <0.1% |
| | Other Uncategorized | 8.5% | 4.6% |
| | Other Inorganic Fines | 1.4% | <0.1% |
| | Other C&D | 3.6% | 6.2% |
| | Medical Waste | 1.9% | <0.1% |
| | Furniture | 0.7% | 3.1% |
| | Mattresses | <0.1% | 0.9% |

Table 5. Mercer County Residential Waste by Location

| Material Type | | Suburban | Urban |
|---|---|---|---|
| Recyclable | Newspaper | 1.0% | 0.9% |
| | Corrugated Cardboard | 3.8% | 3.8% |
| | White Office Paper | 1.2% | 1.3% |
| | Box Board | 3.2% | 3.0% |
| | Magazines | 1.3% | 1.0% |
| | PET Containers | 1.9% | 3.3% |
| | HDPE Containers | 1.6% | 0.9% |
| | Aluminum Cans | 0.7% | 0.9% |
| | Steel Cans | 0.3% | 0.4% |
| | Other Ferrous | 0.9% | 0.8% |
| | Other Non-Ferrous | 1.1% | 0.2% |
| | Glass Containers | 2.5% | 3.1% |
| Co m | Compostable Paper | 8.7% | 6.8% |

| | | | |
|---|---|---|---|
| | Food Waste | 19.5% | 19.8% |
| | Leaves | 0.8% | 1.4% |
| | Grass | 5.3% | 4.1% |
| | Brush | 0.6% | 1.2% |
| | Soil/Ash | 1.8% | 1.2% |
| Other Divertibles | Cloth | 3.8% | 5.9% |
| | Rubber | 0.1% | 0.1% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% |
| | Plywood | 0.3% | <0.1% |
| | Batteries | <0.1% | <0.1% |
| | Paints | 0.5% | 0.7% |
| | Pallets | <0.1% | 0.7% |
| | Tree Parts | <0.1% | <0.1% |
| | Other Wood | 3.6% | 3.5% |
| | Electronic Waste | 2.0% | 1.9% |
| | Solvents/Corrosive/Flammable | 0.2% | <0.1 |
| Non-Divertible | Other Paper (receipts) | 3.2% | 2.3% |
| | #3, 4 and 5 Containers | 0.9% | 0.6% |
| | Plastic Films | 10.7% | 9.6% |
| | Polystrene (#6) | 1.9% | 2.1% |
| | Rigid Plastic | 2.2% | 2.4% |
| | Other Plastic | <0.1% | 0.5% |
| | Fines | 2.5% | 3.0% |
| | Aerosol Containers | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | 0.7% |
| | Drywall/Gypsum Board | 0.9% | 0.7% |
| | Ceiling Tiles | <0.1% | 0.3% |
| | Other Uncategorized | 8.0% | 6.0% |
| | Other Inorganic Fines | 0.7% | 0.3% |
| | Other C&D | 1.1% | 2.5% |
| | Medical Waste | <0.1% | <0.1% |
| | Furniture | 1.2% | 2.0% |
| | Mattresses | <0.1% | <0.1% |

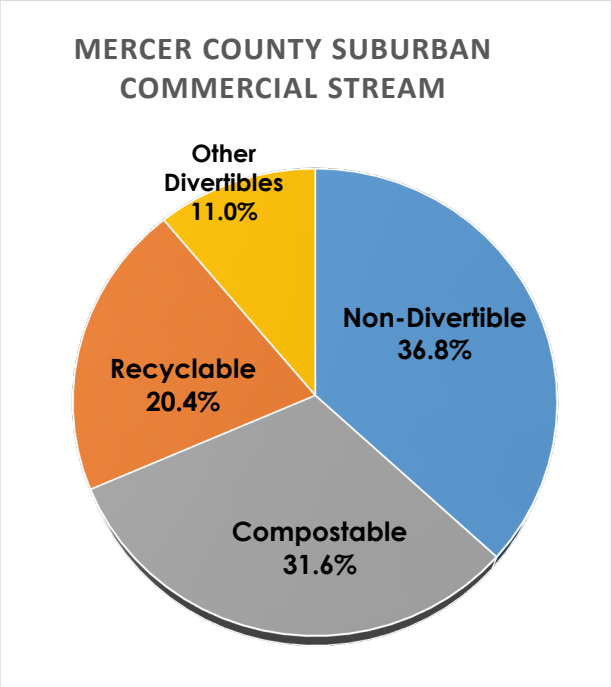


Figure 9. Mercer County Suburban Commercial Waste Stream Components

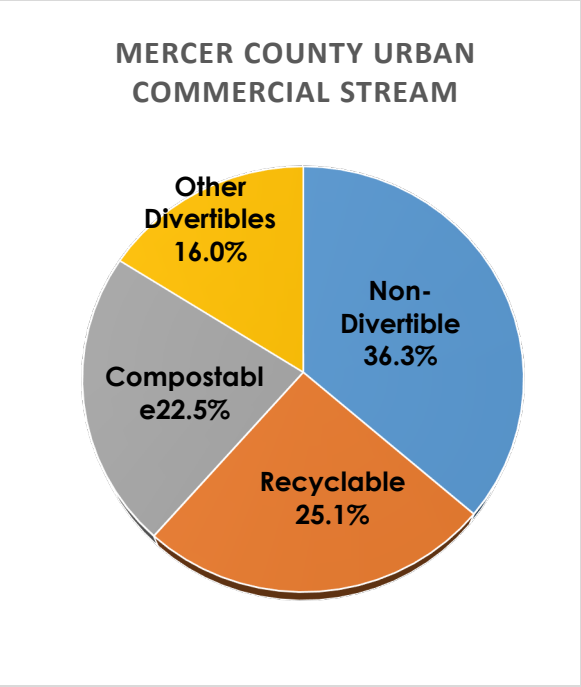


Figure 10. Mercer County Urban Commercial Waste Stream Components

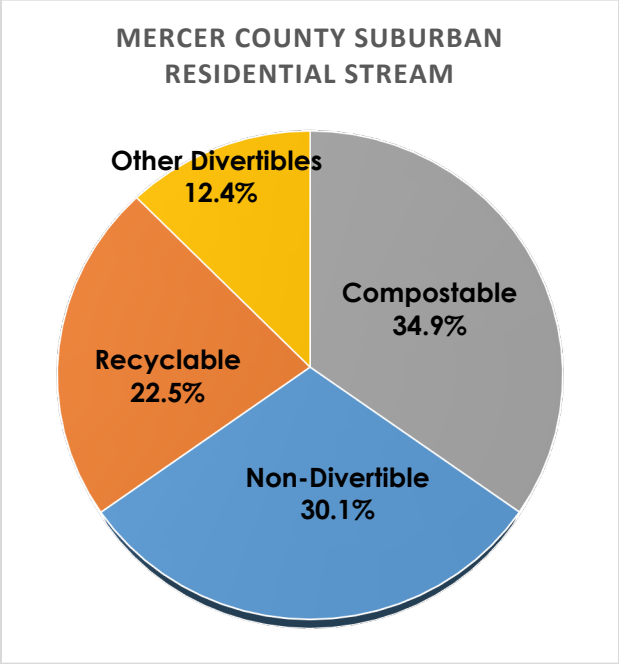


Figure 11. Mercer County Suburban Residential Waste Stream Components

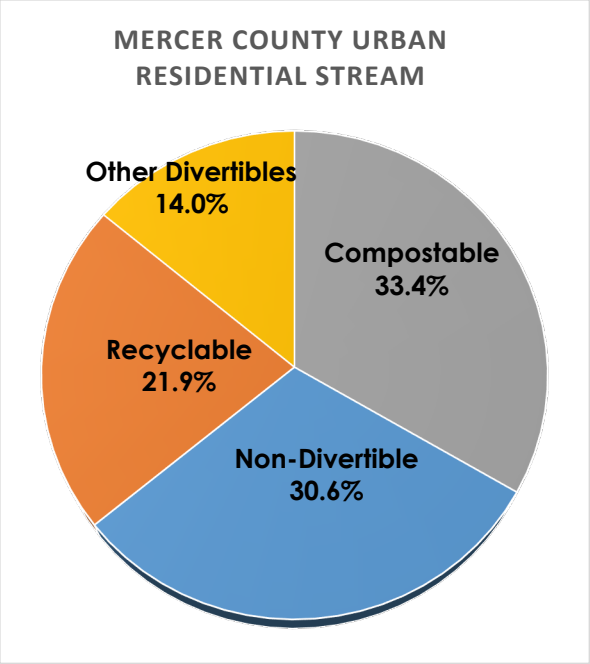


Figure 12. Mercer County Urban Residential Waste Stream Components

Mercer County's commercial waste stream (Tables 4 & 5 and Figures 9 & 10) assessments revealed that suburban commercial facilities dispose 35% more compostable waste than urban commercial facilities. This could be attributed to the larger number of farmers markets in suburban areas that potentially generate more compostable food waste, or other geographic land use factors. In contrast to the compostable fraction, urban commercial facilities dispose 45% more of the other-divertible category waste than suburban commercial facilities. This increase can be especially related to urban commercial facilities disposal, on average, of more pallets and electronic waste than their suburban counterparts. Similarly, urban commercial facilities dispose approximately 23% more recyclables than suburban commercial facilities. A high percentage of the corrugated-cardboard component in the waste streams can easily be diverted by curbside recycling collection. Mercer County's non-divertible components of urban and suburban commercial streams are comparable.

Mercer County's urban and suburban residential waste streams (Figures 11 and 12) show that the components' percentages are comparable. For both the suburban and urban streams assessments, the study revealed that compostable and non-divertible components comprise the largest proportion of the waste streams. This may be attributed to the majority of urban and suburban residents in Mercer County having similar social and economic conditions.

### *Contamination Assessment in Single Stream Recycling Program in Mercer County:*

In the US, single stream recycling has been practiced in many states and jurisdictions for the last 10-15 years. Undeniably, single stream recycling increased the quantity of recycled materials, but reduced the quality of the separated materials, resulting in a contaminated supply and reduced economic viability of recycling operations. It is estimated that the residue amount at the Material Recovery Facilities (MRFs) is approximately 10-15% higher if it is receiving single streamed waste as compared to MRFs receiving source separated recycled waste. Cross contamination of waste streams, such as plastics contamination with paper waste, or vice versa, and plastic waste contamination in food waste, negatively affects efficient reutilization practices. The cross contamination of recycled materials affects their market penetration and value which is highly dependent on the materials physical and chemical characteristics. Therefore, NJDEP granted our project permission to assess the contamination levels in Mercer County's recycling streams. We chose the City of Princeton as a pilot assessment area and performed summer and winter contamination assessments.

Princeton covers an area of 18.1 square miles in the heart of central New Jersey. It is composed of the former Township of Princeton and Borough of Princeton, which consolidated as Princeton. The population of Princeton is approximately 30,000. A substantial portion of the property of Princeton University lies within the borders of the Township of Princeton. Princeton is one of the first communities in New Jersey to practice volunteer food waste recycling. Princeton has a curbside single-stream recycling pickup program. While conducting the study at the Mercer County Improvement Authority's Transfer Station, the team collected 18 recycling samples to characterize for each assessment(Table 6).

Table 7 summarizes the recycling streams and their compositions for summer and winter seasons and yearly average. We found that summer contamination is approximately 6% and winter contamination is approximately 2.7% averaging yearly contamination approximately 4.5%. Our Assessment revealed that the City of Princeton's contamination levels, both seasonal and yearly average, in the recycled waste stream are considerably low as compared to other cities. Such as, Lowell, MA contamination level is reported as 16% with single-stream recycling.

Table 6. Materials Grouping for Recycling Contamination Assessment

| Material Category | Material Group |
|---|---|
| Newspaper | **Recyclable Paper** |
| Corrugated Cardboard | |
| White Office Paper | |
| Magazines | |
| Other Paper (receipts) | |
| Pet Containers | **Recyclable Plastic** |
| HDPE Containers | |
| #3,4, 5 Containers | |
| Glass | **Glass Containers** |
| Aluminum Cans | **Recyclable Metal** |
| Steel Cans | |
| Other Ferrous | |
| Other Non-Ferrous | |
| Plastic Films | **Other Contamination** |
| Compostable Paper | |
| Rigid Plastics | |
| Fines | |
| Textiles | |
| Other Uncategorized | |
| Polystyrene (#6) | |
| Other Inorganic Fines | |
| Food Waste | |
| Electronic waste | |
| Aerosol Containers | |

Table 7. City of Princeton's Seasonal Recycling Stream Compositions

| Material Group | Summer Composition | Winter Composition | Overall Composition |
|---|---|---|---|
| Recyclable Paper | 67.96% | 67.70% | 67.8% |
| Recyclable Plastic | 7.50% | 8.2% | 7.8% |
| Glass Containers | 16.12% | 17.3% | 16.7% |
| Recyclable Metal | 2.14% | 4.1% | 3.1% |
| **Other Contamination** | **6.29%** | **2.7%** | **4.5%** |
| **TOTAL** | **100.0%** | **100.0%** | **100.0%** |

Table 8. Princeton Recyclable Materials and Contamination Levels

| Material Category | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|
| Recyclable Paper | 67.8% | 9.0% | 64.3% | 71.3% |
| Recyclable Plastic | 7.8% | 3.1% | 6.7% | 9.0% |
| Glass Containers | 16.7% | 6.2% | 14.3% | 19.1% |
| Recyclable Metal | 3.1% | 1.4% | 2.6% | 3.7% |
| **Other Contamination** | **4.5%** | **5.3%** | **2.5%** | **6.6%** |
| **TOTAL** | **100.0%** | **100.0%** | **100%** | **100%** |

Princeton's contamination levels (Table 8) are comparable to city of Cambridge , MA which recently reported recycling contamination levels at 4%. [3] However, another study carried out for the city of New York revealed, with source separated recycling, a 19.5 percent contamination rate in residential curbside recycling for collection of metals, glass, and plastics, and an 8.9 percent contamination rate for paper collection (appendix 1)(Table 9).

Table 9. New York City Residential Recycling Contamination

| Residential Curbside Metal, Glass, and Plastics Recycling Collections Contamination | Residential Curbside Paper Recycling Collections Contamination |
|---|---|
| 19.5% | 8.9% |

Compared to the results from the sampling of Princeton's residential recycling program, both of these percentages are larger than the total contamination rate of Princeton's 4.5 percent. The City of Princeton residents are paying additional attention to environmental matters, since the township shared sufficient educational materials with the residents. Princeton is one of the first cities in New Jersey where the citizens volunteered to recycle food waste. In NYC, the curbside recycling collection is not single-stream, but the results indicate an overall higher contamination rate in the NYC urban residential recycling stream. The cities of New York, NY and Lowell, MA (3) are high population density cities.

These results indicate that the reduction of contamination in recycling streams is very much related to informed residents doing a better job of sorting. This emphasizes the importance of outreach and education that towns, cities and recycling companies provide for recycling.

**PASSAIC COUNTY:**

Passaic County borders New York State on the north and is surrounded on the other sides by Sussex, Morris, Essex and Bergen counties in New Jersey. Passaic County has 186 square miles of land area, making it the 18th in size among New Jersey's counties. On the basis of population, it ranks as the 9th most populous county

in New Jersey. The 2020 population of Passaic County was estimated by the US Census Bureau to be 524,118. Passaic County is densely populated and the majority of the county is considered to be an urban location.

We performed four seasonal waste characterization studies for Passaic County. Because the transfer of waste from Passaic County to Burlington County for the assessment required a special agreement between the Counties, we were able to assess only residential waste streams from Passaic County (Table 10).

Table 10. Passaic County Seasonal and Average Urban Residential Waste Composition

| | Material Type | Summer | Fall | Winter | Spring | Residential Average |
|---|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.1% | 0.7% | 1.9% | 0.8% | 1.1% |
| | Corrugated Cardboard | 3.5% | 9.6% | 5.3% | 4.8% | 5.8% |
| | White Office Paper | 1.4% | 1.0% | 0.8% | 1.1% | 1.1% |
| | Box Board | 2.7% | 2.4% | 1.8% | 2.5% | 2.3% |
| | Magazines | 0.5% | 0.6% | 1.0% | 0.6% | 0.7% |
| | Other Paper | 2.7% | 2.4% | 5.2% | 5.0% | 3.8% |
| | PET Containers | 2.1% | 1.5% | 1.4% | 2.5% | 1.9% |
| | HDPE Containers | 1.0% | 1.8% | 1.1% | 0.6% | 1.2% |
| | Aluminum Cans | 0.4% | 0.5% | 0.7% | 0.4% | 0.5% |
| | Steel Cans | 0.7% | 0.2% | 0.4% | 0.5% | 0.4% |
| | Other Ferrous | 1.2% | 0.6% | 0.7% | 1.3% | 1.0% |
| | Other Non-Ferrous | 0.2% | 0.3% | 1.1% | 0.4% | 0.5% |
| | Glass Containers | 2.3% | 1.6% | 2.6% | 2.3% | 2.2% |
| Compostable | Compostable Paper | 8.9% | 9.7% | 9.8% | 8.6% | 9.2% |
| | Food Waste | 16.6% | 17.6% | 21.6% | 21.2% | 19.3% |
| | Leaves | 0.6% | 4.2% | <0.1% | 1.6% | 1.6% |
| | Grass | 3.7% | 0.6% | <0.1% | <0.1% | 1.1% |
| | Brush | 0.5% | 0.7% | 0.3% | 2.2% | 0.9% |
| Other Divertibles | Textiles | 6.7% | 6.3% | 5.4% | 4.0% | 5.6% |
| | Rubber | <0.1% | <0.1% | <0.1% | 0.4% | <0.1% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | 1.9% | 0.4% | <0.1% | 0.8% | 0.8% |
| | Plywood | <0.1% | 0.5% | <0.1% | <0.1% | 0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.8% | <0.1% | 0.2% | 0.7% | 0.4% |
| | Pallets | 0.9% | <0.1% | <0.1% | <0.1% | 0.2% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Other Wood | 4.6% | 4.5% | 2.5% | 5.0% | 4.2% |
| | Soil/Ash | 1.6% | 1.0% | 1.2% | 1.1% | 1.2% |
| | Electronic Waste | 0.7% | 0.8% | 1.2% | 1.0% | 0.9% |
| | Solvents/Corrosive/Flammable | <0.1% | 0.6% | 0.2% | <0.1% | 0.2% |
| Non-Divertible | #3, 4 and 5 Containers | 0.5% | 0.4% | 0.6% | 0.5% | 0.5% |
| | Plastic Films | 7.8% | 12.0% | 12.1% | 9.2% | 10.3% |
| | Polystrene (#6) | 1.7% | 2.5% | 1.9% | 2.0% | 2.0% |
| | Rigid Plastic | 2.5% | 2.0% | 3.6% | 2.4% | 2.6% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Fines | 2.6% | 2.3% | 2.0% | 1.7% | 2.1% |
| | Aerosol Containers | 0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | 0.4% | <0.1% | <0.1% |
| | Drywall/Gypsum Board | <0.1% | 0.7% | 1.0% | <0.1% | 0.4% |
| | Ceiling Tiles | 0.3% | <0.1% | 0.3% | <0.1% | 0.1% |
| | Other Uncategorized | 9.7% | 6.6% | 8.4% | 9.6% | 8.6% |
| | Other Inorganic Fines | <0.1% | 0.4% | <0.1% | 0.1% | <0.1% |
| | Other C&D | 2.8% | 1.3% | 1.5% | 4.1% | 2.4% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | 3.0% | 1.6% | 1.7% | 1.0% | 1.8% |
| | Mattresses | 1.7% | <0.1% | <0.1% | <0.1% | 0.4% |

**Composition based on 36 samples.**

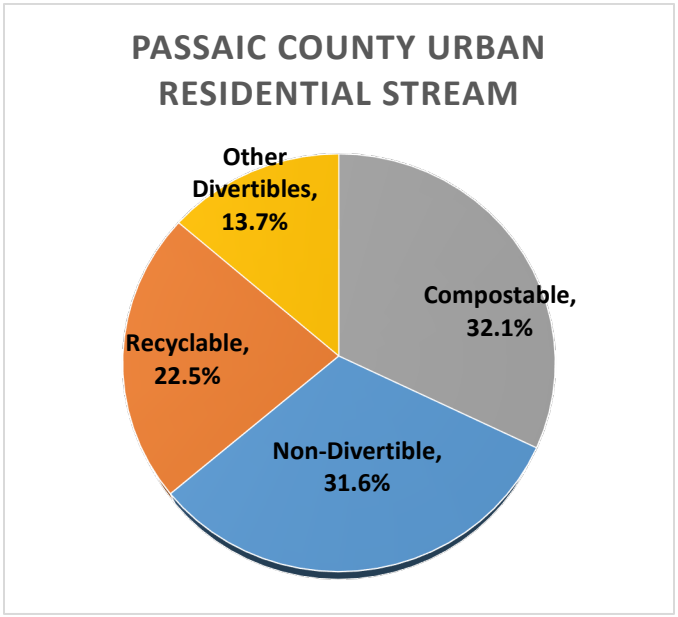


Figure 13. Passaic County Urban Residential Waste Composition

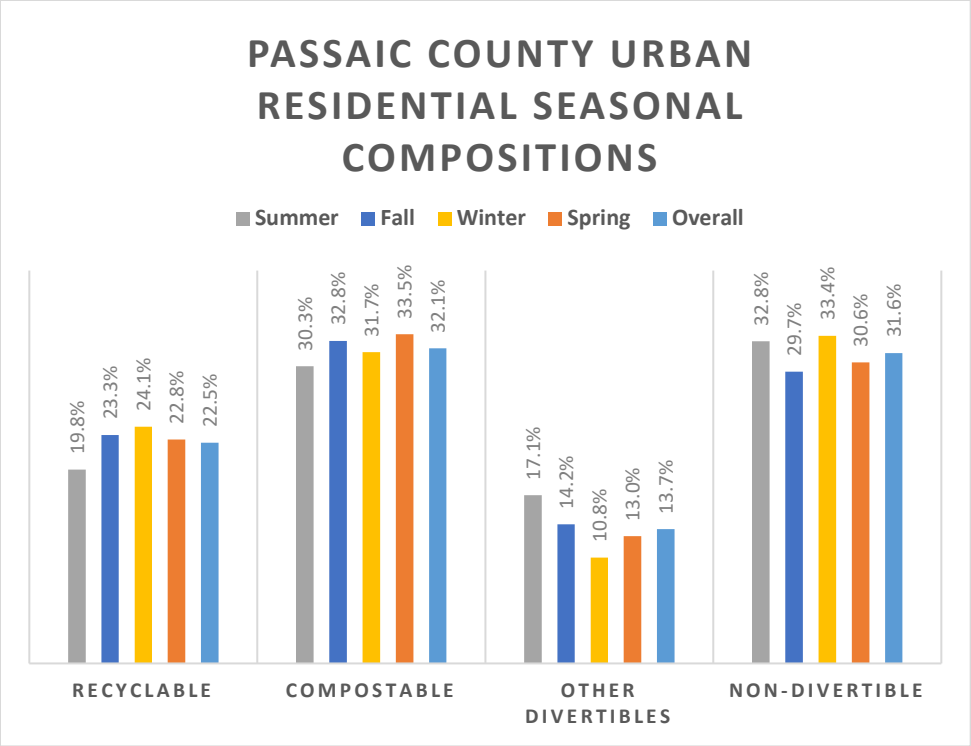


Figure 14. Passaic County Urban Residential Waste Seasonal Variations

The assessment of the seasonal changes in the Passaic County's urban residential MSW revealed that compostable components were higher in the fall, winter and spring assessments than the summer assessment. This may be attributal to food waste recycling being easier in summer season than others. We noticed that the summer season resulted in less total compostable and compostable percentages however, other divertible and non-divertible components did not show a similar trend. As a result, Passaic County's urban residential waste stream components are comparable to Burlington and Mercer County's urban residential waste streams.

## IV. CONCLUSIONS & RECOMMENDATIONS

Our yearlong waste characterization study provides detailed real-time data on three of New Jersey Countys' ID #10 MSW waste stream composition. To date, several counties performed waste characterization studies. However, methodology of characterization studies vary from study to study. Some studies utilized similar approach to our study, hand sorting and weighing [1] while some other studies utilized "proxy extrapolation" by using available proxy data (e.g. number of beds, number of students, revenue) or other estimator modeling tools[2]. This study serves as a comparison to those studies in order to compare findings. Our study is one of the most comprehensive studies performed in New Jersey so far because it characterized waste streams from three separate counties in north, central and southern New Jersey using same methodology and similar seasonal waste streams.

In this project, residential and commercial waste streams from three counties was assessed. We also proposed to assess the institutional waste streams however, obtaining waste from institutional sources only was not possible in the counties we performed our study. We were able to characterize urban, suburban and rural streams from Burlington County, urban and suburban streams from Mercer County and only urban residential streams from Passaic County, based on the demographic and geographic features of the counties. Our study provides a high-level waste characterization analysis for commercial waste streams in New Jersey. We also noticed variances between commercial and residential streams, and we believe that our data will serve as an informative tool for the State to improve waste recycling activities in New Jersey. As the CET report reiterates (Appendix 2), understanding the waste generation variances between rural, suburban and urban geographies can help inform us about how to prioritize to improve waste disposal and waste reduction initiatives, including food waste.

Our study revealed that New Jersey waste streams show similar trends overall. The largest component is food waste. The New Jersey Food Waste Recycling mandate has been in effect since October 2021. However, our study did not detect any significant food waste reduction trends in the waste streams for the Fall 2021, Winter 2022 and Spring 2022 assessments for the commercial waste streams in the two Counties we assessed. We only noticed a small reduction of food waste content in the rural commercial stream of Burlington County. The emerging infrastructure of food waste recycling facilities is still in its infancy and yet to develop to a level for efficient food waste recycling in New Jersey. The assessments of food waste content in the residential waste streams of the three counties contained approximately 17-19%. In the future, the State may consider expanding food waste recycling to residential streams after the food waste recycling infrastructure is in place to handle food waste efficiently. We also assessed the total compostable waste portion in MSW and believe that, in addition to food waste, other waste components that are compostable should end up in the organics recycling programs. Our findings revealed that New Jersey needs more food waste and organics recycling facilities in order to divert organics from landfills efficiently. This will support State's Climate Change mitigation efforts and achieve a more efficient Circular Carbon Economy. More compostables diversion from landfills will not only reduce GHG leakage into the atmosphere from landfill surfaces, it will also enable the State to recover crop nutrients and soil amendments to be used for soil remediation.

While this report is definitely one the most comprehensive and up-to-date characterization study performed in the State, we believe that more detailed studies will provide further needed information. In prior studies food waste characterization studies were performed by estimating and modeling using proxy data, we recommend that the next food waste characterization studies to be performed on site at large food waste generating commercial and institutional facilities to better understand the types and amounts of food waste being generated and separated. The future study should be performed at:

- Restaurants, catering facilities
- Food wholesalers and distributers
- Food processing facilities, and
- Grocers and large farm markets

This study determined that the State would achieve greater food waste reductions by education and outreach to the residents and businesses.

Many cities around the country have reported high levels of contamination in their recycling streams, especially after they adopted single-stream recycling. In fact, SCS Engineers reported that the city of New York with source separated recycling, also has a problem of high levels of contamination in their recycling streams. Our assessment determined that city of Princeton's recycling stream contamination levels appear to be in the low levels of approximately 4.5%. Food waste contamination is only 0.2% (Appendix 2). We believe that outreach and education should be included in recycling programs. New Jersey is one of the pioneering states in recycling practices. However, it would be beneficial to re-educate New Jersey residents of current recycling practices, especially plastics and food waste.

References:


1. "Mercer County Improvement Authority Solid Waste and Recycling Quantification and Characterization Study", 2015, T&M Associates.
2. "**Bergen County Solid Waste Composition and Generation Study 2003 to 2029"** Report, 2019, Mott MacDonald, mottmac.com.
3. Cambridge Recycling Contamination Rate Drops to Record Low of 4%. Recycle Right Campaign Efforts Save the City of Cambridge $100,000 in 2020 (cambridgema.gov)
4. Cities are still struggling to fix recycling contamination — and now, it's getting personal | Waste Dive
5.


Appendices:

1. Municipal Solid Waste Quantification and Characterization Study, Burlington,

   Mercer & Passaic County, 2022, SCS Engineers.

2. Waste Characterization Study Comparative Analysis, 2022, CET.

3. Recycling & Processing of Various Fractions of Municipal Solid Waste in Burlington, Mercer, and Union Counties in New Jersey, NJCAT.

Appendix 1 – SCS Report

# Municipal Solid Waste Quantification and Characterization Study

## Burlington, Mercer, & Passaic County

**Rutgers University**

State University of New Jersey

57 US Highway 1
New Brunswick, NJ 08901-8554

SCS ENGINEERS

02221024.00 | July 5, 2022

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# FIGURES

# TABLES

# 1 INTRODUCTION

In order to assist the State of New Jersey meet the waste reduction and recycling goals that target recycling 50 percent of the Municipal Solid Waste (MSW) Type 10 waste and 60 percent of the entire waste stream, SCS Engineers contracted with Rutgers Universtity to conduct a Waste Characterization Study.

Samples were collected from residential and commercial waste streams in Burlington, Mercer, and Passaic Counties, as highlighted in **Figure 1**. Additionally, SCS characterized the recycling stream in the Municipality of Princeton, New Jersey, which is located in Mercer County.

In 2017, New Jersey passed Bill S-3027, to reduce food waste by 50 percent by the year 2030 compared to 2017 quantities. It ambitiously emphasizes reduction at the most primary production levels all the way to the use by consumers. The Characterization Study found a large proportion of food waste in samples from each of the three counties. This data highlights the need to reduce food waste from the MSW stream in New Jersey.

Figure 1. State of New Jersey


The results in **Section 3** are summarized compositions of residential and commercial waste streams generated in urban, suburban, and rural areas. For more in-depth explorations of the sample compositions, refer to **Appendix A** and **Appendix B**.

Overall, this report aims to give the State of New Jersey reliable data on the compositions of different waste streams by geographical area and population density to better plan how they will target waste reductions in order to meet the timeline of S-3027 and general MSW reductions.

# 2 CHARACTERIZATION METHOD

Samples each weighing approximately 200 pounds were captured from residential and commercial waste streams subcategorized as either rural, suburban, or urban. Samples were collected from front-end and rear-load waste collection vehicles, and the drivers were interviewed to determine the source of the waste. The collected recycling stream samples each measured approximately one cubic yard. Field sampline was conducted over four seasons:

- Summer: August 2021 (Mercer County, Princeton Recycling, Burlington County, Passaic County)
- Fall: October 2021 (Burlington County, Passaic County)
- Winter: February 2022 (Mercer County, Princeton Recycling, Burlington County, Passaic County)
- Spring: May 2022 (Burlington County, Passaic County)

For each sample, materials were identified, sorted into bins, and weighed (**Figure 2**). Individual material weights were then converted to a respective percentage of the total sample weight. The material categories along with examples can be found in **Table 1**.

Figure 1. Manual Sorting of Materials

There were four 4-day sampling periods at the Burlington County Resource Recovery Complex and two 5-day sampling periods at the Mercer County Improvement Authorities Transfer Station. Overall, the project resulted in 234 samples:

- 108 samples of waste from rural, suburban, and urban streams in Burlington County
- 72 samples of waste from suburban and urban streams in Mercer County
- 18 samples of residential recyclables generated in Mercer County (Princeton)
- 36 samples of waste from urban residential streams in Passaic County

Table 1. Material Categories and Examples

| Material Type | | Examples |
|---|---|---|
| Recyclable | Newspaper | Newsprint, newspapers |
| | Corrugated Cardboard | Shipping or packing boxes |
| | White Office Paper | Copy paper, notebook paper, envelopes |
| | Box Board | Soda and beer cases, cereal boxes |
| | Magazines | Catalogs, subscription magazines |
| | Other Paper | Junk mail, receipts, envelopes, recyclable paper not otherwise categorized |
| | PET Containers | #1 plastic bottles, clear containers |
| | HDPE Containers | #2 opaque bottles, milk jugs |
| | Aluminum Cans | Soda cans |
| | Steel Cans | Food containers (canned soup/vegetables) |
| | Other Ferrous | Magnetic metal scrap, paint cans, clothing hangers |
| | Other Non-Ferrous | Other metal scraps (copper, brass, lead, zinc) |
| | Glass Containers | Glass bottles, containers |
| Compostable | Compostable Paper | Paper towels, napkins, tissues, food-contaminated paper |
| | Food Waste | Food scraps, liquids, packaged food |
| | Leaves | Fallen leaves, plant trimmings |
| | Grass | Lawn clippings |
| | Brush | Small woody branches, sticks, twigs, foliage |

The table continues on the next page.

| | Material Type | Examples |
|---|---|---|
| Other Divertibles | Textiles | Clothing textiles, blankets, tarps |
| | Rubber | Latex gloves, rubber bands, tires, hoses |
| | Leather | Leather textiles, shoes, wallets, belts, scraps |
| | Particle Board | Chipboard made from wood chips/sawdust |
| | Plywood | Wood scraps/C&D |
| | Batteries | Non-lithium batteries |
| | Paints | Paint cans, stains |
| | Pallets | Wood pallets, broken pallets |
| | Tree Parts | Large limbs, branches |
| | Other Wood | Wood waste not otherwise categorized |
| | Soil/Ash | Dirt, dusty debris, decomposed matter |
| | Electronic Waste | Computers, phones, power supplies |
| | Solvents/Corrosive/Flammable | Automobile fluids, gasoline, antifreeze |
| Non-Divertible | #3, 4 and 5 Containers | Plastic containers labeled #3-#5 |
| | Plastic Films | Thin plastics, grocery bags (#4,#5) |
| | Polystrene (#6) | Styrofoam packaging, solo cups/plates |
| | Rigid Plastic | Hard plastic furniture, buckets, toys |
| | Other Plastic | Plastic products not otherwise categorized |
| | Fines | Small commingled materials, straws, scraps |
| | Aerosol Containers | Hair spray, air freshener, deodorant |
| | Asphalt | Asphalt shingles, asphalt debris |
| | Masonry Materials | Bricks, clay shingles, terracotta |
| | Drywall/Gypsum Board | C&D drywall, clean or broken |
| | Ceiling Tiles | Fiberglass, gypsum, clay tiles |
| | Other Uncategorized | Other non-divertible materials |
| | Other Inorganic Fines | Other fine, unsortable materials |
| | Other C&D | Construction & Demolition debris |
| | Medical Waste | Needles, contaminated bandages |
| | Furniture | Couches, desks, chairs, bookshelves |
| | Mattresses | Bed mattresses, cushions |

# 3 OVERALL RESULTS

The results from the waste characterization study are visually presented in the following figures and tables. They give a snapshot of the composition of the samples collected over the entirety of the study. For more detailed tables with confidence limits for each material, see **Appendix A**. For tables and figures comparing compositions of the samples between seasons, see **Appendix B**.

## RESIDENTIAL WASTE STREAM

The rural, suburban, and urban residential waste stream samples show how some of the MSW stream is comprised of materials from New Jersey residences.

**Table 2** displays the top ten materials found by County and population. Food waste comprises the largest percentage from each of the sampled waste streams, with non-divertible plastic films coming second in most of the residential streams. Materials such as food waste and compostable paper are considered divertible with composting operations.

Table 2. Top 10 Material Compositions by Residential Area

| | Mercer County | | Burlington County | | | Passaic County |
|---|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban | Urban |
| Food Waste | 19.5% | 19.8% | 18.8% | 13.4% | 17.9% | 19.3% |
| Plastic Films | 10.7% | 9.6% | 9.6% | 7.8% | 8.9% | 10.3% |
| Compostable Paper | 8.7% | 6.8% | 9.7% | 8.0% | 9.5% | 9.2% |
| Other Uncategorized | 8.0% | 6.0% | 7.6% | 7.9% | 6.7% | 8.6% |
| Cloth | 3.8% | 5.9% | 4.2% | 6.4% | 9.7% | 5.6% |
| Corrugated Cardboard | 3.8% | 3.8% | 2.0% | 2.0% | 4.9% | 5.8% |
| Other Wood | 3.6% | 3.5% | 2.0% | 5.2% | 2.7% | 4.2% |
| Other Paper (receipts) | 3.2% | 2.3% | 3.2% | 4.2% | 3.8% | 3.8% |
| Grass | 5.3% | 4.1% | 5.0% | 1.1% | 1.1% | 1.1% |
| Rigid Plastic | 2.2% | 2.4% | 2.2% | 4.4% | 2.9% | 2.6% |
| **TOTAL** | **68.7%** | **64.4%** | **64.4%** | **60.4%** | **68.2%** | **70.4%** |

**Figures 3 through 8** present the residential waste compositions by County and population density according their divertibility. Refer to **Appendix A** for full composition tables.

**Figure 3** presents the composition by weight of the Mercer County suburban residential waste stream samples, while **Figure 4** presents the composition of the urban residential stream. For both streams, compostables and non-divertibles comprise the largest proportion of materials.

Figure 2. Mercer County Suburban Residential Stream

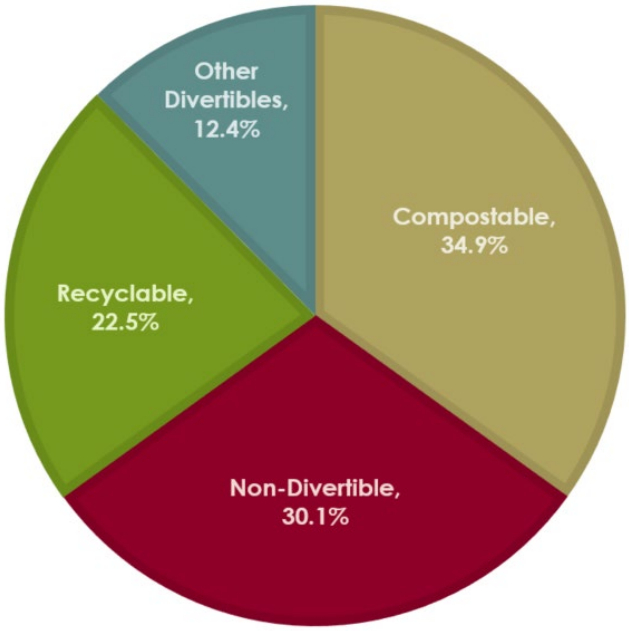
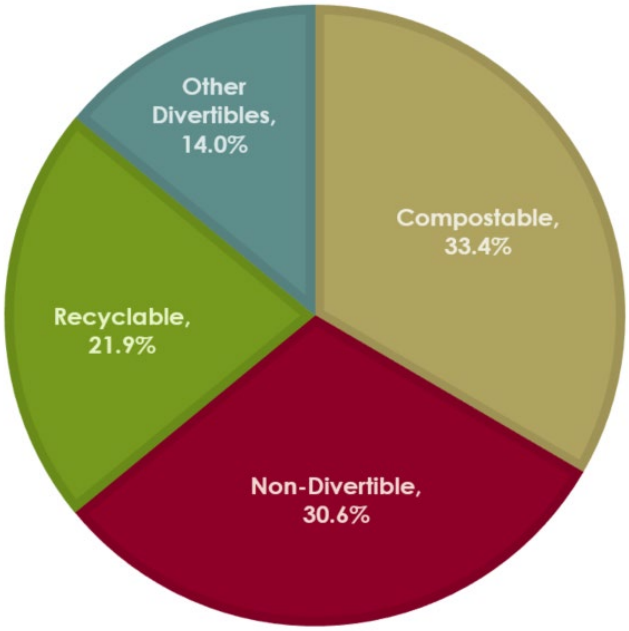



Figure 3. Mercer County Urban Residential Stream




When compared to **Figures 5 through 7**, which examine residential streams in Burlington County, urban stream samples reflect similar material compositions to the sampled Mercer County residential streams. **Figure 5** and **Figure 7** show a higher composition of compostable materials in the rural and urban residential stream samples. **Figure 6** shows a larger proportion of non-divertibles and that recyclables comprise the smallest proportion of the suburban residential stream.

**Figure 8** shows that the Passaic County residential stream is very similar to urban residential streams in Mercer County and Burlington County.

Figure 4. Burlington County Rural Residential Stream

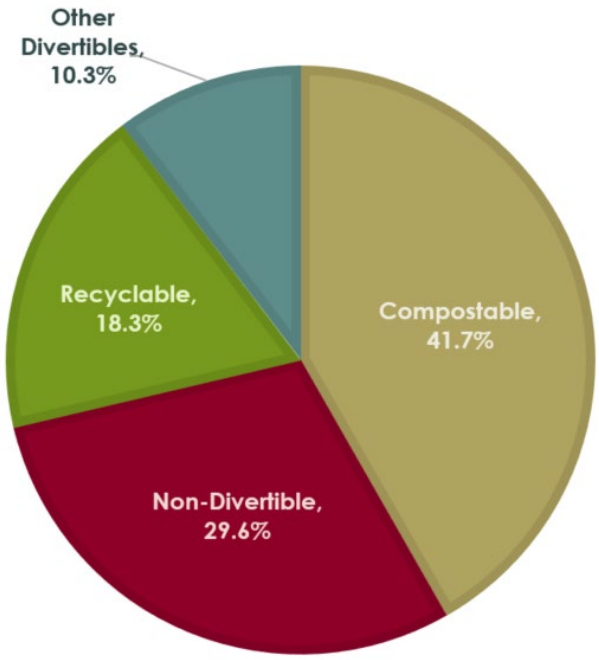



Figure 5. Burlington County Suburban Residential Stream

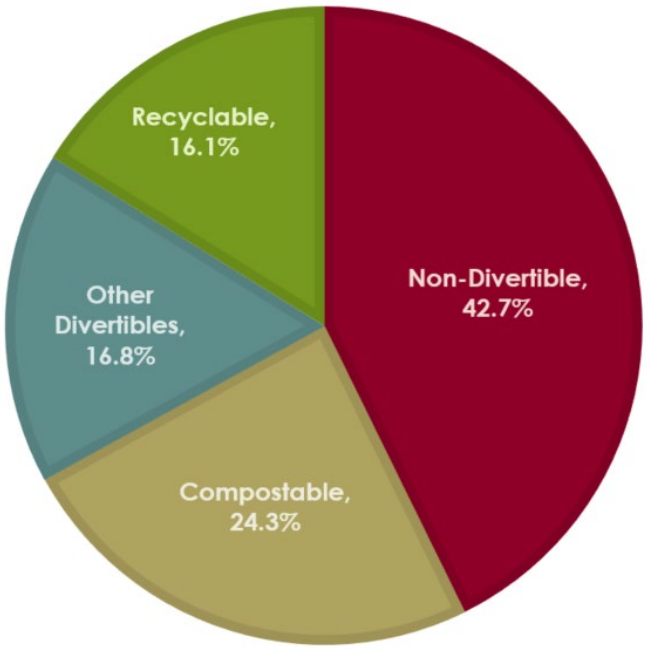



Figure 6. Burlington County Urban Residential Stream

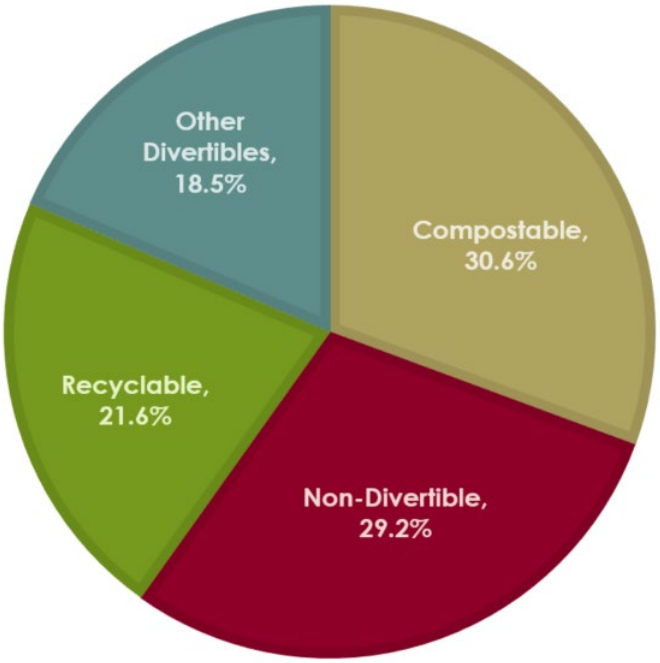



Figure 7. Passaic County Urban Residential Stream

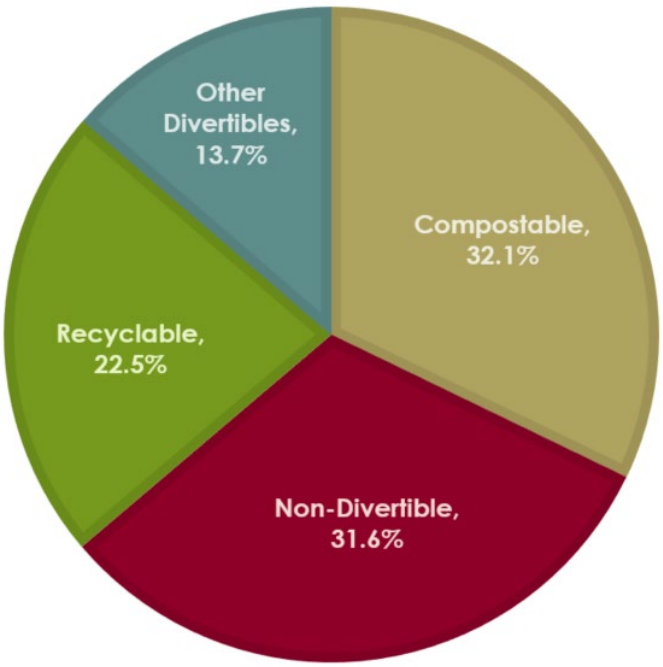


Table 3 displays the top four recyclable materials present in residential waste streams of the three studied counties. Overall, corrugated cardboard is the largest recyclable component of the streams across all three counties. It is most prevalent in the urban streams of Burlington and Passaic County. PET plastic containers appear to be more common in urban streams based on the compared samples.

Table 3. Top Four Recyclable Materials by Residential Waste Stream

| Material Type | Mercer County | | Burlington County | | | Passaic County |
|---|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban | Urban |
| Corrugated Cardboard | 3.8% | 3.8% | 2.0% | 2.0% | 4.9% | 5.8% |
| Box Board | 3.2% | 3.0% | 2.0% | 1.9% | 2.0% | 2.3% |
| Glass Containers | 2.5% | 3.1% | 2.2% | 1.1% | 2.0% | 2.2% |
| PET Containers | 1.9% | 3.3% | 1.9% | 1.0% | 2.1% | 1.9% |
| Other Recyclables | 11.2% | 8.8% | 10.1% | 10.2% | 10.6% | 10.3% |
| **TOTAL RECYCLABLES** | **22.5%** | **21.9%** | **18.3%** | **16.1%** | **21.6%** | **22.5%** |

Table 4 provides a composition comparison of top three compostable materials between residential waste streams in Mercer, Burlington, and Passaic Counties. Overall, food comprises up the largest proportion of compostable materials. Compostable paper makes up the next largest proportion of compostales in Mercer and Passaic County, but grass makes up a larger proportion in Burlington County.

Table 4. Top Three Compostable Materials by Residential Stream

| Material Type | Mercer County | | Burlington County | | | Passaic County |
|---|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban | Urban |
| Food Waste | 19.5% | 19.8% | 2.0% | 2.0% | 4.9% | 19.3% |
| Compostable Paper | 8.7% | 6.8% | 0.8% | 0.7% | 1.2% | 9.2% |
| Grass | 5.3% | 4.1% | 2.0% | 1.9% | 2.0% | 1.1% |
| Other Compostables | 1.4% | 2.6% | 36.8% | 19.7% | 22.5% | 2.5% |
| **TOTAL COMPOSTABLES** | **34.9%** | **33.4%** | **41.7%** | **24.3%** | **30.6%** | **32.1%** |

## COMMERCIAL WASTE STREAM

Commercial wastes from Mercer County and Burlington County are split into rural, suburban, and urban streams, similar to the residential streams. The following table and figures display results from the collected samples of the waste streams of various business entities in New Jersey.

Figure 8. Sorting Materials

Table 5 shows the top ten material compositions in the collected commercial stream samples based on an average across each sample. The percentages are averaged equally across the two or four seasons that samples were collected for each type of stream. While corrugated cardboard is listed fifth, it is the second-largest component of the urban commercial stream in Mercer County and can be diverted by curbside recycling collection. Similarly to the residential streams, food waste makes up the largest percentage of each commercial waste stream samples, while non-divertible plastic films make up the second-largest proportion on average.

Table 5. Top 10 Material Compositions by Commercial Area

| | Mercer County | | Burlington County | | |
|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban |
| Food Waste | 20.0% | 13.6% | 18.8% | 21.6% | 25.7% |
| Plastic Films | 9.9% | 9.3% | 9.8% | 9.4% | 11.5% |
| Compostable Paper | 8.4% | 7.3% | 8.7% | 10.9% | 11.1% |
| Other Uncategorized | 8.5% | 4.6% | 7.4% | 6.7% | 7.5% |
| Corrugated Cardboard | 5.1% | 12.5% | 4.6% | 4.7% | 2.6% |
| Other C&D | 3.6% | 6.2% | 3.7% | 5.4% | 2.8% |
| Other Paper (receipts) | 2.1% | 1.4% | 4.1% | 5.8% | 5.0% |
| Other Wood | 3.2% | 5.6% | 3.9% | 2.3% | 1.7% |
| Rigid Plastic | 3.2% | 2.7% | 3.3% | 3.4% | 2.5% |
| Box Board | 2.6% | 1.6% | 3.4% | 2.7% | 2.2% |
| **TOTAL** | **66.6%** | **64.9%** | **67.7%** | **72.8%** | **72.7%** |

**Figures 10-14** give breakdowns of the commercial waste streams based on the divertibility by material type, as seen in **Appendix A**.

**Figures 10 and 11** show the composition of the suburban and urban Mercer County commercial stream from the Summer and Winter seasonal sampling events.

Most notably, there is a considerable increase in the proportion of recyclable materials and "other divertibles," while the composition of compostables decreases in the urban stream. This could be due to a larger number of farmers markets in suburban areas that produce compostable food waste, or other geographic land use factors. For breakdowns of each stream by individual material type, see **Appendix A**.

Figure 9. Mercer County Suburban Commercial Stream

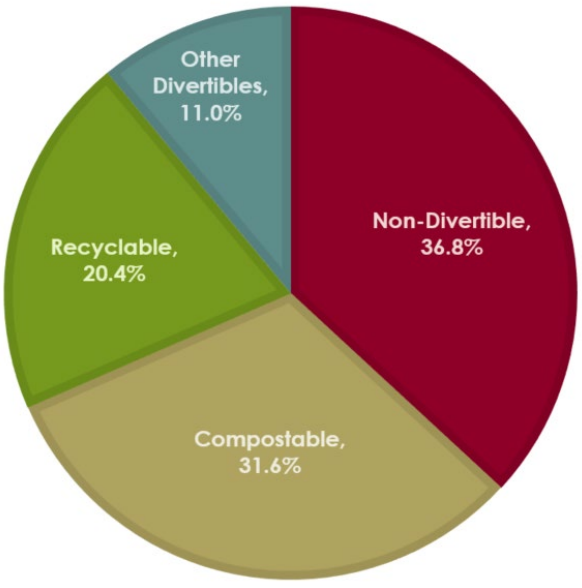
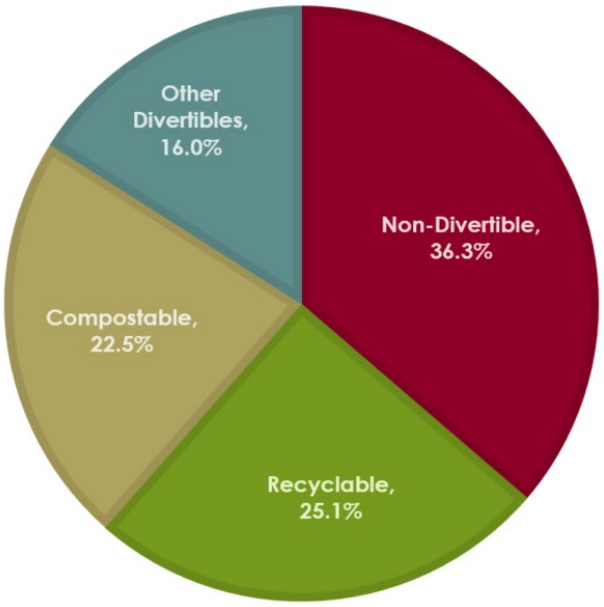



Figure 10. Mercer County Urban Commercial Stream




**Figures 12-14** show the composition of samples from rural, suburban, and urban commercial streams in Burlington County. In the three figures, compostables and non-divertibles make up the largest proportion of materials. Over 60 percent of the waste stream is divertible by composting, recycling, or other diversion programs. They are mostly consistent, with the exception being rural stream samples containing a much larger percentage of "other divertibles" (**Figure 12**).

Figure 11. Burlington County Rural Commercial Stream

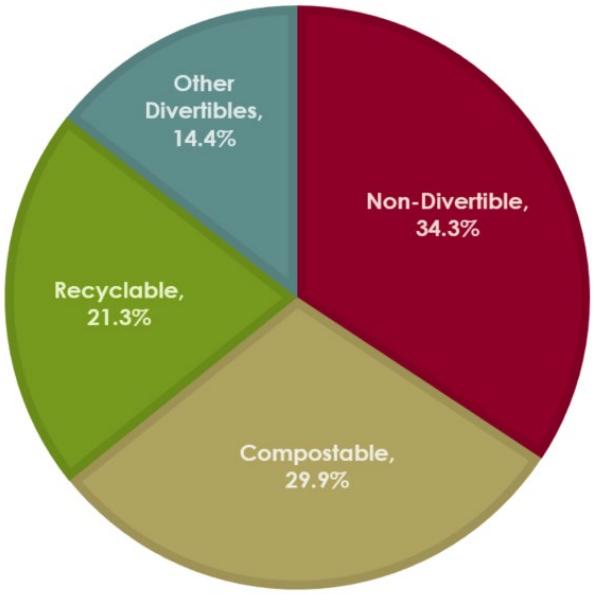



Figure 12. Burlington County Suburban Commercial Stream

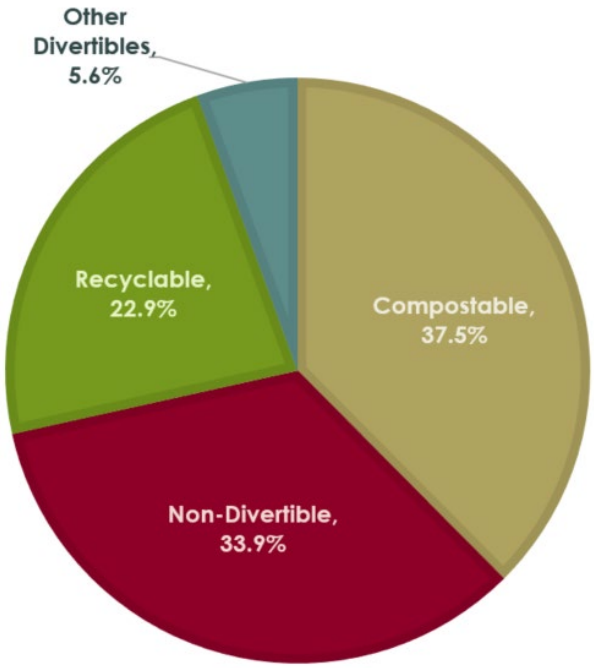



Figure 13. Burlington County Urban Commercial Stream

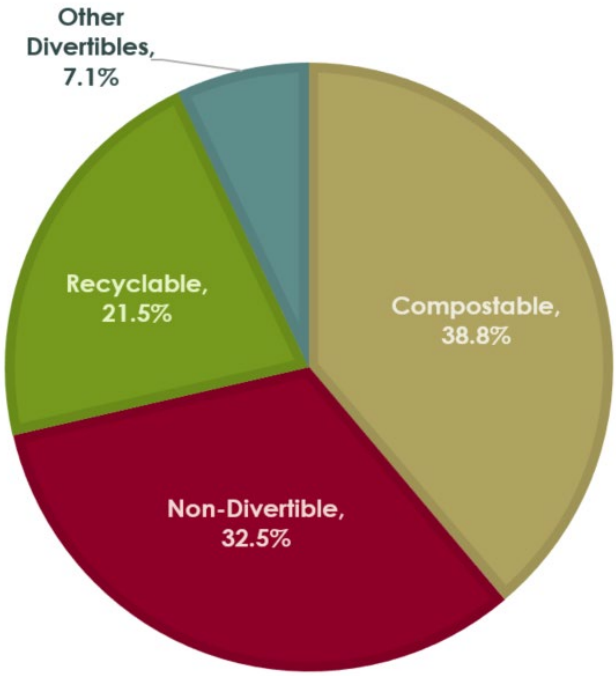


Table 6 shows the top four recyclable materials in commercial streams across the three studied counties. Corrugated cardboard is most prevalent, especially in Mercer County's sampled urban commercial waste stream, making up over 50 percent of the recyclable materials found in the samples. White office paper also appears at higher proportions in the commercial streams as opposed to residential streams in the same counties.

Table 6. Top Four Recyclable Materials by Commercial Stream

| Material Type | Mercer County | | Burlington County | | |
|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban |
| Corrugated Cardboard | 5.1% | 12.5% | 4.6% | 4.7% | 2.6% |
| Box Board | 2.6% | 1.6% | 3.4% | 2.7% | 2.2% |
| PET Containers | 1.6% | 1.0% | 1.9% | 2.0% | 2.7% |
| White Office Paper | 1.4% | 2.2% | 1.7% | 2.3% | 2.6% |
| Other Recyclables | 9.7% | 7.7% | 9.7% | 11.2% | 11.3% |
| **TOTAL RECYCLABLES** | **20.4%** | **25.1%** | **21.3%** | **22.9%** | **21.5%** |

Table 7 shows the top three compostable materials found. The rest of the compostable materials in the samples were relatively low proportions. Food waste makes up over 50 percent of compostable materials in each stream, often over 60 percent. There is a significantly lower proportion of compostable yard materials than were found in residential waste stream samples.

Table 7. Top Three Compostable Materials by Commercial Stream

| Material Type | Mercer County | | Burlington County | | |
|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban |
| Food Waste | 20.0% | 13.6% | 18.8% | 21.6% | 25.7% |
| Compostable Paper | 8.4% | 7.3% | 8.7% | 10.9% | 11.1% |
| Grass | 2.6% | 1.0% | 1.1% | 1.0% | 0.7% |
| Other Compostables | 0.6% | 0.6% | 1.3% | 4.0% | 1.2% |
| **TOTAL COMPOSTABLES** | **31.6%** | **22.5%** | **29.9%** | **37.5%** | **38.8%** |

## PRINCETON RECYCLING STREAM

The town of Princeton has a curbside recycling pickup program. While conducting the study at the Mercer County Improvement Authorities Transfer Station, the team collected 18 recycling samples to characterize. Each composition column below totals to 100 percent.

The materials presented in **Table 8** have been grouped into five categories: recyclable paper, recyclable plastic, glass containers, recyclable metal, and other contamination. The former four are accepted recyclable materials. The study was conducted to identify contamination in the recycling stream. As shown on the table, a smaller proportion of contamination was found in Winter samples.

Table 8. Princeton Recyclable Materials and Contamination by Season

| Material Category | Winter Composition | Overall Composition |
|---|---|---|
| Recyclable Paper | 67.7% | 67.8% |
| Recyclable Plastic | 8.2% | 7.8% |
| Glass Containers | 17.3% | 16.7% |
| Recyclable Metal | 4.1% | 3.1% |
| Other Contamination | 2.7% | 4.5% |
| **TOTAL** | **100.0%** | **100.0%** |

**Table 9** shows the same composition of materials in the samples averaged equally between the two seasons they were collected. Confidence limits are at the 90 percent level. Both tables show a remarkably low proportion of contamination to the other materials collected.

Table 9. Overall Princeton Recyclable Materials and Contamination

| Material Category | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|
| Recyclable Paper | 67.8% | 9.0% | 64.3% | 71.3% |
| Recyclable Plastic | 7.8% | 3.1% | 6.7% | 9.0% |
| Glass Containers | 16.7% | 6.2% | 14.3% | 19.1% |
| Recyclable Metal | 3.1% | 1.4% | 2.6% | 3.7% |
| Other Contamination | 4.5% | 5.3% | 2.5% | 6.6% |

| | | |
|---|---|---|
| **TOTAL** | **100.0%** | |

Figure 14. Non-Recyclable Materials

**Figure 15** shows examples of non-recyclable contamination. These include plastic films (bubble wrap) and multi-layered materials such as chip bags.

**Figure 16** displays the averaged material composition from **Table 9** in visual form. The pie chart shows that recyclable paper makes up over half of the recycling stream and overall very little contamination in the samples.

Figure 15. Overall Princeton Recycling Stream Composition

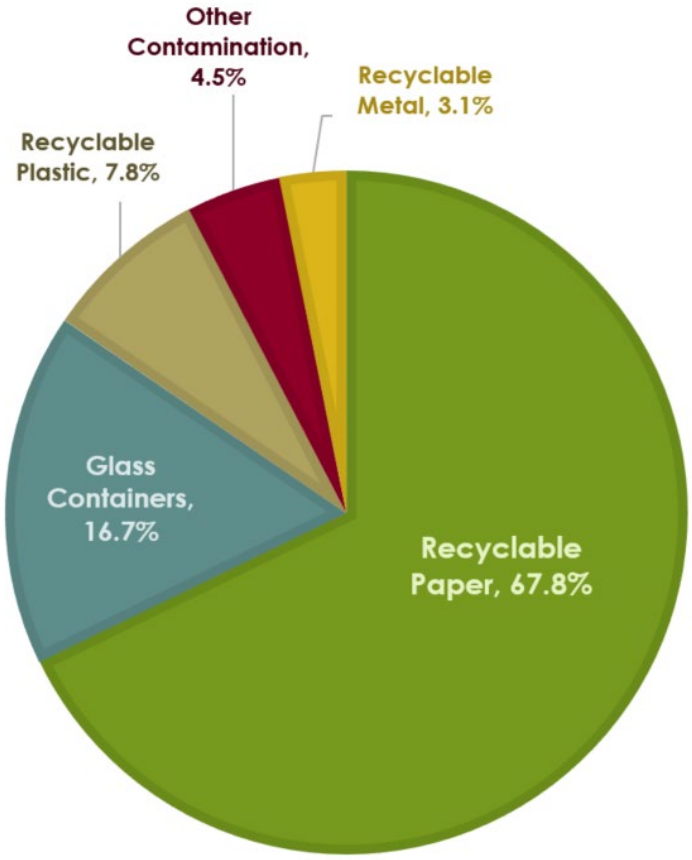



Table 10 displays the results from a Waste Characterization Study in New York City (NYC), New York. The study was conducted in 2017 by a commissioner from the NYC Department of Sanitation, and a PDF report is listed on the EPA's website.

Table 10. New York City Residential Recycling Contamination

| Residential Curbside Metal, Glass, and Plastics Recycling Collections Contamination | Residential Curbside Paper Recycling Collections Contamination |
|---|---|
| 19.5% | 8.9% |

The data from the study cites a 19.5 percent contamination rate in residential curbside recycling collection for metals, glass, and plastics, and an 8.9 percent contamination rate for paper collection. Compared to the results from the sampling of Princeton's residential recycling program, both of these percentages are larger than the total contamination rate of Princeton (4.5 percent). In NYC, the curbside recycling collection is not single-stream, but results do indicate an overall higher contamination rate in the NYC urban residential recycling stream.

Table 11, seen on the next page, shows the 11 types of recycling contamination that were found in samples from Princeton's recycling stream. Confidence limits are at the 90 percent confidence level. Therefore, 90 percent of samples from the residential recycling stream in Princeton will have compositions within the given range for each respective material.

Based on the collected data, plastic films are the most prevalent type of contamination found in the samples. For each material type, there were some samples where they were never found, and some where a higher proportion were found. This can explain the low composition percentages and the larger spread (standard deviation).

Table 11. Types of Contamination in Princeton Recycling Stream

| Material Type | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|
| Plastic Films | 1.3% | 1.4% | 0.7% | 1.8% |
| Compostable Paper | 0.8% | 2.6% | <0.1% | 1.8% |
| Rigid Plastic | 0.5% | 0.9% | 0.1% | 0.8% |
| Fines | 0.5% | 1.9% | <0.1% | 1.2% |
| Textiles | 0.4% | 1.8% | <0.1% | 1.1% |
| Other Uncategorized | 0.2% | 0.7% | <0.1% | 0.5% |
| Polystrene (#6) | 0.2% | 0.5% | <0.1% | 0.4% |
| Other Inorganic Fines | 0.2% | 0.9% | <0.1% | 0.6% |
| Food Waste | 0.2% | 0.6% | <0.1% | 0.4% |
| Electronic Waste | 0.2% | 0.6% | <0.1% | 0.4% |
| Aerosol Containers | 0.1% | 0.4% | <0.1% | 0.2% |

## CONCLUSIONS

Between the different sample collections, the characterization of material streams in New Jersey show overall consistent results. Most noticeably, the largest proportion of materials that made up the samples of each waste streams was food waste. A significant proportion of waste streams are materials that have the potential to be diverted in recycling and composting programs or otherwise. Contamination is a challenge for recycling collection and marketing throughout the country, but the Princeton recycling composition study shows promising results of low contamination proportions in the collected samples compared to New York City's residential recycling contamination proportion, as seen in the report by their Department of Sanitation.

# APPENDIX A:

## WASTE STREAM BY SOURCE

The following tables present the average waste stream composition by the population density of the collection route from which the samples were collected, categorized into rural, suburban, and urban streams. The confidence intervals are calculated at a 90 percent confidence level. Based on the collected samples, there is a 90-percent likelihood that the proportion of a given material in a future sample will fall between the confidence limits.

### MERCER COUNTY

Table 12. Mercer County Suburban Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.0% | 0.5% | 0.8% | 1.2% |
| | Corrugated Cardboard | 3.8% | 3.1% | 2.6% | 5.0% |
| | White Office Paper | 1.2% | 1.1% | 0.8% | 1.6% |
| | Box Board | 3.2% | 2.0% | 2.4% | 3.9% |
| | Magazines | 1.3% | 1.6% | 0.7% | 2.0% |
| | Other Paper | 3.2% | 2.6% | 2.2% | 4.2% |
| | PET Containers | 1.9% | 1.3% | 1.4% | 2.4% |
| | HDPE Containers | 1.6% | 1.5% | 1.0% | 2.1% |
| | Aluminum Cans | 0.7% | 0.5% | 0.5% | 0.8% |
| | Steel Cans | 0.3% | 0.5% | 0.2% | 0.5% |
| | Other Ferrous | 0.9% | 1.5% | 0.3% | 1.5% |
| | Other Non-Ferrous | 1.1% | 1.4% | 0.5% | 1.6% |
| | Glass Containers | 2.5% | 2.4% | 1.6% | 3.4% |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Compostable | Compostable Paper | 8.7% | 3.6% | 7.3% | 10.0% |
| | Food Waste | 19.5% | 7.5% | 16.6% | 22.4% |
| | Leaves | 0.8% | 2.0% | <0.1% | 1.6% |
| | Grass | 5.3% | 8.7% | 2.0% | 8.7% |
| | Brush | 0.6% | 1.4% | <0.1% | 1.1% |
| Other Divertibles | Textiles | 3.8% | 2.3% | 2.9% | 4.7% |
| | Rubber | 0.1% | 0.6% | <0.1% | 0.4% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | <0.1% | <0.1% | N/A | N/A |
| | Plywood | 0.3% | 1.5% | <0.1% | 0.9% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.5% | 1.3% | <0.1% | 1.0% |
| | Pallets | <0.1% | <0.1% | N/A | N/A |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 3.6% | 3.7% | 2.2% | 5.1% |
| | Soil/Ash | 1.8% | 3.3% | 0.5% | 3.1% |
| | Electronic Waste | 2.0% | 4.2% | 0.4% | 3.6% |
| | Solvents/Corrosive/Flammable | 0.2% | 0.7% | <0.1% | 0.4% |
| Non-Divertible | #3, 4 and 5 Containers | 0.9% | 0.7% | 0.6% | 1.2% |
| | Plastic Films | 10.7% | 3.9% | 9.1% | 12.2% |
| | Polystrene (#6) | 1.9% | 1.4% | 1.4% | 2.5% |
| | Rigid Plastic | 2.2% | 1.5% | 1.6% | 2.8% |
| | Other Plastic | <0.1% | 0.1% | <0.1% | <0.1% |
| | Fines | 2.5% | 1.0% | 2.2% | 2.9% |
| | Aerosol Containers | <0.1% | <0.1% | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | <0.1% | <0.1% | N/A | N/A |
| | Drywall/Gypsum Board | 0.9% | 2.8% | <0.1% | 2.0% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 8.0% | 2.8% | 6.9% | 9.1% |
| | Other Inorganic Fines | 0.7% | 2.0% | <0.1% | 1.5% |
| | Other C&D | 1.1% | 2.5% | <0.1% | 2.1% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 1.2% | 3.7% | <0.1% | 2.7% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 18 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 13. Mercer County Urban Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 0.4% | 0.8% | 1.1% |
| | Corrugated Cardboard | 3.8% | 3.2% | 2.6% | 5.0% |
| | White Office Paper | 1.3% | 1.3% | 0.8% | 1.8% |
| | Box Board | 3.0% | 2.3% | 2.2% | 3.8% |
| | Magazines | 1.0% | 0.9% | 0.6% | 1.3% |
| | Other Paper | 2.3% | 2.0% | 1.6% | 3.1% |
| | PET Containers | 3.3% | 2.3% | 2.4% | 4.1% |
| | HDPE Containers | 0.9% | 0.7% | 0.6% | 1.2% |
| | Aluminum Cans | 0.9% | 0.7% | 0.6% | 1.2% |
| | Steel Cans | 0.4% | 0.5% | 0.3% | 0.6% |
| | Other Ferrous | 0.8% | 1.7% | 0.2% | 1.4% |
| | Other Non-Ferrous | 0.2% | 0.3% | <0.1% | 0.3% |
| | Glass Containers | 3.1% | 2.8% | 2.0% | 4.1% |
| Compostable | Compostable Paper | 6.8% | 2.6% | 5.9% | 7.8% |
| | Food Waste | 19.8% | 3.9% | 18.4% | 21.3% |
| | Leaves | 1.4% | 4.3% | <0.1% | 3.0% |
| | Grass | 4.1% | 7.8% | 1.2% | 7.0% |
| | Brush | 1.2% | 2.3% | 0.3% | 2.1% |
| Other Divertibles | Textiles | 5.9% | 3.4% | 4.6% | 7.2% |
| | Rubber | 0.1% | 0.5% | <0.1% | 0.3% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% | N/A | N/A |
| | Plywood | <0.1% | <0.1% | N/A | N/A |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.7% | 1.7% | <0.1% | 1.3% |
| | Pallets | 0.7% | 2.9% | <0.1% | 1.7% |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 3.5% | 4.6% | 1.9% | 5.2% |
| | Soil/Ash | 1.2% | 3.3% | <0.1% | 2.4% |
| | Electronic Waste | 1.9% | 2.8% | 0.8% | 2.9% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.6% | 0.8% | 0.3% | 0.9% |
| | Plastic Films | 9.6% | 3.3% | 8.4% | 10.8% |
| | Polystrene (#6) | 2.1% | 1.3% | 1.6% | 2.5% |
| | Rigid Plastic | 2.4% | 1.6% | 1.8% | 3.0% |
| | Other Plastic | 0.5% | 1.1% | <0.1% | 0.9% |
| | Fines | 3.0% | 0.9% | 2.6% | 3.3% |
| | Aerosol Containers | <0.1% | 0.2% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.7% | 1.8% | <0.1% | 1.4% |
| | Drywall/Gypsum Board | 0.7% | 3.2% | <0.1% | 1.9% |
| | Ceiling Tiles | 0.3% | 1.2% | <0.1% | 0.7% |
| | Other Uncategorized | 6.0% | 3.0% | 4.9% | 7.2% |
| | Other Inorganic Fines | 0.3% | 0.8% | <0.1% | 0.6% |
| | Other C&D | 2.5% | 4.6% | 0.8% | 4.2% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 2.0% | 4.3% | 0.4% | 3.5% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 20 samples.**

**Confidence Limits are calculated at the 90% confidence level.**
**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 14. Mercer County Suburban Commercial Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.1% | 0.6% | 0.9% | 1.3% |
| | Corrugated Cardboard | 5.1% | 6.6% | 2.5% | 7.7% |
| | White Office Paper | 1.4% | 1.8% | 0.7% | 2.1% |
| | Box Board | 2.6% | 2.1% | 1.8% | 3.4% |
| | Magazines | 0.5% | 0.4% | 0.3% | 0.6% |
| | Other Paper | 2.1% | 1.6% | 1.5% | 2.7% |
| | PET Containers | 1.6% | 1.2% | 1.1% | 2.1% |
| | HDPE Containers | 1.6% | 1.6% | 1.0% | 2.2% |
| | Aluminum Cans | 0.5% | 0.7% | 0.3% | 0.8% |
| | Steel Cans | 0.3% | 0.4% | 0.2% | 0.5% |
| | Other Ferrous | 0.9% | 1.7% | 0.3% | 1.6% |
| | Other Non-Ferrous | 0.3% | 0.5% | 0.1% | 0.5% |
| | Glass Containers | 2.4% | 2.9% | 1.2% | 3.5% |
| Compostable | Compostable Paper | 8.4% | 4.0% | 6.9% | 10.0% |
| | Food Waste | 20.0% | 11.5% | 15.5% | 24.4% |
| | Leaves | <0.1% | 0.4% | <0.1% | 0.2% |
| | Grass | 2.6% | 5.5% | 0.5% | 4.7% |
| | Brush | 0.5% | 2.1% | <0.1% | 1.4% |
| Other Divertibles | Textiles | 3.7% | 3.5% | 2.3% | 5.0% |
| | Rubber | 0.6% | 2.1% | <0.1% | 1.5% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | 0.3% | 1.5% | <0.1% | 0.9% |
| | Plywood | <0.1% | <0.1% | N/A | N/A |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.3% | 0.8% | <0.1% | 0.6% |
| | Pallets | <0.1% | <0.1% | N/A | N/A |
| | Tree Parts | 1.0% | 2.8% | <0.1% | 2.1% |
| | Other Wood | 3.2% | 4.1% | 1.6% | 4.8% |
| | Soil/Ash | 1.1% | 1.9% | 0.4% | 1.8% |
| | Electronic Waste | 0.8% | 1.6% | 0.1% | 1.4% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.7% | 0.6% | 0.4% | 0.9% |
| | Plastic Films | 9.9% | 4.4% | 8.2% | 11.6% |
| | Polystrene (#6) | 2.1% | 1.3% | 1.7% | 2.6% |
| | Rigid Plastic | 3.2% | 3.0% | 2.0% | 4.3% |
| | Other Plastic | 0.3% | 1.1% | <0.1% | 0.7% |
| | Fines | 3.0% | 0.9% | 2.6% | 3.3% |
| | Aerosol Containers | <0.1% | 0.3% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | <0.1% | <0.1% | N/A | N/A |
| | Drywall/Gypsum Board | 1.6% | 3.2% | 0.3% | 2.8% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 8.5% | 4.7% | 6.7% | 10.3% |
| | Other Inorganic Fines | 1.4% | 3.6% | <0.1% | 2.8% |
| | Other C&D | 3.6% | 4.8% | 1.8% | 5.5% |
| | Medical Waste | 1.9% | 5.6% | <0.1% | 4.1% |
| | Furniture | 0.7% | 2.1% | <0.1% | 1.5% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 18 samples.**

**Confidence Limits are calculated at the 90% confidence level.**
**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 15. Mercer County Urban Commercial Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 1.5% | 0.2% | 1.5% |
| | Corrugated Cardboard | 12.5% | 10.9% | 8.0% | 17.0% |
| | White Office Paper | 2.2% | 3.3% | 0.9% | 3.6% |
| | Box Board | 1.6% | 1.9% | 0.8% | 2.4% |
| | Magazines | 0.6% | 0.5% | 0.4% | 0.8% |
| | Other Paper | 1.4% | 1.0% | 1.0% | 1.8% |
| | PET Containers | 1.0% | 0.9% | 0.7% | 1.4% |
| | HDPE Containers | 1.0% | 1.4% | 0.4% | 1.6% |
| | Aluminum Cans | 0.3% | 0.3% | 0.2% | 0.4% |
| | Steel Cans | 0.2% | 0.5% | <0.1% | 0.4% |
| | Other Ferrous | 2.5% | 3.5% | 1.0% | 3.9% |
| | Other Non-Ferrous | <0.1% | <0.1% | <0.1% | <0.1% |
| | Glass Containers | 0.9% | 1.8% | 0.2% | 1.6% |
| Compostable | Compostable Paper | 7.3% | 3.1% | 6.0% | 8.6% |
| | Food Waste | 13.6% | 11.4% | 9.0% | 18.3% |
| | Leaves | <0.1% | <0.1% | N/A | N/A |
| | Grass | 1.0% | 3.3% | <0.1% | 2.4% |
| | Brush | 0.5% | 2.1% | <0.1% | 1.4% |
| Other Divertibles | Textiles | 2.0% | 2.3% | 1.1% | 3.0% |
| | Rubber | 0.9% | 3.0% | <0.1% | 2.1% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | 0.8% | 1.8% | <0.1% | 1.6% |
| | Plywood | <0.1% | <0.1% | N/A | N/A |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | N/A | N/A |
| | Pallets | 4.3% | 8.9% | 0.7% | 8.0% |
| | Tree Parts | 0.1% | 0.4% | <0.1% | 0.3% |
| | Other Wood | 5.6% | 6.3% | 3.0% | 8.2% |
| | Soil/Ash | 0.6% | 1.6% | <0.1% | 1.2% |
| | Electronic Waste | 1.7% | 2.1% | 0.8% | 2.5% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| | Material Type | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.6% | 0.6% | 0.3% | 0.8% |
| | Plastic Films | 9.3% | 3.8% | 7.8% | 10.9% |
| | Polystrene (#6) | 3.5% | 5.8% | 1.1% | 5.9% |
| | Rigid Plastic | 2.7% | 2.0% | 1.9% | 3.5% |
| | Other Plastic | 0.2% | 0.9% | <0.1% | 0.6% |
| | Fines | 2.0% | 1.4% | 1.5% | 2.6% |
| | Aerosol Containers | <0.1% | <0.1% | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.8% | 3.2% | <0.1% | 2.1% |
| | Drywall/Gypsum Board | 2.3% | 6.5% | <0.1% | 5.0% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 4.6% | 3.5% | 3.2% | 6.0% |
| | Other Inorganic Fines | <0.1% | 0.3% | <0.1% | 0.2% |
| | Other C&D | 6.2% | 9.1% | 2.4% | 9.9% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 3.1% | 6.0% | 0.6% | 5.6% |
| | Mattresses | 0.9% | 3.4% | <0.1% | 2.3% |

**Composition based on 16 samples.**

**Confidence Limits are calculated at the 90% confidence level.**
**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

## BURLINGTON COUNTY

Table 16. Burlington County Rural Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.8% | 0.5% | 0.6% | 1.0% |
| | Corrugated Cardboard | 2.0% | 1.2% | 1.6% | 2.5% |
| | White Office Paper | 1.4% | 1.5% | 0.9% | 2.0% |
| | Box Board | 2.0% | 1.4% | 1.5% | 2.6% |
| | Magazines | 0.9% | 1.1% | 0.5% | 1.3% |
| | Other Paper | 3.2% | 1.9% | 2.5% | 4.0% |
| | PET Containers | 1.9% | 1.3% | 1.4% | 2.4% |
| | HDPE Containers | 1.0% | 0.8% | 0.7% | 1.3% |
| | Aluminum Cans | 0.4% | 0.3% | 0.2% | 0.5% |
| | Steel Cans | 0.5% | 0.8% | 0.2% | 0.8% |
| | Other Ferrous | 1.3% | 1.8% | 0.6% | 2.0% |
| | Other Non-Ferrous | 0.5% | 0.7% | 0.3% | 0.8% |
| | Glass Containers | 2.2% | 1.5% | 1.6% | 2.8% |
| Compostable | Compostable Paper | 9.7% | 3.1% | 8.5% | 10.8% |
| | Food Waste | 18.8% | 3.5% | 17.5% | 20.2% |
| | Leaves | 6.6% | 10.9% | 2.4% | 10.9% |
| | Grass | 5.0% | 7.6% | 2.1% | 8.0% |
| | Brush | 1.6% | 3.0% | 0.4% | 2.7% |
| Other Divertibles | Textiles | 4.2% | 3.5% | 2.8% | 5.5% |
| | Rubber | 0.4% | 1.2% | <0.1% | 0.8% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | <0.1% | <0.1% | N/A | N/A |
| | Plywood | 0.8% | 2.3% | <0.1% | 1.6% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.3% | 0.8% | <0.1% | 0.5% |
| | Pallets | <0.1% | <0.1% | N/A | N/A |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 2.0% | 2.2% | 1.2% | 2.9% |
| | Soil/Ash | 1.3% | 4.3% | <0.1% | 3.0% |
| | Electronic Waste | 1.1% | 1.6% | 0.5% | 1.8% |
| | Solvents/Corrosive/Flammable | 0.2% | 0.7% | <0.1% | 0.5% |

The table continues on the next page.

| | Material Type | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.9% | 0.6% | 0.6% | 1.1% |
| | Plastic Films | 9.6% | 3.5% | 8.3% | 11.0% |
| | Polystrene (#6) | 2.5% | 1.9% | 1.8% | 3.2% |
| | Rigid Plastic | 2.2% | 1.0% | 1.8% | 2.6% |
| | Other Plastic | <0.1% | 0.2% | <0.1% | 0.1% |
| | Fines | 2.7% | 3.0% | 1.6% | 3.9% |
| | Aerosol Containers | 0.1% | 0.2% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | <0.1% | <0.1% | N/A | N/A |
| | Drywall/Gypsum Board | 0.6% | 2.2% | <0.1% | 1.5% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 7.6% | 3.5% | 6.2% | 8.9% |
| | Other Inorganic Fines | <0.1% | <0.1% | N/A | N/A |
| | Other C&D | 0.8% | 1.8% | <0.1% | 1.5% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 2.6% | 4.1% | 1.0% | 4.2% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 18 samples.**
**Confidence Limits are calculated at the 90% confidence level.**
**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 17. Burlington County Suburban Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.7% | 0.5% | 0.6% | 0.9% |
| | Corrugated Cardboard | 2.0% | 1.8% | 1.3% | 2.7% |
| | White Office Paper | 0.8% | 1.0% | 0.4% | 1.3% |
| | Box Board | 1.9% | 1.3% | 1.4% | 2.3% |
| | Magazines | 1.1% | 2.8% | <0.1% | 2.2% |
| | Other Paper | 4.2% | 2.3% | 3.3% | 5.1% |
| | PET Containers | 1.0% | 1.1% | 0.6% | 1.5% |
| | HDPE Containers | 1.0% | 0.9% | 0.6% | 1.3% |
| | Aluminum Cans | 0.2% | 0.4% | <0.1% | 0.4% |
| | Steel Cans | <0.1% | 0.2% | <0.1% | 0.2% |
| | Other Ferrous | 1.7% | 2.9% | 0.6% | 2.8% |
| | Other Non-Ferrous | 0.4% | 1.0% | <0.1% | 0.7% |
| | Glass Containers | 1.1% | 1.4% | 0.5% | 1.6% |
| Compostable | Compostable Paper | 8.0% | 2.7% | 7.0% | 9.1% |
| | Food Waste | 13.4% | 7.6% | 10.4% | 16.3% |
| | Leaves | 1.3% | 3.6% | <0.1% | 2.7% |
| | Grass | 1.1% | 2.7% | <0.1% | 2.1% |
| | Brush | 0.5% | 1.9% | <0.1% | 1.2% |
| Other Divertibles | Textiles | 6.4% | 6.3% | 4.0% | 8.9% |
| | Rubber | 1.1% | 3.4% | <0.1% | 2.4% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | 0.6% | 1.8% | <0.1% | 1.3% |
| | Plywood | 0.3% | 1.1% | <0.1% | 0.7% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | N/A | N/A |
| | Pallets | 0.5% | 2.1% | <0.1% | 1.3% |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 5.2% | 4.9% | 3.4% | 7.1% |
| | Soil/Ash | 1.0% | 3.4% | <0.1% | 2.4% |
| | Electronic Waste | 1.5% | 2.7% | 0.5% | 2.6% |
| | Solvents/Corrosive/Flammable | 0.1% | 0.6% | <0.1% | 0.4% |

The table continues on the next page.

| | Material Type | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.5% | 0.5% | 0.3% | 0.7% |
| | Plastic Films | 7.8% | 3.2% | 6.6% | 9.1% |
| | Polystrene (#6) | 1.6% | 1.1% | 1.1% | 2.0% |
| | Rigid Plastic | 4.4% | 3.5% | 3.0% | 5.7% |
| | Other Plastic | 0.3% | 1.0% | <0.1% | 0.7% |
| | Fines | 1.8% | 1.6% | 1.2% | 2.4% |
| | Aerosol Containers | 0.2% | 0.3% | <0.1% | 0.3% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.9% | 2.1% | <0.1% | 1.7% |
| | Drywall/Gypsum Board | 4.0% | 13.0% | <0.1% | 9.1% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 7.9% | 5.1% | 5.9% | 9.9% |
| | Other Inorganic Fines | 0.4% | 1.5% | <0.1% | 1.0% |
| | Other C&D | 6.3% | 9.7% | 2.6% | 10.0% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 5.8% | 8.4% | 2.5% | 9.0% |
| | Mattresses | 0.9% | 3.8% | <0.1% | 2.4% |

**Composition based on 18 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 18. Burlington County Urban Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.2% | 2.0% | 0.3% | 2.0% |
| | Corrugated Cardboard | 4.9% | 8.6% | 1.4% | 8.5% |
| | White Office Paper | 1.2% | 1.4% | 0.6% | 1.8% |
| | Box Board | 2.0% | 0.9% | 1.6% | 2.3% |
| | Magazines | 0.6% | 0.5% | 0.5% | 0.8% |
| | Other Paper | 3.8% | 3.9% | 2.2% | 5.5% |
| | PET Containers | 2.1% | 1.4% | 1.5% | 2.7% |
| | HDPE Containers | 1.4% | 1.3% | 0.9% | 2.0% |
| | Aluminum Cans | 0.6% | 0.7% | 0.3% | 0.8% |
| | Steel Cans | 0.7% | 1.3% | 0.1% | 1.2% |
| | Other Ferrous | 0.9% | 1.6% | 0.3% | 1.6% |
| | Other Non-Ferrous | 0.1% | 0.3% | <0.1% | 0.3% |
| | Glass Containers | 2.0% | 1.8% | 1.2% | 2.7% |
| Compostable | Compostable Paper | 9.5% | 3.5% | 8.1% | 11.0% |
| | Food Waste | 17.9% | 5.7% | 15.5% | 20.2% |
| | Leaves | 0.7% | 1.5% | 0.1% | 1.3% |
| | Grass | 1.1% | 2.1% | 0.2% | 2.0% |
| | Brush | 1.3% | 2.4% | 0.3% | 2.3% |
| Other Divertibles | Textiles | 9.7% | 10.3% | 5.4% | 13.9% |
| | Rubber | <0.1% | <0.1% | N/A | N/A |
| | Leather | 0.4% | 1.5% | <0.1% | 1.0% |
| | Particle Board | 1.5% | 3.6% | <0.1% | 2.9% |
| | Plywood | 0.3% | 1.3% | <0.1% | 0.9% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | N/A | N/A |
| | Pallets | 1.8% | 4.8% | <0.1% | 3.7% |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 2.7% | 3.1% | 1.5% | 4.0% |
| | Soil/Ash | 1.0% | 2.6% | <0.1% | 2.1% |
| | Electronic Waste | 1.2% | 2.6% | 0.2% | 2.3% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| | Material Type | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.8% | 0.6% | 0.6% | 1.1% |
| | Plastic Films | 8.9% | 4.2% | 7.2% | 10.6% |
| | Polystrene (#6) | 2.3% | 1.6% | 1.6% | 3.0% |
| | Rigid Plastic | 2.9% | 1.8% | 2.2% | 3.6% |
| | Other Plastic | <0.1% | <0.1% | N/A | N/A |
| | Fines | 2.0% | 1.3% | 1.5% | 2.5% |
| | Aerosol Containers | <0.1% | 0.2% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.2% | 0.9% | <0.1% | 0.6% |
| | Drywall/Gypsum Board | 0.8% | 2.0% | <0.1% | 1.7% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 6.7% | 4.9% | 4.7% | 8.8% |
| | Other Inorganic Fines | 1.0% | 2.9% | <0.1% | 2.2% |
| | Other C&D | 2.8% | 4.2% | 1.1% | 4.5% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 0.7% | 2.6% | <0.1% | 1.7% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 16 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 19. Burlington County Rural Commercial Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 1.5% | 0.3% | 1.5% |
| | Corrugated Cardboard | 4.6% | 3.6% | 3.2% | 6.0% |
| | White Office Paper | 1.7% | 1.9% | 1.0% | 2.4% |
| | Box Board | 3.4% | 2.6% | 2.4% | 4.5% |
| | Magazines | 0.7% | 0.9% | 0.3% | 1.1% |
| | Other Paper | 4.1% | 2.9% | 3.0% | 5.2% |
| | PET Containers | 1.9% | 1.3% | 1.4% | 2.4% |
| | HDPE Containers | 1.3% | 1.3% | 0.8% | 1.8% |
| | Aluminum Cans | 0.3% | 0.3% | 0.1% | 0.4% |
| | Steel Cans | 0.2% | 0.3% | <0.1% | 0.4% |
| | Other Ferrous | 0.8% | 1.6% | 0.2% | 1.5% |
| | Other Non-Ferrous | 0.2% | 0.4% | <0.1% | 0.3% |
| | Glass Containers | 1.2% | 1.5% | 0.7% | 1.8% |
| Compostable | Compostable Paper | 8.7% | 3.1% | 7.5% | 9.9% |
| | Food Waste | 18.8% | 9.6% | 15.1% | 22.6% |
| | Leaves | 0.9% | 1.8% | 0.2% | 1.6% |
| | Grass | 1.1% | 3.6% | <0.1% | 2.5% |
| | Brush | 0.5% | 1.4% | <0.1% | 1.0% |
| Other Divertibles | Textiles | 2.3% | 3.3% | 1.0% | 3.6% |
| | Rubber | 2.2% | 6.7% | <0.1% | 4.8% |
| | Leather | <0.1% | 0.2% | <0.1% | 0.1% |
| | Particle Board | 0.2% | 0.9% | <0.1% | 0.6% |
| | Plywood | <0.1% | <0.1% | N/A | N/A |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.4% | 1.2% | <0.1% | 0.8% |
| | Pallets | 2.5% | 6.0% | 0.1% | 4.8% |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 3.9% | 5.1% | 1.9% | 5.8% |
| | Soil/Ash | 1.4% | 2.9% | 0.2% | 2.5% |
| | Electronic Waste | 1.6% | 2.5% | 0.6% | 2.5% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.6% | 0.6% | 0.4% | 0.9% |
| | Plastic Films | 9.8% | 5.6% | 7.6% | 11.9% |
| | Polystrene (#6) | 2.3% | 2.0% | 1.5% | 3.0% |
| | Rigid Plastic | 3.3% | 2.5% | 2.4% | 4.3% |
| | Other Plastic | 0.2% | 0.6% | <0.1% | 0.4% |
| | Fines | 1.6% | 1.3% | 1.1% | 2.1% |
| | Aerosol Containers | 0.1% | 0.2% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | <0.1% | <0.1% | N/A | N/A |
| | Drywall/Gypsum Board | 1.0% | 2.3% | <0.1% | 1.9% |
| | Ceiling Tiles | 0.6% | 1.8% | <0.1% | 1.3% |
| | Other Uncategorized | 7.4% | 5.0% | 5.4% | 9.3% |
| | Other Inorganic Fines | 0.1% | 0.5% | <0.1% | 0.3% |
| | Other C&D | 3.7% | 5.9% | 1.4% | 6.0% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 1.1% | 2.4% | 0.1% | 2.0% |
| | Mattresses | 2.6% | 7.6% | <0.1% | 5.5% |

**Composition based on 18 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 20. Burlington County Suburban Commercial Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.7% | 0.6% | 0.4% | 0.9% |
| | Corrugated Cardboard | 4.7% | 6.8% | 2.1% | 7.2% |
| | White Office Paper | 2.3% | 3.6% | 0.9% | 3.7% |
| | Box Board | 2.7% | 1.6% | 2.1% | 3.3% |
| | Magazines | 0.5% | 0.4% | 0.3% | 0.6% |
| | Other Paper | 5.8% | 4.4% | 4.1% | 7.5% |
| | PET Containers | 2.0% | 1.5% | 1.4% | 2.5% |
| | HDPE Containers | 1.0% | 0.7% | 0.7% | 1.2% |
| | Aluminum Cans | 0.4% | 0.4% | 0.3% | 0.6% |
| | Steel Cans | 0.8% | 1.1% | 0.4% | 1.2% |
| | Other Ferrous | 0.6% | 1.6% | <0.1% | 1.2% |
| | Other Non-Ferrous | 0.3% | 0.7% | <0.1% | 0.6% |
| | Glass Containers | 1.1% | 1.6% | 0.5% | 1.7% |
| Compostable | Compostable Paper | 10.9% | 3.7% | 9.6% | 12.3% |
| | Food Waste | 21.6% | 8.0% | 18.5% | 24.6% |
| | Leaves | 1.1% | 2.5% | 0.1% | 2.0% |
| | Grass | 1.0% | 3.6% | <0.1% | 2.3% |
| | Brush | 2.9% | 6.6% | 0.4% | 5.4% |
| Other Divertibles | Textiles | 1.1% | 2.3% | 0.3% | 2.0% |
| | Rubber | 0.3% | 1.2% | <0.1% | 0.7% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | <0.1% | 0.3% | <0.1% | 0.2% |
| | Plywood | <0.1% | <0.1% | N/A | N/A |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.4% | 1.8% | <0.1% | 1.1% |
| | Pallets | <0.1% | <0.1% | N/A | N/A |
| | Tree Parts | 0.3% | 1.4% | <0.1% | 0.8% |
| | Other Wood | 2.3% | 3.0% | 1.1% | 3.4% |
| | Soil/Ash | 0.8% | 1.6% | 0.1% | 1.4% |
| | Electronic Waste | 0.4% | 0.8% | <0.1% | 0.7% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.4% | 0.4% | 0.3% | 0.6% |
| | Plastic Films | 9.4% | 2.9% | 8.3% | 10.5% |
| | Polystrene (#6) | 2.0% | 1.6% | 1.5% | 2.6% |
| | Rigid Plastic | 3.4% | 1.9% | 2.7% | 4.1% |
| | Other Plastic | <0.1% | <0.1% | N/A | N/A |
| | Fines | 2.1% | 1.1% | 1.7% | 2.5% |
| | Aerosol Containers | <0.1% | 0.1% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | <0.1% | <0.1% | N/A | N/A |
| | Drywall/Gypsum Board | 0.2% | 0.7% | <0.1% | 0.5% |
| | Ceiling Tiles | <0.1% | <0.1% | N/A | N/A |
| | Other Uncategorized | 6.7% | 3.7% | 5.3% | 8.1% |
| | Other Inorganic Fines | 0.9% | 3.1% | <0.1% | 2.1% |
| | Other C&D | 5.4% | 8.2% | 2.3% | 8.5% |
| | Medical Waste | 0.6% | 2.6% | <0.1% | 1.6% |
| | Furniture | 2.8% | 6.8% | 0.2% | 5.4% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 19 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

Table 21. Burlington County Urban Commercial Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.7% | 0.6% | 0.5% | 0.9% |
| | Corrugated Cardboard | 2.6% | 2.4% | 1.7% | 3.5% |
| | White Office Paper | 2.6% | 5.0% | 0.7% | 4.6% |
| | Box Board | 2.2% | 1.4% | 1.6% | 2.7% |
| | Magazines | 0.8% | 0.7% | 0.5% | 1.0% |
| | Other Paper | 5.0% | 4.2% | 3.4% | 6.6% |
| | PET Containers | 2.7% | 2.2% | 1.9% | 3.5% |
| | HDPE Containers | 1.3% | 1.5% | 0.7% | 1.9% |
| | Aluminum Cans | 0.3% | 0.3% | 0.2% | 0.5% |
| | Steel Cans | 0.3% | 0.7% | <0.1% | 0.6% |
| | Other Ferrous | 0.5% | 1.3% | <0.1% | 1.0% |
| | Other Non-Ferrous | <0.1% | 0.2% | <0.1% | 0.1% |
| | Glass Containers | 2.4% | 2.9% | 1.3% | 3.5% |
| Compostable | Compostable Paper | 11.1% | 3.9% | 9.7% | 12.6% |
| | Food Waste | 25.7% | 10.0% | 21.9% | 29.5% |
| | Leaves | 0.8% | 2.5% | <0.1% | 1.7% |
| | Grass | 0.7% | 2.0% | <0.1% | 1.5% |
| | Brush | 0.4% | 1.3% | <0.1% | 0.9% |
| Other Divertibles | Textiles | 2.9% | 2.5% | 1.9% | 3.8% |
| | Rubber | <0.1% | <0.1% | N/A | N/A |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | 0.5% | 1.6% | <0.1% | 1.1% |
| | Plywood | 0.3% | 1.4% | <0.1% | 0.9% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.2% | 0.7% | <0.1% | 0.4% |
| | Pallets | <0.1% | <0.1% | N/A | N/A |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 1.7% | 3.2% | 0.5% | 2.9% |
| | Soil/Ash | 0.4% | 1.2% | <0.1% | 0.9% |
| | Electronic Waste | 1.0% | 1.8% | 0.3% | 1.7% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | N/A | N/A |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.7% | 0.9% | 0.3% | 1.0% |
| | Plastic Films | 11.5% | 4.9% | 9.6% | 13.3% |
| | Polystrene (#6) | 1.9% | 1.3% | 1.4% | 2.4% |
| | Rigid Plastic | 2.5% | 1.2% | 2.0% | 2.9% |
| | Other Plastic | <0.1% | <0.1% | N/A | N/A |
| | Fines | 2.1% | 1.2% | 1.7% | 2.6% |
| | Aerosol Containers | 0.1% | 0.2% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.5% | 2.1% | <0.1% | 1.3% |
| | Drywall/Gypsum Board | 0.5% | 1.5% | <0.1% | 1.0% |
| | Ceiling Tiles | 0.4% | 1.3% | <0.1% | 0.9% |
| | Other Uncategorized | 7.5% | 3.9% | 6.1% | 9.0% |
| | Other Inorganic Fines | <0.1% | <0.1% | N/A | N/A |
| | Other C&D | 2.8% | 3.7% | 1.4% | 4.3% |
| | Medical Waste | 0.7% | 2.1% | <0.1% | 1.5% |
| | Furniture | 1.4% | 3.2% | 0.2% | 2.6% |
| | Mattresses | <0.1% | <0.1% | N/A | N/A |

**Composition based on 19 samples.**

**Confidence Limits are calculated at the 90% confidence level.**

**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

## PASSAIC COUNTY

Table 22. Passaic County Urban Residential Stream Composition by Material

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.1% | 1.4% | 0.7% | 1.5% |
| | Corrugated Cardboard | 5.8% | 4.5% | 4.6% | 7.0% |
| | White Office Paper | 1.1% | 1.0% | 0.8% | 1.3% |
| | Box Board | 2.3% | 1.3% | 2.0% | 2.7% |
| | Magazines | 0.7% | 0.5% | 0.6% | 0.9% |
| | Other Paper | 3.8% | 3.0% | 3.0% | 4.6% |
| | PET Containers | 1.9% | 1.2% | 1.6% | 2.2% |
| | HDPE Containers | 1.2% | 0.9% | 0.9% | 1.4% |
| | Aluminum Cans | 0.5% | 0.4% | 0.4% | 0.6% |
| | Steel Cans | 0.4% | 0.4% | 0.3% | 0.6% |
| | Other Ferrous | 1.0% | 1.5% | 0.6% | 1.4% |
| | Other Non-Ferrous | 0.5% | 1.3% | 0.1% | 0.8% |
| | Glass Containers | 2.2% | 1.7% | 1.7% | 2.7% |
| Compostable | Compostable Paper | 9.2% | 2.8% | 8.5% | 10.0% |
| | Food Waste | 19.3% | 5.1% | 17.9% | 20.7% |
| | Leaves | 1.6% | 3.2% | 0.7% | 2.5% |
| | Grass | 1.1% | 2.7% | 0.3% | 1.8% |
| | Brush | 0.9% | 2.1% | 0.3% | 1.5% |
| Other Diverttibles | Textiles | 5.6% | 3.6% | 4.6% | 6.6% |
| | Rubber | <0.1% | 0.5% | <0.1% | 0.2% |
| | Leather | <0.1% | <0.1% | N/A | N/A |
| | Particle Board | 0.8% | 1.9% | 0.3% | 1.3% |
| | Plywood | 0.1% | 0.8% | <0.1% | 0.3% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.4% | 1.3% | <0.1% | 0.8% |
| | Pallets | 0.2% | 1.3% | <0.1% | 0.6% |
| | Tree Parts | <0.1% | <0.1% | N/A | N/A |
| | Other Wood | 4.2% | 4.4% | 3.0% | 5.3% |
| | Soil/Ash | 1.2% | 2.3% | 0.6% | 1.9% |
| | Electronic Waste | 0.9% | 1.3% | 0.6% | 1.3% |
| | Solvents/Corrosive/Flammable | 0.2% | 1.0% | <0.1% | 0.5% |

The table continues on the next page.

| Material Type | | Overall Composition | Overall Standard Deviation | Lower Confidence Limit | Upper Confidence Limit |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.5% | 0.3% | 0.4% | 0.6% |
| | Plastic Films | 10.3% | 3.6% | 9.3% | 11.3% |
| | Polystrene (#6) | 2.0% | 1.5% | 1.6% | 2.4% |
| | Rigid Plastic | 2.6% | 1.2% | 2.3% | 3.0% |
| | Other Plastic | <0.1% | <0.1% | N/A | N/A |
| | Fines | 2.1% | 1.0% | 1.9% | 2.4% |
| | Aerosol Containers | <0.1% | 0.1% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | N/A | N/A |
| | Masonry Materials | 0.1% | 0.6% | <0.1% | 0.3% |
| | Drywall/Gypsum Board | 0.4% | 1.4% | <0.1% | 0.8% |
| | Ceiling Tiles | 0.1% | 0.5% | <0.1% | 0.3% |
| | Other Uncategorized | 8.6% | 2.9% | 7.8% | 9.4% |
| | Other Inorganic Fines | 0.1% | 0.6% | <0.1% | 0.3% |
| | Other C&D | 2.4% | 4.0% | 1.3% | 3.5% |
| | Medical Waste | <0.1% | <0.1% | N/A | N/A |
| | Furniture | 1.8% | 3.6% | 0.8% | 2.8% |
| | Mattresses | 0.4% | 2.6% | <0.1% | 1.1% |

**Composition based on 36 samples.**
**Confidence Limits are calculated at the 90% confidence level.**
**N/A indicates the material was not found while sampling, so confidence intervals cannot be calculated.**

# APPENDIX B:

## COMPOSITIONS BY SEASON

The following tables present the compositions of waste streams and how they differ between seasons. They are organized by county and population density of the collection routes (rural, suburban, and urban).

### MERCER COUNTY

Table 23. Mercer County Suburban Residential Stream Compositions by Material

| | Material Type | Summer Composition | Winter Composition |
|---|---|---|---|
| Recyclable | Newspaper | 1.0% | 1.0% |
| | Corrugated Cardboard | 4.8% | 2.7% |
| | White Office Paper | 1.6% | 0.9% |
| | Box Board | 3.1% | 3.3% |
| | Magazines | 1.8% | 0.8% |
| | Other Paper | 1.4% | 4.9% |
| | PET Containers | 1.5% | 2.2% |
| | HDPE Containers | 1.6% | 1.5% |
| | Aluminum Cans | 0.7% | 0.7% |
| | Steel Cans | 0.3% | 0.3% |
| | Other Ferrous | 0.9% | 0.8% |
| | Other Non-Ferrous | 1.7% | 0.4% |
| | Glass Containers | 1.9% | 3.1% |
| Compostable | Compostable Paper | 8.4% | 8.9% |
| | Food Waste | 19.1% | 19.9% |
| | Leaves | 1.6% | <0.1% |
| | Grass | 10.7% | <0.1% |
| | Brush | 0.5% | 0.6% |

The table continues on the next page.

| | Material Type | Summer Composition | Winter Composition |
|---|---|---|---|
| Other Divertibles | Textiles | 3.1% | 4.5% |
| | Rubber | 0.3% | <0.1% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% |
| | Plywood | <0.1% | 0.7% |
| | Batteries | <0.1% | <0.1% |
| | Paints | 0.8% | 0.2% |
| | Pallets | <0.1% | <0.1% |
| | Tree Parts | <0.1% | <0.1% |
| | Other Wood | 4.1% | 3.1% |
| | Soil/Ash | 1.8% | 1.8% |
| | Electronic Waste | 1.4% | 2.6% |
| | Solvents/Corrosive/Flammable | <0.1% | 0.3% |
| Non-Divertible | #3, 4 and 5 Containers | 1.2% | 0.5% |
| | Plastic Films | 9.0% | 12.3% |
| | Polystrene (#6) | 1.4% | 2.5% |
| | Rigid Plastic | 1.7% | 2.7% |
| | Other Plastic | <0.1% | <0.1% |
| | Fines | 2.8% | 2.3% |
| | Aerosol Containers | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 0.8% | 1.1% |
| | Ceiling Tiles | <0.1% | <0.1% |
| | Other Uncategorized | 7.2% | 8.8% |
| | Other Inorganic Fines | <0.1% | 1.4% |
| | Other C&D | <0.1% | 2.1% |
| | Medical Waste | <0.1% | <0.1% |
| | Furniture | 1.5% | 1.0% |
| | Mattresses | <0.1% | <0.1% |

**Composition based on 18 samples.**

Table 24. Mercer County Urban Residential Stream Compositions by Material

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 1.0% |
| | Corrugated Cardboard | 4.5% | 3.1% |
| | White Office Paper | 1.6% | 0.9% |
| | Box Board | 3.1% | 2.9% |
| | Magazines | 1.0% | 0.9% |
| | Other Paper | 0.7% | 4.0% |
| | PET Containers | 3.3% | 3.2% |
| | HDPE Containers | 0.6% | 1.2% |
| | Aluminum Cans | 0.7% | 1.1% |
| | Steel Cans | 0.6% | 0.3% |
| | Other Ferrous | 0.5% | 1.1% |
| | Other Non-Ferrous | 0.1% | 0.2% |
| | Glass Containers | 3.1% | 3.0% |
| Compostable | Compostable Paper | 5.6% | 8.1% |
| | Food Waste | 21.5% | 18.2% |
| | Leaves | 2.8% | <0.1% |
| | Grass | 8.2% | <0.1% |
| | Brush | 1.3% | 1.2% |
| Other Divertibles | Textiles | 5.3% | 6.5% |
| | Rubber | 0.2% | <0.1% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% |
| | Plywood | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% |
| | Paints | 0.7% | 0.7% |
| | Pallets | <0.1% | 1.3% |
| | Tree Parts | <0.1% | <0.1% |
| | Other Wood | 3.6% | 3.5% |
| | Soil/Ash | 2.1% | 0.3% |
| | Electronic Waste | 1.4% | 2.4% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% |

The table continues on the next page.

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.3% | 0.9% |
| | Plastic Films | 8.4% | 10.8% |
| | Polystrene (#6) | 1.6% | 2.5% |
| | Rigid Plastic | 1.6% | 3.2% |
| | Other Plastic | 0.6% | 0.4% |
| | Fines | 3.0% | 2.9% |
| | Aerosol Containers | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | 0.5% | 0.9% |
| | Drywall/Gypsum Board | <0.1% | 1.4% |
| | Ceiling Tiles | <0.1% | 0.6% |
| | Other Uncategorized | 5.7% | 6.4% |
| | Other Inorganic Fines | 0.3% | 0.3% |
| | Other C&D | 2.9% | 2.1% |
| | Medical Waste | <0.1% | <0.1% |
| | Furniture | 1.5% | 2.4% |
| | Mattresses | <0.1% | <0.1% |

**Composition based on 20 samples.**

Table 25. Mercer County Suburban Commercial Stream Compositions by Material

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Recyclable | Newspaper | 1.4% | 0.8% |
| | Corrugated Cardboard | 7.9% | 2.3% |
| | White Office Paper | 2.3% | 0.6% |
| | Box Board | 2.9% | 2.3% |
| | Magazines | 0.6% | 0.3% |
| | Other Paper | 1.5% | 2.6% |
| | PET Containers | 1.6% | 1.6% |
| | HDPE Containers | 1.4% | 1.8% |
| | Aluminum Cans | 0.4% | 0.7% |
| | Steel Cans | 0.3% | 0.4% |
| | Other Ferrous | 0.9% | 1.0% |
| | Other Non-Ferrous | 0.3% | 0.3% |
| | Glass Containers | 1.7% | 3.0% |
| Compostable | Compostable Paper | 6.5% | 10.3% |
| | Food Waste | 16.2% | 23.7% |
| | Leaves | 0.2% | <0.1% |
| | Grass | 5.3% | <0.1% |
| | Brush | 1.0% | 0.1% |
| Other Divertibles | Textiles | 3.2% | 4.2% |
| | Rubber | 1.3% | <0.1% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | 0.7% | <0.1% |
| | Plywood | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% |
| | Paints | 0.3% | 0.3% |
| | Pallets | <0.1% | <0.1% |
| | Tree Parts | 1.9% | <0.1% |
| | Other Wood | 3.7% | 2.8% |
| | Soil/Ash | 1.3% | 0.9% |
| | Electronic Waste | 0.9% | 0.6% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% |

The table continues on the next page.

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.9% | 0.4% |
| | Plastic Films | 8.9% | 10.9% |
| | Polystrene (#6) | 2.1% | 2.2% |
| | Rigid Plastic | 3.3% | 3.0% |
| | Other Plastic | 0.6% | <0.1% |
| | Fines | 3.1% | 2.8% |
| | Aerosol Containers | 0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 2.0% | 1.1% |
| | Ceiling Tiles | <0.1% | <0.1% |
| | Other Uncategorized | 8.2% | 8.8% |
| | Other Inorganic Fines | 2.2% | 0.6% |
| | Other C&D | 1.6% | 5.7% |
| | Medical Waste | <0.1% | 3.8% |
| | Furniture | 1.4% | <0.1% |
| | Mattresses | <0.1% | <0.1% |

**Composition based on 18 samples.**

Table 26. Mercer County Urban Commercial Stream Compositions by Material

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Recyclable | Newspaper | 1.3% | 0.4% |
| | Corrugated Cardboard | 15.9% | 9.1% |
| | White Office Paper | 4.0% | 0.4% |
| | Box Board | 2.2% | 1.0% |
| | Magazines | 0.7% | 0.5% |
| | Other Paper | 0.6% | 2.1% |
| | PET Containers | 1.1% | 1.0% |
| | HDPE Containers | 1.4% | 0.6% |
| | Aluminum Cans | 0.4% | 0.1% |
| | Steel Cans | <0.1% | 0.4% |
| | Other Ferrous | 3.3% | 1.6% |
| | Other Non-Ferrous | <0.1% | <0.1% |
| | Glass Containers | 0.9% | 1.0% |
| Compostable | Compostable Paper | 6.6% | 8.0% |
| | Food Waste | 11.8% | 15.4% |
| | Leaves | <0.1% | <0.1% |
| | Grass | 2.0% | <0.1% |
| | Brush | <0.1% | 1.1% |
| Other Divertibles | Textiles | 1.8% | 2.3% |
| | Rubber | 1.6% | 0.2% |
| | Leather | <0.1% | <0.1% |
| | Particle Board | 1.6% | <0.1% |
| | Plywood | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% |
| | Pallets | 1.7% | 7.0% |
| | Tree Parts | 0.2% | <0.1% |
| | Other Wood | 4.4% | 6.9% |
| | Soil/Ash | 0.3% | 0.8% |
| | Electronic Waste | 1.3% | 2.0% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% |

The table continues on the next page.

| Material Type | | Summer Composition | Winter Composition |
|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.7% | 0.4% |
| | Plastic Films | 8.0% | 10.7% |
| | Polystrene (#6) | 4.6% | 2.4% |
| | Rigid Plastic | 2.4% | 3.0% |
| | Other Plastic | <0.1% | 0.5% |
| | Fines | 2.7% | 1.4% |
| | Aerosol Containers | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% |
| | Masonry Materials | 1.6% | <0.1% |
| | Drywall/Gypsum Board | 4.0% | 0.6% |
| | Ceiling Tiles | <0.1% | <0.1% |
| | Other Uncategorized | 4.7% | 4.5% |
| | Other Inorganic Fines | 0.2% | <0.1% |
| | Other C&D | 2.0% | 10.3% |
| | Medical Waste | <0.1% | <0.1% |
| | Furniture | 3.6% | 2.5% |
| | Mattresses | <0.1% | 1.7% |

**Composition based on 16 samples.**

Figure 16. Seasonal Composition of **Recyclables** in Mercer County

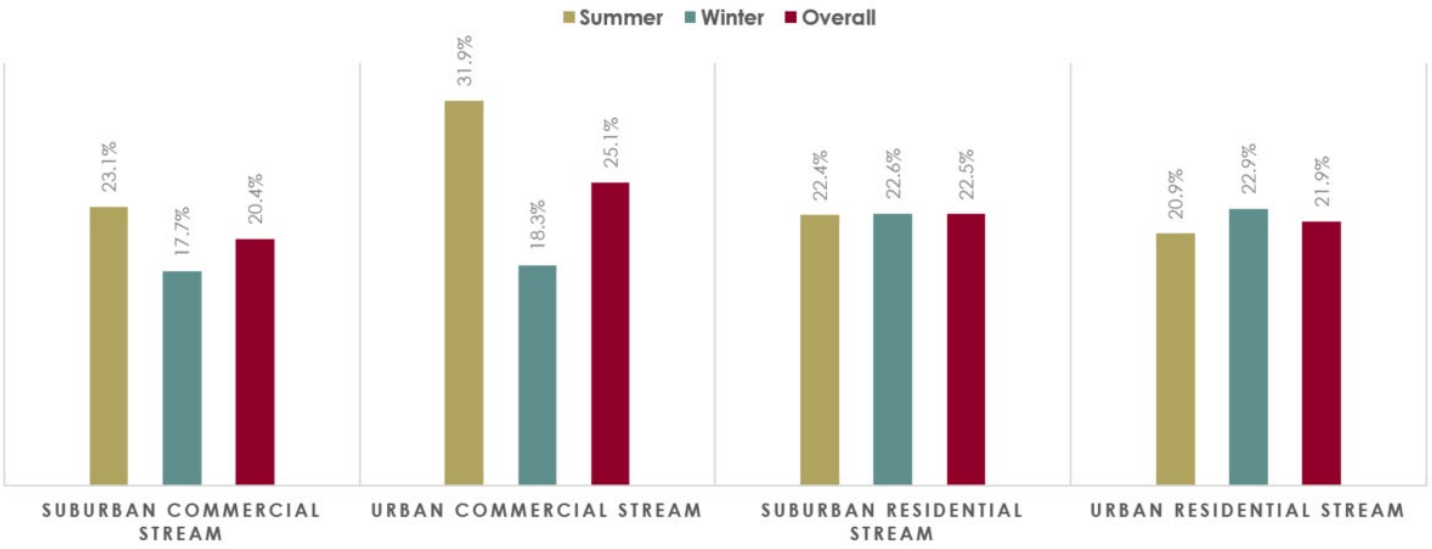



Figure 17. Seasonal Composition of **Compostables** in Mercer County

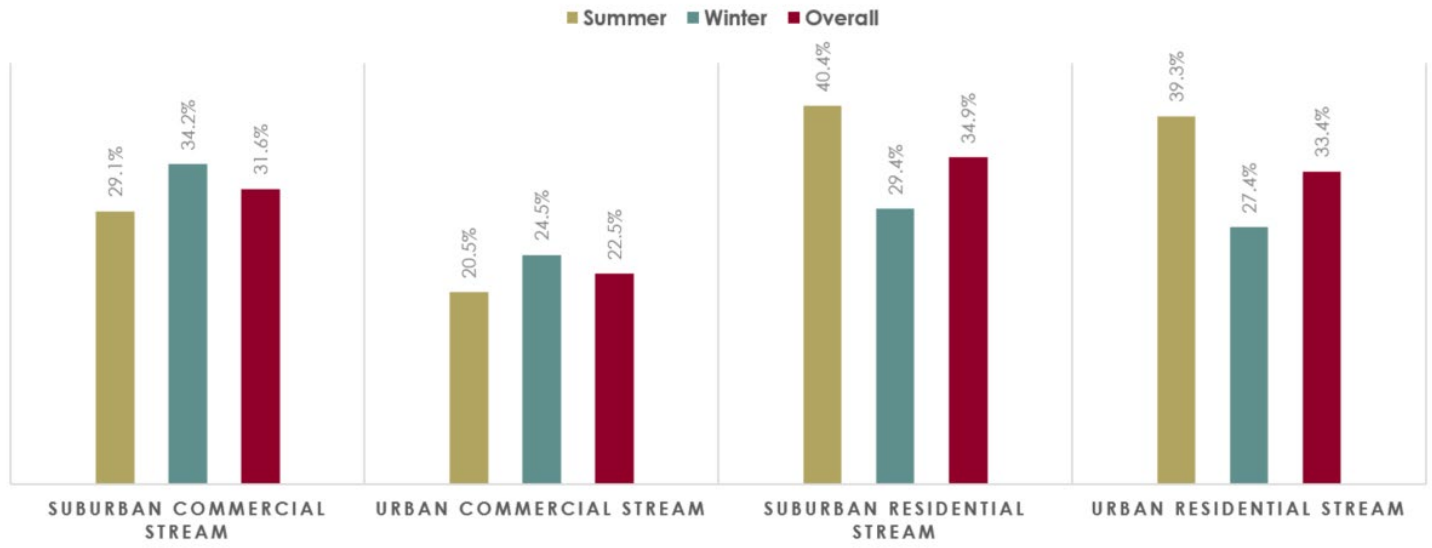


Figure 18. Seasonal Composition of **Other Divertibles** in Mercer County

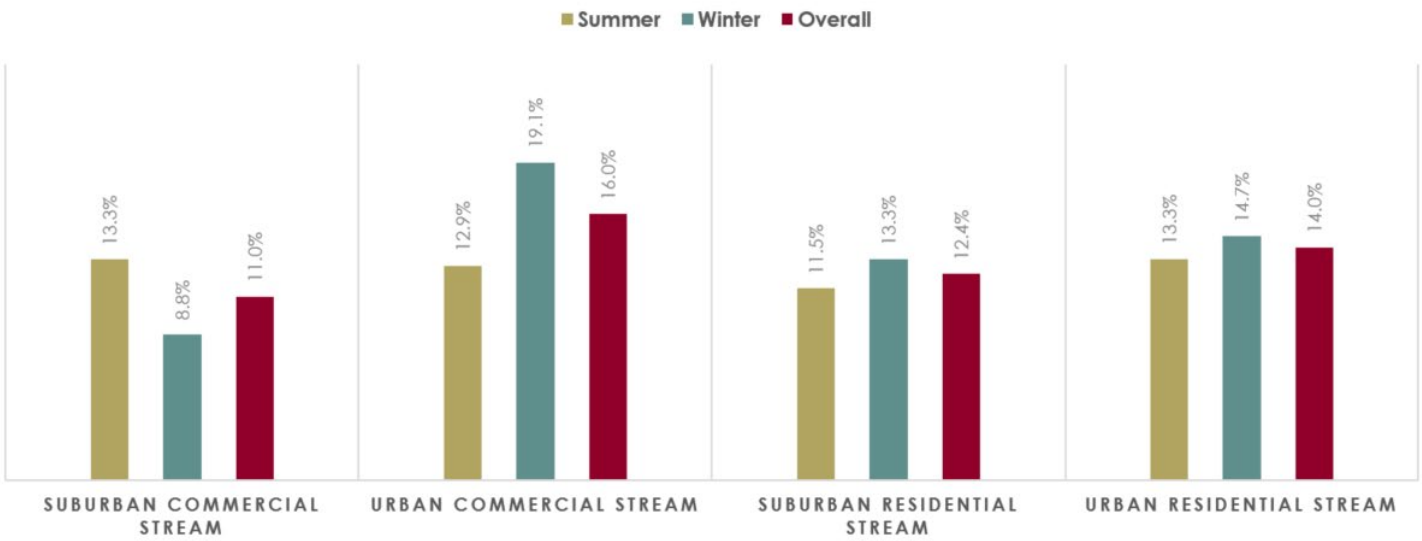
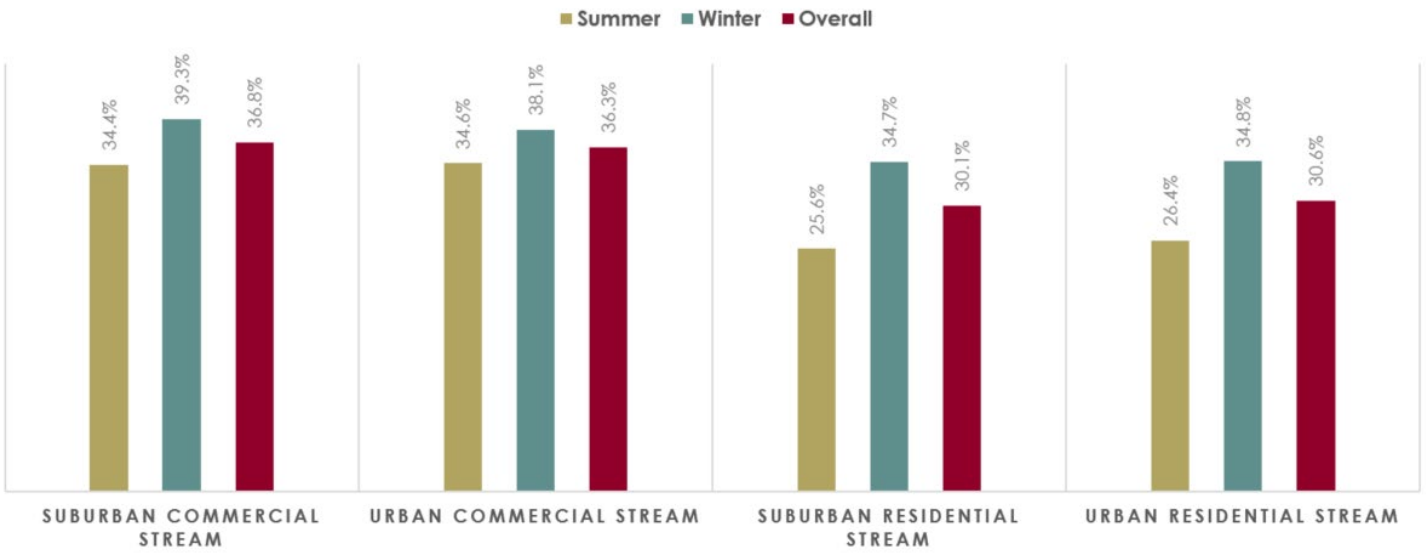



Figure 19. Seasonal Composition of **Non-Divertibles** in Mercer County



## BURLINGTON COUNTY

Table 27. Burlington County Rural Residential Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.9% | 0.6% | 0.9% | 1.0% |
| | Corrugated Cardboard | 1.4% | 3.4% | 1.8% | 1.9% |
| | White Office Paper | 1.8% | 1.7% | 0.6% | 1.8% |
| | Box Board | 2.1% | 2.1% | 2.6% | 1.3% |
| | Magazines | 0.5% | 1.5% | 0.6% | 1.2% |
| | Other Paper | 3.1% | 2.4% | 3.6% | 3.7% |
| | PET Containers | 1.4% | 2.9% | 2.5% | 0.9% |
| | HDPE Containers | 0.6% | 1.1% | 1.4% | 0.9% |
| | Aluminum Cans | 0.3% | 0.6% | 0.5% | <0.1% |
| | Steel Cans | 0.4% | 1.1% | 0.4% | 0.2% |
| | Other Ferrous | 2.5% | 0.1% | 1.4% | 0.7% |
| | Other Non-Ferrous | 0.5% | 1.2% | 0.5% | <0.1% |
| | Glass Containers | 1.9% | 2.3% | 3.2% | 1.4% |
| Compostable | Compostable Paper | 9.8% | 7.1% | 11.6% | 9.6% |
| | Food Waste | 18.1% | 16.5% | 21.1% | 19.2% |
| | Leaves | 1.7% | 4.2% | <0.1% | 23.7% |
| | Grass | 13.4% | 1.4% | <0.1% | 4.4% |
| | Brush | 3.0% | 2.9% | 0.3% | <0.1% |
| Other Divertibles | Textiles | 2.1% | 7.3% | 5.1% | 2.5% |
| | Rubber | 0.3% | 1.3% | <0.1% | <0.1% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% | <0.1% | <0.1% |
| | Plywood | <0.1% | 3.5% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.5% | <0.1% | 0.4% | <0.1% |
| | Pallets | <0.1% | <0.1% | <0.1% | <0.1% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 1.0% | 3.6% | 2.7% | 0.9% |
| | Soil/Ash | <0.1% | 1.7% | 3.5% | <0.1% |
| | Electronic Waste | 2.8% | <0.1% | 1.4% | <0.1% |
| | Solvents/Corrosive/Flammable | <0.1% | 0.8% | 0.2% | <0.1% |

The table continues on the next page.

| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 1.0% | 0.6% | 1.1% | 0.8% |
| | Plastic Films | 7.4% | 9.8% | 12.4% | 8.9% |
| | Polystrene (#6) | 2.0% | 3.3% | 3.5% | 1.0% |
| | Rigid Plastic | 2.3% | 1.8% | 2.6% | 2.0% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | 0.2% |
| | Fines | 3.8% | 3.5% | 2.1% | 1.3% |
| | Aerosol Containers | 0.1% | 0.3% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 1.9% | <0.1% | 0.4% | <0.1% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Uncategorized | 8.4% | 6.8% | 7.0% | 8.1% |
| | Other Inorganic Fines | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other C&D | <0.1% | 1.2% | 1.4% | 0.5% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | 3.3% | 1.7% | 3.2% | 1.8% |
| | Mattresses | <0.1% | <0.1% | <0.1% | <0.1% |

**Composition based on 18 samples.**

Table 28. Burlington County Suburban Residential Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.0% | 0.5% | 0.6% | 0.9% |
| | Corrugated Cardboard | 1.0% | 3.4% | 1.8% | 1.5% |
| | White Office Paper | 0.7% | 0.4% | 0.6% | 1.6% |
| | Box Board | 2.1% | 0.7% | 2.7% | 2.1% |
| | Magazines | 0.3% | 3.1% | 0.4% | 0.5% |
| | Other Paper | 2.4% | 3.1% | 4.4% | 6.4% |
| | PET Containers | 2.0% | 0.7% | 0.8% | 0.8% |
| | HDPE Containers | 1.2% | 0.9% | 1.1% | 0.8% |
| | Aluminum Cans | 0.7% | <0.1% | 0.2% | 0.1% |
| | Steel Cans | <0.1% | <0.1% | <0.1% | 0.3% |
| | Other Ferrous | 0.1% | 4.5% | 0.3% | 1.2% |
| | Other Non-Ferrous | <0.1% | 1.3% | <0.1% | <0.1% |
| | Glass Containers | 1.7% | 0.3% | 2.3% | 0.3% |
| Compostable | Compostable Paper | 8.1% | 5.5% | 10.2% | 8.7% |
| | Food Waste | 18.3% | 4.2% | 15.9% | 16.6% |
| | Leaves | <0.1% | 1.0% | 1.0% | 2.9% |
| | Grass | <0.1% | 2.1% | <0.1% | 1.7% |
| | Brush | 0.1% | <0.1% | 2.0% | <0.1% |
| Other Divertibles | Textiles | 14.6% | 8.0% | 2.3% | 1.6% |
| | Rubber | 0.6% | 0.7% | <0.1% | 2.8% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | 2.1% | <0.1% | <0.1% |
| | Plywood | <0.1% | <0.1% | <0.1% | 0.9% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | <0.1% | <0.1% |
| | Pallets | <0.1% | 1.8% | <0.1% | <0.1% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 3.3% | 9.0% | 2.4% | 5.3% |
| | Soil/Ash | <0.1% | 2.9% | <0.1% | 0.8% |
| | Electronic Waste | 1.2% | 3.9% | <0.1% | 0.7% |
| | Solvents/Corrosive/Flammable | <0.1% | 0.5% | <0.1% | <0.1% |

The table continues on the next page.

| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.9% | 0.2% | 0.4% | 0.5% |
| | Plastic Films | 7.3% | 5.1% | 8.5% | 10.4% |
| | Polystrene (#6) | 2.1% | 1.6% | 1.5% | 1.2% |
| | Rigid Plastic | 6.8% | 5.7% | 2.1% | 2.9% |
| | Other Plastic | 0.6% | 0.7% | <0.1% | <0.1% |
| | Fines | 2.6% | 1.7% | 1.2% | 1.8% |
| | Aerosol Containers | 0.2% | 0.2% | <0.1% | 0.3% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | 1.8% | <0.1% | 1.3% |
| | Drywall/Gypsum Board | 2.1% | <0.1% | 13.7% | 1.9% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Uncategorized | 6.7% | 5.8% | 8.3% | 10.7% |
| | Other Inorganic Fines | <0.1% | <0.1% | 1.6% | <0.1% |
| | Other C&D | 3.4% | 2.2% | 13.6% | 6.9% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | 8.1% | 11.1% | <0.1% | 3.2% |
| | Mattresses | <0.1% | 3.2% | <0.1% | <0.1% |

**Composition based on 18 samples.**

Table 29. Burlington County Urban Residential Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 2.3% | 0.8% | 1.1% | 0.6% |
| | Corrugated Cardboard | 1.3% | 2.9% | 12.9% | 2.7% |
| | White Office Paper | 1.3% | 2.0% | 1.0% | 0.7% |
| | Box Board | 2.3% | 2.1% | 1.8% | 1.7% |
| | Magazines | 0.2% | 0.7% | 1.0% | 0.7% |
| | Other Paper | 2.4% | 3.5% | 7.3% | 2.2% |
| | PET Containers | 2.7% | 2.6% | 1.4% | 1.6% |
| | HDPE Containers | 1.2% | 0.8% | 0.5% | 3.2% |
| | Aluminum Cans | 1.0% | 0.3% | 0.7% | 0.3% |
| | Steel Cans | 1.2% | 0.8% | <0.1% | 0.7% |
| | Other Ferrous | 1.6% | 1.4% | <0.1% | 0.6% |
| | Other Non-Ferrous | <0.1% | 0.4% | <0.1% | <0.1% |
| | Glass Containers | 0.5% | 3.2% | 2.2% | 2.0% |
| Compostable | Compostable Paper | 10.3% | 9.3% | 9.7% | 8.8% |
| | Food Waste | 20.4% | 15.8% | 14.5% | 20.7% |
| | Leaves | 0.3% | 1.9% | <0.1% | 0.7% |
| | Grass | 0.8% | 0.5% | <0.1% | 3.1% |
| | Brush | <0.1% | 3.1% | 0.4% | 1.9% |
| Other Divertibles | Textiles | 7.7% | 7.9% | 17.2% | 5.9% |
| | Rubber | <0.1% | <0.1% | <0.1% | <0.1% |
| | Leather | <0.1% | <0.1% | 1.5% | <0.1% |
| | Particle Board | 0.7% | 5.2% | <0.1% | <0.1% |
| | Plywood | 1.3% | <0.1% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | <0.1% | <0.1% |
| | Pallets | 3.2% | <0.1% | 3.8% | <0.1% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 2.5% | <0.1% | 4.1% | 4.4% |
| | Soil/Ash | 0.6% | 3.5% | <0.1% | <0.1% |
| | Electronic Waste | 0.9% | 3.6% | 0.3% | 0.2% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | <0.1% | <0.1% |

The table continues on the next page.

| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 1.3% | 0.5% | 0.7% | 0.7% |
| | Plastic Films | 11.2% | 5.5% | 9.4% | 9.5% |
| | Polystrene (#6) | 3.0% | 3.5% | 1.5% | 1.3% |
| | Rigid Plastic | 4.3% | 3.0% | 2.0% | 2.3% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | <0.1% |
| | Fines | 2.4% | 1.3% | 2.3% | 2.0% |
| | Aerosol Containers | <0.1% | <0.1% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | <0.1% | 0.9% |
| | Drywall/Gypsum Board | <0.1% | 1.8% | <0.1% | 1.6% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Uncategorized | 9.5% | 5.7% | 1.0% | 10.8% |
| | Other Inorganic Fines | <0.1% | <0.1% | 1.9% | 2.2% |
| | Other C&D | 1.6% | 3.8% | <0.1% | 5.6% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | <0.1% | 2.6% | <0.1% | <0.1% |
| | Mattresses | <0.1% | <0.1% | <0.1% | <0.1% |

**Composition based on 16 samples.**

Table 30. Burlington County Rural Commercial Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.4% | 0.7% | 0.4% | 1.9% |
| | Corrugated Cardboard | 4.7% | 7.0% | 3.0% | 3.3% |
| | White Office Paper | 0.6% | 1.4% | 1.2% | 3.3% |
| | Box Board | 3.9% | 3.4% | 1.9% | 4.3% |
| | Magazines | 0.3% | 0.5% | 1.4% | 0.7% |
| | Other Paper | 4.9% | 2.4% | 3.8% | 5.4% |
| | PET Containers | 1.2% | 1.6% | 1.5% | 3.1% |
| | HDPE Containers | 2.3% | 1.0% | 1.3% | 0.7% |
| | Aluminum Cans | <0.1% | 0.4% | 0.3% | 0.2% |
| | Steel Cans | <0.1% | 0.2% | <0.1% | 0.5% |
| | Other Ferrous | 0.6% | 1.0% | <0.1% | 1.5% |
| | Other Non-Ferrous | <0.1% | <0.1% | 0.6% | 0.2% |
| | Glass Containers | 0.3% | 2.1% | 0.2% | 2.0% |
| Compostable | Compostable Paper | 6.3% | 8.8% | 10.6% | 8.9% |
| | Food Waste | 22.5% | 21.3% | 15.7% | 15.9% |
| | Leaves | <0.1% | 1.2% | <0.1% | 2.0% |
| | Grass | 3.8% | 0.9% | <0.1% | <0.1% |
| | Brush | <0.1% | <0.1% | 1.4% | 0.6% |
| Other Divertibles | Textiles | 1.7% | 1.2% | 4.4% | 2.3% |
| | Rubber | 6.8% | 2.1% | <0.1% | 0.5% |
| | Leather | 0.2% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | 0.8% | <0.1% | <0.1% |
| | Plywood | <0.1% | <0.1% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 1.1% | 0.6% | <0.1% | <0.1% |
| | Pallets | <0.1% | 4.8% | <0.1% | 4.0% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 8.4% | 3.5% | 1.3% | 2.6% |
| | Soil/Ash | 1.1% | <0.1% | 2.4% | 2.1% |
| | Electronic Waste | 3.3% | 0.6% | 1.8% | 1.0% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | <0.1% | <0.1% |

The table continues on the next page.

| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.7% | 0.9% | 0.4% | 0.6% |
| | Plastic Films | 3.3% | 11.0% | 15.4% | 9.2% |
| | Polystrene (#6) | 1.2% | 4.4% | 1.7% | 1.5% |
| | Rigid Plastic | 3.5% | 2.8% | 2.4% | 4.4% |
| | Other Plastic | 0.7% | <0.1% | <0.1% | <0.1% |
| | Fines | <0.1% | 1.5% | 2.6% | 2.1% |
| | Aerosol Containers | 0.2% | <0.1% | <0.1% | 0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 1.0% | 1.3% | 1.7% | <0.1% |
| | Ceiling Tiles | <0.1% | 1.2% | 1.2% | <0.1% |
| | Other Uncategorized | 2.0% | 4.6% | 10.4% | 12.0% |
| | Other Inorganic Fines | <0.1% | <0.1% | <0.1% | 0.4% |
| | Other C&D | 6.2% | 3.6% | 2.8% | 2.5% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | 1.6% | 1.0% | 1.8% | <0.1% |
| | Mattresses | 5.4% | <0.1% | 6.3% | <0.1% |

**Composition based on 18 samples.**

Table 31. Burlington County Suburban Commercial Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.3% | 0.5% | 0.6% | 1.2% |
| | Corrugated Cardboard | 3.1% | 10.2% | 3.7% | 3.0% |
| | White Office Paper | 0.3% | 2.1% | 0.6% | 6.1% |
| | Box Board | 2.8% | 3.2% | 2.1% | 2.7% |
| | Magazines | <0.1% | 0.4% | 0.6% | 0.8% |
| | Other Paper | 3.3% | 3.6% | 3.5% | 12.3% |
| | PET Containers | 2.4% | 1.5% | 1.2% | 2.8% |
| | HDPE Containers | 0.7% | 0.8% | 1.7% | 0.7% |
| | Aluminum Cans | 0.2% | 0.6% | 0.1% | 0.9% |
| | Steel Cans | 0.1% | 1.6% | 1.5% | 0.1% |
| | Other Ferrous | 1.2% | 0.2% | 0.7% | 0.4% |
| | Other Non-Ferrous | <0.1% | 0.3% | 0.9% | <0.1% |
| | Glass Containers | <0.1% | 0.9% | 2.2% | 1.2% |
| Compostable | Compostable Paper | 9.2% | 7.4% | 13.7% | 12.8% |
| | Food Waste | 20.3% | 17.3% | 30.5% | 17.4% |
| | Leaves | <0.1% | 1.8% | <0.1% | 2.6% |
| | Grass | 3.1% | 0.9% | <0.1% | <0.1% |
| | Brush | 1.6% | 10.3% | 1.2% | <0.1% |
| Other Divertibles | Textiles | <0.1% | 0.7% | 2.8% | 1.0% |
| | Rubber | 1.1% | <0.1% | <0.1% | <0.1% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | 0.3% | <0.1% | <0.1% |
| | Plywood | <0.1% | <0.1% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | <0.1% | <0.1% | <0.1% | 1.5% |
| | Pallets | <0.1% | <0.1% | <0.1% | <0.1% |
| | Tree Parts | 1.2% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 4.0% | 4.3% | 0.2% | 1.0% |
| | Soil/Ash | 0.9% | 1.2% | 1.0% | <0.1% |
| | Electronic Waste | <0.1% | <0.1% | 0.2% | 1.3% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | <0.1% | <0.1% |

The table continues on the next page.

| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.4% | 0.2% | 0.5% | 0.5% |
| | Plastic Films | 10.3% | 7.1% | 9.9% | 9.9% |
| | Polystrene (#6) | 1.1% | 1.8% | 2.5% | 2.7% |
| | Rigid Plastic | 2.9% | 3.5% | 4.2% | 3.0% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | <0.1% |
| | Fines | 2.8% | 1.6% | 1.7% | 2.1% |
| | Aerosol Containers | <0.1% | 0.2% | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 0.4% | 0.6% | <0.1% | <0.1% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Uncategorized | 4.5% | 3.8% | 7.6% | 10.2% |
| | Other Inorganic Fines | <0.1% | 4.5% | <0.1% | <0.1% |
| | Other C&D | 14.6% | 3.5% | 1.1% | 1.8% |
| | Medical Waste | <0.1% | <0.1% | 2.3% | <0.1% |
| | Furniture | 7.1% | 3.0% | 1.2% | <0.1% |
| | Mattresses | <0.1% | <0.1% | <0.1% | <0.1% |

**Composition based on 19 samples.**

Table 32. Burlington County Urban Commercial Stream Compositions by Material

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 0.4% | 1.1% | 0.5% | 0.9% |
| | Corrugated Cardboard | 3.8% | 2.4% | 2.3% | 1.9% |
| | White Office Paper | 0.4% | 2.3% | 6.7% | 0.8% |
| | Box Board | 3.0% | 2.0% | 1.3% | 2.3% |
| | Magazines | 1.0% | 0.9% | 0.6% | 0.6% |
| | Other Paper | 3.2% | 3.3% | 10.3% | 2.8% |
| | PET Containers | 5.5% | 0.9% | 2.9% | 1.4% |
| | HDPE Containers | 1.3% | 2.2% | 0.8% | 0.8% |
| | Aluminum Cans | 0.6% | 0.2% | 0.4% | <0.1% |
| | Steel Cans | <0.1% | 0.9% | <0.1% | 0.4% |
| | Other Ferrous | 1.1% | <0.1% | 0.3% | 0.8% |
| | Other Non-Ferrous | <0.1% | 0.1% | <0.1% | 0.2% |
| | Glass Containers | 0.9% | 5.2% | 1.5% | 1.8% |
| Compostable | Compostable Paper | 13.2% | 8.4% | 11.7% | 11.4% |
| | Food Waste | 30.0% | 29.8% | 22.6% | 19.2% |
| | Leaves | <0.1% | 3.1% | <0.1% | <0.1% |
| | Grass | 0.3% | 1.3% | <0.1% | 1.5% |
| | Brush | 1.1% | 0.3% | <0.1% | <0.1% |
| Other Divertibles | Textiles | 2.8% | 2.3% | 3.3% | 3.2% |
| | Rubber | <0.1% | <0.1% | <0.1% | <0.1% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | <0.1% | <0.1% | 0.8% | 1.5% |
| | Plywood | 1.3% | <0.1% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.6% | <0.1% | <0.1% | <0.1% |
| | Pallets | <0.1% | <0.1% | <0.1% | <0.1% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 2.3% | 1.3% | 0.5% | 3.0% |
| | Soil/Ash | 0.9% | 0.2% | <0.1% | 0.7% |
| | Electronic Waste | 1.3% | 2.1% | 0.2% | 0.3% |
| | Solvents/Corrosive/Flammable | <0.1% | <0.1% | <0.1% | <0.1% |

The table continues on the next page.

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.6% | 0.3% | 0.4% | 1.7% |
| | Plastic Films | 11.0% | 7.1% | 15.3% | 12.6% |
| | Polystrene (#6) | 2.1% | 1.5% | 2.8% | 0.9% |
| | Rigid Plastic | 1.8% | 2.7% | 3.2% | 2.2% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | <0.1% |
| | Fines | 2.8% | 1.5% | 2.2% | 2.1% |
| | Aerosol Containers | <0.1% | 0.2% | <0.1% | 0.2% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | 1.8% | <0.1% | <0.1% |
| | Drywall/Gypsum Board | 1.0% | 0.8% | <0.1% | <0.1% |
| | Ceiling Tiles | <0.1% | <0.1% | <0.1% | 1.9% |
| | Other Uncategorized | 4.9% | 6.7% | 7.8% | 11.7% |
| | Other Inorganic Fines | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other C&D | <0.1% | 4.4% | 0.3% | 7.6% |
| | Medical Waste | <0.1% | <0.1% | 1.5% | 1.4% |
| | Furniture | 0.9% | 2.8% | <0.1% | 2.2% |
| | Mattresses | <0.1% | <0.1% | <0.1% | <0.1% |

**Composition based on 19 samples.**

Figure 20. Seasonal Composition of **Recyclables** in Burlington County

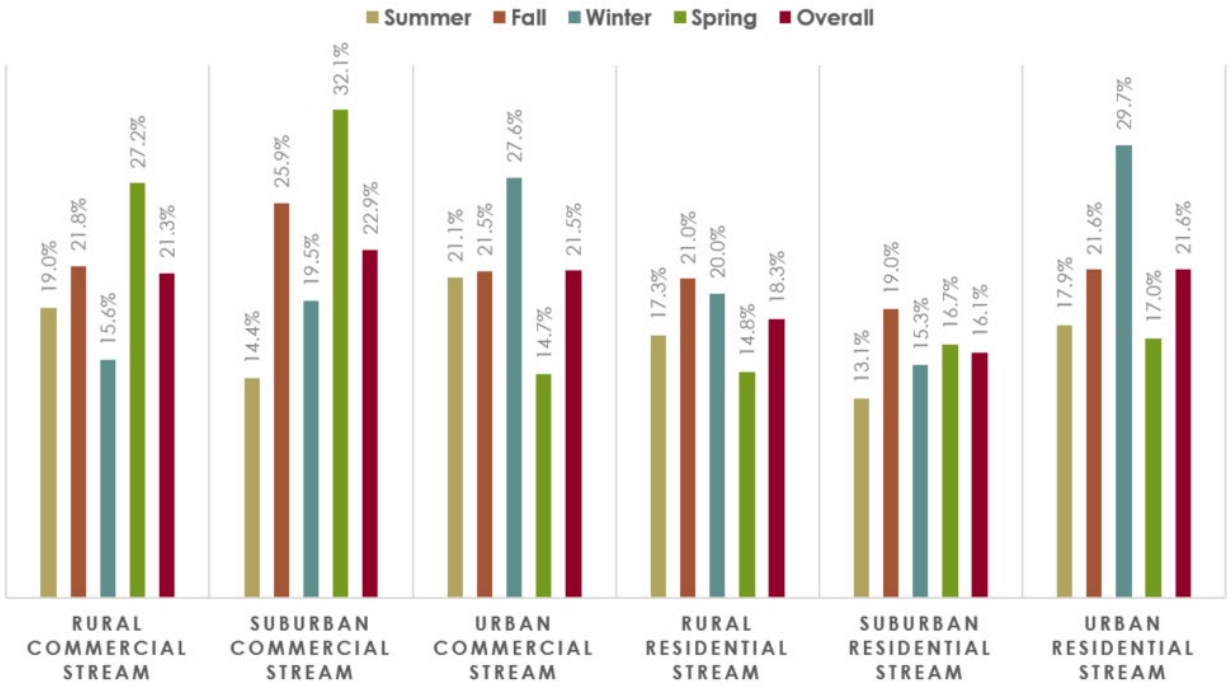



Figure 21. Seasonal Composition of **Compostables** in Burlington County

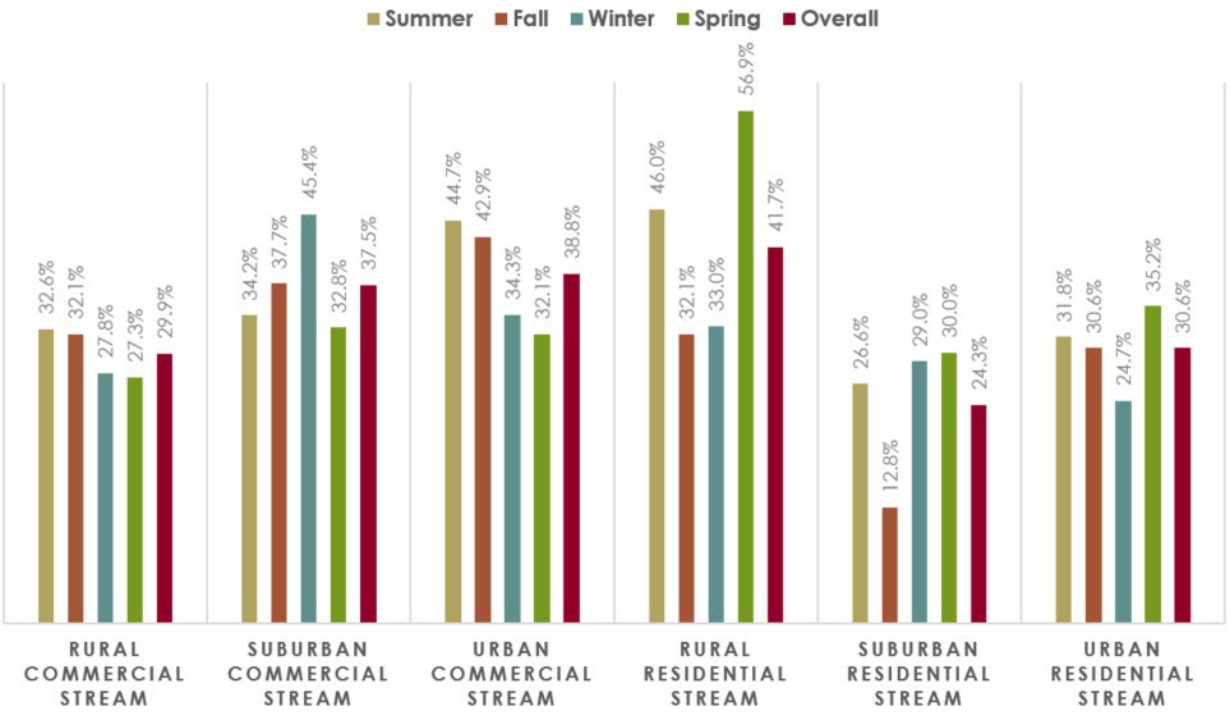


Figure 22. Seasonal Composition of **Other Divertibles** in Burlington County

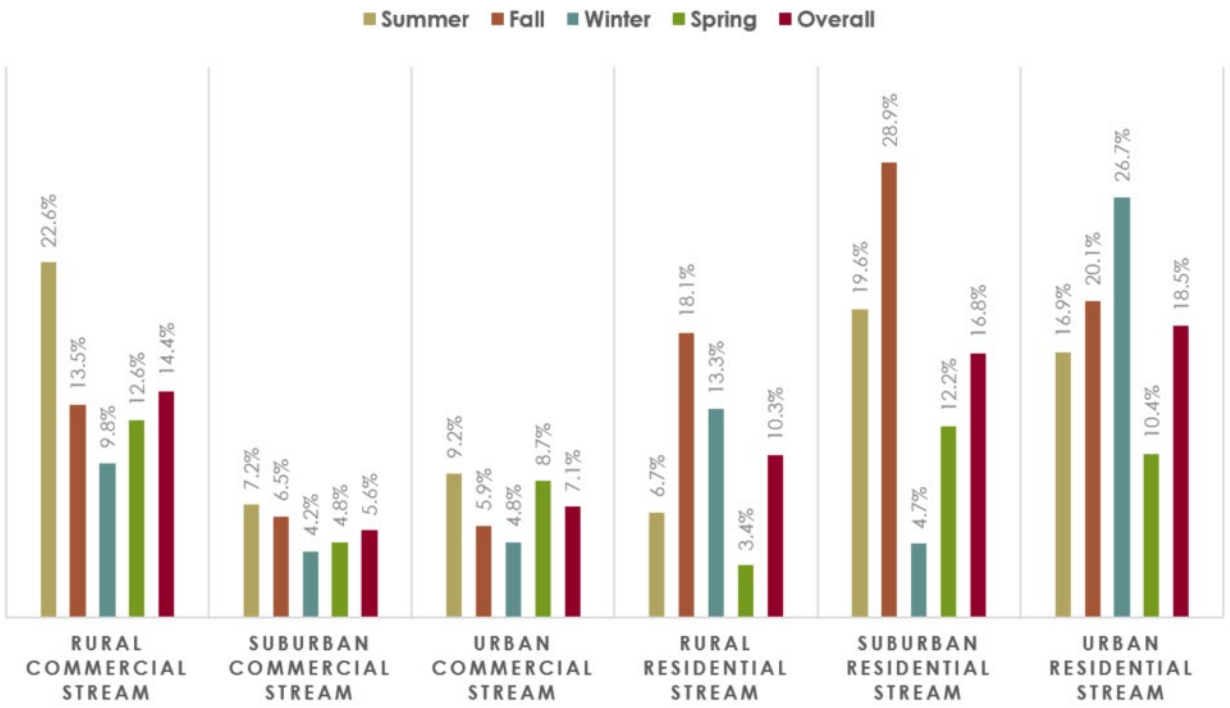
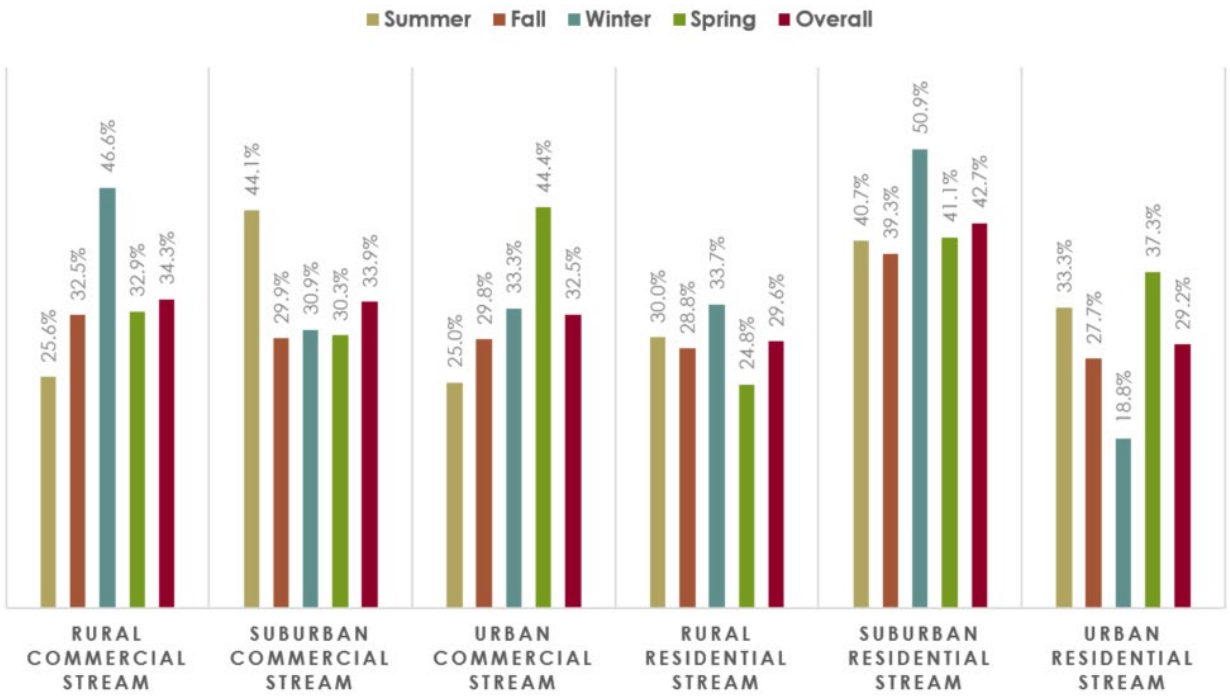



Figure 23. Seasonal Composition of **Non-Divertibles** in Burlington County



## PASSAIC COUNTY

Table 33. Passaic County Urban Residential Stream Compositions by Material

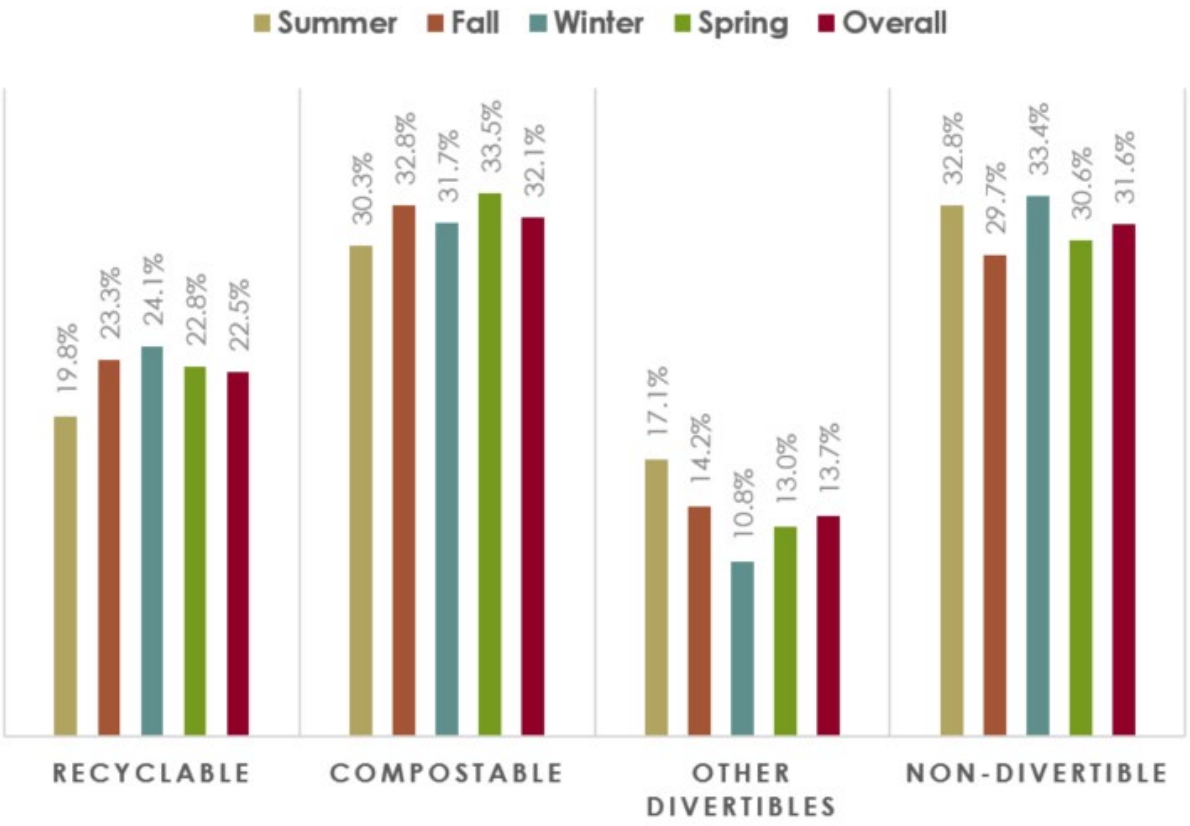
| | Material Type | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Recyclable | Newspaper | 1.1% | 0.7% | 1.9% | 0.8% |
| | Corrugated Cardboard | 3.5% | 9.6% | 5.3% | 4.8% |
| | White Office Paper | 1.4% | 1.0% | 0.8% | 1.1% |
| | Box Board | 2.7% | 2.4% | 1.8% | 2.5% |
| | Magazines | 0.5% | 0.6% | 1.0% | 0.6% |
| | Other Paper | 2.7% | 2.4% | 5.2% | 5.0% |
| | PET Containers | 2.1% | 1.5% | 1.4% | 2.5% |
| | HDPE Containers | 1.0% | 1.8% | 1.1% | 0.6% |
| | Aluminum Cans | 0.4% | 0.5% | 0.7% | 0.4% |
| | Steel Cans | 0.7% | 0.2% | 0.4% | 0.5% |
| | Other Ferrous | 1.2% | 0.6% | 0.7% | 1.3% |
| | Other Non-Ferrous | 0.2% | 0.3% | 1.1% | 0.4% |
| | Glass Containers | 2.3% | 1.6% | 2.6% | 2.3% |
| Compostable | Compostable Paper | 8.9% | 9.7% | 9.8% | 8.6% |
| | Food Waste | 16.6% | 17.6% | 21.6% | 21.2% |
| | Leaves | 0.6% | 4.2% | <0.1% | 1.6% |
| | Grass | 3.7% | 0.6% | <0.1% | <0.1% |
| | Brush | 0.5% | 0.7% | 0.3% | 2.2% |
| Other Divertibles | Textiles | 6.7% | 6.3% | 5.4% | 4.0% |
| | Rubber | <0.1% | <0.1% | <0.1% | 0.4% |
| | Leather | <0.1% | <0.1% | <0.1% | <0.1% |
| | Particle Board | 1.9% | 0.4% | <0.1% | 0.8% |
| | Plywood | <0.1% | 0.5% | <0.1% | <0.1% |
| | Batteries | <0.1% | <0.1% | <0.1% | <0.1% |
| | Paints | 0.8% | <0.1% | 0.2% | 0.7% |
| | Pallets | 0.9% | <0.1% | <0.1% | <0.1% |
| | Tree Parts | <0.1% | <0.1% | <0.1% | <0.1% |
| | Other Wood | 4.6% | 4.5% | 2.5% | 5.0% |
| | Soil/Ash | 1.6% | 1.0% | 1.2% | 1.1% |
| | Electronic Waste | 0.7% | 0.8% | 1.2% | 1.0% |
| | Solvents/Corrosive/Flammable | <0.1% | 0.6% | 0.2% | <0.1% |

The table continues on the next page.

| Material Type | | Summer Composition | Fall Composition | Winter Composition | Spring Composition |
|---|---|---|---|---|---|
| Non-Divertible | #3, 4 and 5 Containers | 0.5% | 0.4% | 0.6% | 0.5% |
| | Plastic Films | 7.8% | 12.0% | 12.1% | 9.2% |
| | Polystrene (#6) | 1.7% | 2.5% | 1.9% | 2.0% |
| | Rigid Plastic | 2.5% | 2.0% | 3.6% | 2.4% |
| | Other Plastic | <0.1% | <0.1% | <0.1% | <0.1% |
| | Fines | 2.6% | 2.3% | 2.0% | 1.7% |
| | Aerosol Containers | 0.1% | <0.1% | <0.1% | <0.1% |
| | Asphalt | <0.1% | <0.1% | <0.1% | <0.1% |
| | Masonry Materials | <0.1% | <0.1% | 0.4% | <0.1% |
| | Drywall/Gypsum Board | <0.1% | 0.7% | 1.0% | <0.1% |
| | Ceiling Tiles | 0.3% | <0.1% | 0.3% | <0.1% |
| | Other Uncategorized | 9.7% | 6.6% | 8.4% | 9.6% |
| | Other Inorganic Fines | <0.1% | 0.4% | <0.1% | 0.1% |
| | Other C&D | 2.8% | 1.3% | 1.5% | 4.1% |
| | Medical Waste | <0.1% | <0.1% | <0.1% | <0.1% |
| | Furniture | 3.0% | 1.6% | 1.7% | 1.0% |
| | Mattresses | 1.7% | <0.1% | <0.1% | <0.1% |

**Composition based on 36 samples.**

Figure 24. Seasonal Composition of Materials in Passaic County



# SCS ENGINEERS

SCS Engineers
Reston, VA 20190
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July 5, 2022

Appendix 2- CET Report

# WASTE CHARACTERIZATION STUDY COMPARATIVE ANALYSIS

## Rutgers University EcoComplex

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**August 5, 2022**

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# INTRODUCTION

The Center for EcoTechnology (CET) conducted a comparative analysis of municipal waste characterization studies to contextualize Rutgers University's Municipal Solid Waste Quantification and Characterization Study for Burlington, Mercer, and Passaic County New Jersey (henceforth referred to as, "Rutgers MSW Report"). This analysis aims to:

- Review findings and compare with two waste characterization studies across the US;
- Examine the food waste findings to extrapolate which business sectors may offer the largest food waste reduction and diversion impact;
- Provide recommendations for achieving food waste reduction and diversion from the commercial and institutional sectors.

CET is an innovative non-profit organization that helps people and businesses save energy and reduce waste. For more than 45 years, CET has offered practical solutions to save money, increase the health and comfort of our homes, and help businesses perform better.

# METHODOLOGY

CET identified two waste characterization studies which provide comparative insights to the Rutgers MSW Report findings. The scope of this report addresses waste generation across the commercial sector. Given the Rutgers MSW Report's layered geographic approach, the selected comparative waste characterization studies aim to provide insights into both geographic and overall MSW trends, potential opportunities for further investigation, and broad recommendations for furthering wasted food solutions. The following provides an overview of each chosen study and the perspective it aims to contribute to the comparative analysis.

### NRDC Estimating Quantities and Types of Food Waste at the City Level (henceforth referred to as, "NRDC Report")

Released in 2017, the NRDC Report provides insights into city (urban) level food waste generation. Each county the Rutgers MSW Report studies - Mercer, Burlington, and Passaic, abut metropolitan cities of Trenton, Philadelphia, and New York, respectively. This proximity to larger cities increases the likelihood that all three counties experience regional impacts. The NRDC Report offers potential insights into what recommendations could be most applicable for urban regions in New Jersey.

> *This first-of-its-kind report by the Natural Resources Defense Council describes the results of a food waste baseline assessment study in three U.S. cities—Denver, Nashville, and New York City—for residential and non-residential sectors, including the industrial, commercial and institutional (ICI) sectors. The intent of the study was to characterize the amount of food that is wasted in these cities, identify some of the reasons why the food is going to waste, and then use that data to help inform and inspire initiatives to prevent wasting food, to rescue surplus food to benefit people in need, and to recycle food scraps (Hoover & Moreno, 2017, p. 5).*

### CET Commercial Food Waste Generation Estimate for Westchester Country Report (henceforth referred to as, "Westchester County Report")

The 2018 Westchester County Report provides insights into county level food waste generation. Specifically, Westchester County with a population density of 2,332/sq. mi., shares similarities with Mercer County, a metropolitan regional county outside of Trenton, NJ that has a population density of 1,724.9/sq. mi. (United States Mercer, 2020) and Passaic County, a regional metropolitan county outside of New York City, with a population density of 2,817.6/ sq. mi. (United States Passaic, 2020). Identifying a county with similar proximity to urban locations also allowed for comparative insights to Burlington County which boasts a smaller population density, 577.8/sq mi (United States Burlington, 2020).

Through this study, CET surveyed commercial entities in Westchester County. Spanning ten sectors, CET utilized its Food Waste Estimator tool to project generation rates at individual entities with a goal of estimating total annual commercial food waste generation. This information was then used to refine data for estimating food waste that was calculated through a desk-study phase of the project.

### Key Variance Within the Reports Methodology

Three key variances between the comparative studies were identified when conducting the analysis: how the studies defined commercial food waste, the type of compostable material reviewed, and how each study derived its reporting data. The NRDC Report and Westchester County Report uses the term "Institutional, Commercial, and Industrial (ICI)" to classify the waste stream analyzed while the Rutgers MSW Report utilizes the term "Commercial Sector". The two former reports identify which sectors are reflected within its definition for "ICI" (see section, Analysis, Table 1 and 2). It is reasonable to assume that the Rutgers MSW Report "Commercial Sector" waste stream is analogous to that of the comparative studies. However, given the report only provided the "Commercial Sector" as a definition, it is plausible there are variances in the reporting - both in which sectors are present in the New Jersey counties studied, as well as which sectors were identified as part of the study.

Beyond sector variances, the type of compostable materials that were accounted for also varied between the comparative studies. In particular, food soiled paper and grass and yard trimmings were not accounted for in the NRDC Report (Hoover & Moreno, 2017, p. 48). Given the Westchester County Report utilized the CET Food Waste Estimator tool and estimated food waste generation to derive its reporting data, it is fair to assume that, similar to the NRDC Report, the report did not account for food soiled paper and grass and yard trimmings. While in the Rutgers MSW Report it was observed for the commercial sectors that, "There is a significantly lower proportion of compostable yard materials than were found in residential waste stream samples" (SCS Engineers, 2022, p. 18).

The studies also utilized different methodologies to derive its reporting data. The Rutgers MSW Report conducted 200-pound sample studies over four seasons (SCS Engineers, 2022, p.5). Whereas the NRDC Report provided estimates based on "proxy extrapolation", detailing "we

used available proxy data (e.g. number of beds, number of students, revenue) to create an estimate of food waste generation based on conversion factors from previous studies" (Hoover & Moreno, 2017, p. 46). Similarly, the Westchester County Report estimated total annual commercial food waste generation by collecting from data from 61 surveyed entities and applied CET's Food Waste Estimator tool to scale those numbers across each sector and derive food waste generation estimates for individual entities (Center for EcoTechnology, 2019, p. 2).

# ANALYSIS

The Rutgers MSW Report provides a high-level waste characterization analysis for commercial waste streams in New Jersey. The report provides a strong narrative from a geographic classification perspective. Understanding the waste generation variance between rural, suburban, and urban geographies can help inform how to prioritize food waste reduction initiatives. The Rutgers MSW Report also provides a comprehensive look at the compostable waste steam rather than food waste alone. This is a proactive step considering general policy trends demonstrate increased bans on single-use items and encourage pivoting to compost-friendly alternatives. The following details the focus areas for the comparative analysis:

- Commercial Waste Sector Comparison
- Disposed Food Waste Percentage of Total Commercial MSW Generated by County
- Investigating the Impact of Compostable Paper on Rural, Suburban, and Urban Waste Streams

Although the waste characterization studies showed variances between them, several trends and insights emerged. The following analysis aims to provide context to these trends and insights as well as identify possible opportunities for more comprehensive analysis that could further insights and help further inform forthcoming food waste reduction initiatives.

### Commercial Waste Sector Comparison

Both the NRDC Report and Westchester Country Report analyzed commercial food waste by sector. These studies reported Restaurants (full-service) as the sector with highest percent of food waste disposed, closely followed by Restaurants (limited-service) (Hoover & Moreno, 2017, p. 50); Center for EcoTechnology, 2019, p. 2). Averaging the two restaurant sectors percentages, Westchester County reported 33% of total disposed commercial food waste while the NRDC Report reported 44% for the restaurant sector (Center for EcoTechnology, 2019, p. 3; Hoover & Moreno, 2017, p. 50). The NRDC Report's higher percentage is reasonable given the study's urban scope with higher population densities compared to Westchester County which encompasses rural, suburban, and urban geographies.

All three New Jersey counties are part of large metropolitan areas similar to Westchester County, in particular Mercer and Passaic County have similar populations densities (see above). These analogous characteristics support Westchester County as a reasonable comparison to extrapolate plausible trends for New Jersey commercial food waste generation by sector. Given the Rutgers MSW Report looked more broadly at the commercial waste overall, the NDRC

Report and Westchester Country Report provide a framework for deeper analysis of New Jersey commercial wasted food by sector. In particular, the NRDC Report underscores the value in understanding sector-based generation to identify "where [intervention efforts] will be most effective in reducing waste and leveraging [intervention] resources" (Hoover & Moreno, 2017, p. 54).

Additional insights around sector-based food waste generation include the Westchester County Report observing that "food manufacturers were already diverting the vast majority of their food waste; this is consistent with findings of food manufacturing in other states, where it is simply more cost-effective to divert rather than haul as trash steady quantities of a known food waste stream" (Center for EcoTechnology, 2019, p. 2). While it is plausible that New Jersey would find similar trends to Westchester County, pursuing a deeper analysis that identifies which New Jersey commercial sectors generate the greatest amount of food waste, would provide insights into how to best prioritize interventions and programming for greatest impact. The following tables from the Westchester County Report and the NRDC Report highlight food waste generation rates by sector and can be informative in the absence of sector-specific data from the Rutgers MSW Report.

*Table 1 Estimated food waste disposed and generated by sector in Westchester County (Source: Westchester County Report)*

**Table 2. Estimated food waste disposed and generated by sector in Westchester County.**

| Sector | Estimated food waste disposed (t/yr) | % of total disposed | Estimated food waste generated (t/yr) |
|---|---|---|---|
| Assisted Living | 3,022 | 2% | 3,022 |
| Colleges & Universities | 760 | 1% | 760 |
| Correctional Facilities | 101 | 0.1% | 125 |
| Elementary | 541 | 0.4% | 541 |
| Middle Schools | 283 | 0.2% | 283 |
| High Schools | 134 | 0.1% | 134 |
| Hospitals | 3,148 | 2% | 3,148 |
| Lodging & Hotels | 911 | 1% | 911 |
| Restaurants - Full-Service | 51,661 | 41% | 51,661 |
| Restaurants - Limited-Service | 31,563 | 25% | 31,563 |
| Supermarkets & Grocery | 7,318 | 8% | 10,923 |
| Venues & Events | 441 | 0.3% | 441 |
| Food Manufacturers | 3,265 | 16% | 21,764 |
| **TOTAL** | **103,148** | **100%** | **125,277** |

*Table 2 NRDC commercial food waste generation results for Nashville, Denver, and NYC (Source: NRDC Report)*

| TABLE 60: ESTIMATED FOOD WASTE GENERATED BY SECTOR (ICI ONLY) | | | | | | |
|---|---|---|---|---|---|---|
| | NASHVILLE | | DENVER | | NYC | |
| | FOOD WASTE GENERATION (TONS/YEAR) | % OF TOTAL | FOOD WASTE GENERATION (TONS/YEAR) | % OF TOTAL | FOOD WASTE GENERATION (TONS/YEAR) | % OF TOTAL |
| Restaurants & Caterers | 59,993 | 50% | 45,158 | 42% | 262,226 | 44% |
| Colleges & Universities | 3,223 | 3% | 2,736 | 3% | 30,115 | 5% |
| K-12 Schools | 876 | 1% | 1,296 | 1% | 12,895 | 2% |
| Hospitality (Hotels) | 6,773 | 6% | 7,675 | 7% | 52,113 | 9% |
| Health Care | 3,794 | 3% | 2,683 | 2% | 28,752 | 5% |
| Events & Recreation Facilities | 2,996 | 3% | 4,197 | 4% | 7,520 | 1% |
| Correctional Facilities | 469 | 0% | 568 | 1% | 2,976 | 1% |
| Grocers & Markets | 15,299 | 13% | 11,480 | 11% | 61,310 | 10% |
| Food Wholesalers & Distributors | 14,271 | 12% | 16,757 | 15% | 49,122 | 8% |
| Food Manufacturing & Processing | 11,586 | 10% | 15,980 | 15% | 86,296 | 15% |
| TOTAL | 119,280 | 100% | 108,530 | 100% | 593,325 | 100% |

## Disposed Food Waste Percentage of Total Commercial MSW Generated by County

The Westchester County Report highlights findings about the percentage of food waste represented out of total commercial waste generated. Table 3 below outlines this percentage for the communities included in this study as well as Westchester County. Mercer County's urban generation can be observed as a slight outlier compared to the remainder of these source points.

*Table 3 Comparative disposed food waste as percentage (Data Source: Rutgers MSW Report and Westchester County Report)*

| Location | Disposed food waste as percentage (%) |
|---|---|
| Mercer County – Suburban | 20.0% |
| Mercer County – Urban | 13.6% |
| Burlington County – Rural | 18.8% |
| Burlington County – Suburban | 21.6% |
| Burlington County – Urban | 25.7% |
| Westchester County | 21% |

Mercer County, NJ and Westchester County, NY share similar population density allowing for a county level comparison, 1,725.8/ sq. mi. and 2,332/sq. mi. respectively (United States Mercer, 2020; United States Westchester, 2020). Given Westchester County exclusively analyzed food waste generation, the following comparison omits compostable paper, grass, and other compostable. Overall, both counties share similar commercial food waste generation rates with Mercer County at 16.8% (SCS Engineers, 2022, p. 15) and Westchester County at 21% (Center for EcoTechnology, 2019, p. 3). The numeric difference between the two data sets, especially being

only 4.2%, could stem from numerous differences included but not limited to variances in the: data collection methodology as outlined in an earlier section; commercial sector composition (number of restaurants versus grocery stores, etc.); access to existing food waste diversion programming or outlets allowing for greater voluntary diversion initiatives; county demographic consumption pattens; or, overall geographic composition between urban, suburban, and rural. Still, overall, this comparison supports the Rutgers MSW Report findings.

The Rutgers MSW Report also collected commercial food waste generation data for Burlington County, NJ. While the county's smaller population density, 577.8/sq. mi. makes it challenging to draw direct quantitative comparison to Westchester or Mercer County, higher level observations can still be gleamed. Despite its smaller population density, Burlington County boasts the highest commercial food waste generation at 22% (although compared to Mercer and Westchester County it is still within range) (SCS Engineers, 2022, p. 15). Most notably, Burlington county's urban food waste generation is almost double Mercer county's generation while their suburban county data are within 2% of each other.

In the Rutgers MSW Report, it was noted that suburban areas contain more farmer's markets which may be generating increased waste, as well as land use factors, though this does not explain why the urban sector would generate a significantly lower proportion of food waste in its MSW. One possible explanation is that Mercer County has a higher population density as it is within the Trenton, NJ metropolitan area whereas Burlington County abuts Philadelphia. General regional impacts from a larger city or sampled hauling routes servicing customers near Philadelphia could explain the higher urban food waste generation especially given the suburban food waste generation rates are so similar. Further research may be conducted to understand current diversion infrastructure in Mercer County as well as the composition of food generating businesses as compared to other entities.

*Table 4 Comparison of Commercial Food Waste and Compostable Paper versus Combined Percentages (Data Source: Rutgers MSW Report)*

| Location | Food Waste | Compostable Paper | Compostable Paper and Food Waste combined |
|---|---|---|---|
| Mercer County – Suburban | 20.0% | 8.4% | 28.4% |
| Mercer County – Urban | 13.6% | 7.3% | 20.9% |
| Burlington County – Rural | 18.8% | 8.7% | 27.5% |
| Burlington County – Suburban | 21.6% | 10.9% | 32.5% |
| Burlington County – Urban | 25.7% | 11.1% | 36.8% |

### Investigating the Impact of Compostable Paper on Rural, Suburban, and Urban Waste Streams

Based on a broad review of the Rutgers MSW Report, it was also noted that the total compostable portion of the Burlington County Rural Commercial Stream is significantly lower than that of the suburban and urban components of its waste stream, as demonstrated in Table 4 above. In comparison to the other areas of Burlington County it is notable that the rural commercial food waste and compostable paper generation are 5-9% lower comparatively to the remainder of the area. This could be contributed to the business sectors in these areas, or alternative handling options such as on-site composting, though further exploration should be conducted to understand factors that contribute to this data.

*Table 5 Top Three Compostable Materials by Commercial Stream (Source: Rutgers MSW Report)*

Table 7. Top Three Compostable Materials by Commercial Stream

| Material Type | Mercer County | | Burlington County | | |
|---|---|---|---|---|---|
| | Suburban | Urban | Rural | Suburban | Urban |
| Food Waste | 20.0% | 13.6% | 18.8% | 21.6% | 25.7% |
| Compostable Paper | 8.4% | 7.3% | 8.7% | 10.9% | 11.1% |
| Grass | 2.6% | 1.0% | 1.1% | 1.0% | 0.7% |
| Other Compostables | 0.6% | 0.6% | 1.3% | 4.0% | 1.2% |
| **TOTAL COMPOSTABLES** | **31.6%** | **22.5%** | **29.9%** | **37.5%** | **38.8%** |

Table 5 above, from the Rutgers MSW Report, outlines the composition of the compostable components of the overall commercial waste streams for each area. As would be expected for commercial to residential waste generation, yard debris makes up a significantly smaller portion of the organics stream from the commercial sectors. As noted in the Rutgers MSW Report, food waste comprises 50-60% of the compostable waste stream, indicating there is an opportunity for diversion (SCS Engineers, 2022, p. 15).

## RECOMMENDATIONS

Insights gained from this study can reveal areas for further investigation and inform next steps for wasted food solutions across the state. The Rutgers MSW Report provides an informative high-level study of commercial waste generation – offering insights about the types of materials generated across all business sectors in each region. As demonstrated through the analysis above, this information can be applied to offer preliminary findings for these communities. However, there is also an opportunity to conduct a more comprehensive study that may provide further insight into the quantity and types of materials generated by each business sector.

Further studies may provide additional data that informs planning and activity in these communities and across the state. For example, a study of sector-specific generation rates, similar to the work conducted for the Westchester County Report, could provide clarity into the

business sectors represented in the studied communities as well as the portion responsible for the largest amount of food waste by category. Planners can utilize this data to develop outreach strategies to support waste reduction initiatives. In the absence of more detailed information, the following sections highlight recommendations for applying findings from the study, as well as drawing on similar studies to inform action in New Jersey. These efforts can work to support the State of New Jersey's target to reduce food waste by 50% by the year 2030 compared to 2017 quantities (SCS Engineers, 2022, p. 10).

### Understanding Existing Initiatives and Infrastructure

Leverage existing efforts, plans and resources to maximize food waste reduction activity. Understanding the current policy landscape can serve as a starting point for planning efforts. The Mid-Atlantic Food Waste Policy Gap Analysis and Inventory includes a review of policies that influence food waste in New Jersey, providing insight into existing requirements for diversion and donation, as well as goals and plans that may impact waste generation. This can reveal areas where strong policies exist and can be leveraged, or where there may be opportunities for a leadership role. Rutgers EcoComplex may also look to the state's Sustainable Organic Material Management Plan for insights on areas of focus, goals, trends, and future growth across the state.

In addition to reviewing rules, plans, and goals, Rutgers EcoComplex could seek to identify other potential collaborators for activity. As noted in the NRDC report, there are opportunities to work with local, state, and federal agencies (Hoover & Moreno, 2017, p. 53). This may entail resource sharing, development of tools, or establishment of new infrastructure that can be created.

Processing infrastructure and capacity are directly connected with diversion. While certain strategies, such as food waste prevention practices, can be done without specific facilities, other efforts such as donation or diversion may require infrastructure. For example, food banks, pantries, and rescue agencies require facilities and equipment for storage, refrigeration, transportation, and distribution. These entities may be able to utilize existing infrastructure through partnerships, but it is important to consider how these requirements will be met as food rescue grows. The more prevention and donation strategies are implemented, the less the community will need to rely on diversion infrastructure. Composting sites and anaerobic digesters also require specific processing facilities, equipment, and transportation. New Jersey maintains a state list of Class C recycling facilities, which encompasses those that can handle food waste. Incremental growth may be a strategy to plan for expansion of donation and diversion while infrastructure is built.

### Estimating Waste Generation by Sector

While the Rutgers MSW Report does not include enough data to offer a sector-by-sector analysis, findings from the Westchester County Report and NRDC Reports can be broadly

applied to these communities. For example, the largest generators of food waste identified in the two aforementioned studies include:

- Restaurants & Caterers
- Food Wholesalers & Distributors
- Food Manufacturing & Processing
- Grocers & Markets

These findings also align with CET's field experience that the above list comprises large-volume food waste generators. Understanding that entities from these sectors may represent some of the large-volume commercial food waste generators in New Jersey, interventions can be identified to reduce waste. A variety of food waste reduction programming may be implemented, such as:

- Technical assistance offering direct support for adopting strategies across the EPA Food Recovery Hierarchy;
- Educational campaigns;
- Outreach initiatives, such as social media campaigns or a newsletter; and/or
- Food business challenges.

Depending on budget and focus, interventions can be targeted to reach a small number of high-volume generators or to implement a broader educational program that addresses waste across larger number of businesses which collectively represent a significant portion of the food waste stream. For example, food manufactures, which as noted in the analysis may currently have outlets for diversion already, typically generate larger quantities of waste per site than an individual restaurant although there may be significantly fewer food manufactures than restaurants in each area. These larger generators typically have a less public-facing impact as compared to restaurants, which could also serve to raise awareness with the public about food waste reduction. Understanding key audiences, current diversion strategies in place, budget for interventions, and time frame may inform initial sectors for focus. Seasonal fluctuations in waste generation could also be considered when developing programming.

In the absence of a full study conducted on waste generation rates by sector, Rutgers EcoComplex may look to existing food waste estimators to inform an area for focus. As referenced in the above analysis, CET developed the RecyclingWorks Food Waste Estimation Guide under contract with the Massachusetts Department of Environmental Protection. This guide compiles industry-specific data to project food waste generation on a business-by-business basis. Focusing solely on employees or students per year, Table 6 shows conversion factors from the NRDC Report that were applied to businesses within the study to arrive at sector-by-sector generation rates (Hoover & Moreno, 2017, Page 52). These calculations could similarly be applied to individual commercial entities.

*Table 6 Selected conversion factors by sector (Source: NRDC Report)*

| TABLE 63: SELECTED BIN DIG CONVERSION FACTORS BY SECTOR | | |
|---|---|---|
| | LOW END OF RANGE | HIGH END OF RANGE |
| Colleges & Universities | 162 lbs/employee/yr | 931 lbs/employee/yr |
| Corporate Cafeterias | 5 lbs/employee/yr | 80 lbs/employee/yr |
| Events & Recreation Facilities | 150 lbs/employee/yr | 4,200 lbs/employee/yr |
| Food Rescue Organizations | 1,823 lbs/employee/yr | 10,455 lbs/employee/yr |
| Health Care (Hospitals) | 32 lbs/employee/yr | 3,500 lbs/employee/yr |
| K-12 Schools | 12 lbs/student/yr | 50 lbs/student/yr |
| Restaurants & Caterers | 82 lbs/employee/yr | 5,200 lbs/employee/yr |

### Achieving Food Waste Reduction and Diversion from the Commercial and Institutional Sectors

While specific recommendations for achieving waste reduction can be tailored to a given business or industry, general practices of prevention, donation and diversion contribute to an overall goal of less waste. Food waste prevention can be a strategy that requires minimal infrastructure for businesses and institutions to implement. Simple tracking sheets can be used to monitor how waste is created and reasons for loss, informing the development of interventions to eliminate waste before it is created. CET's Wasted Food Solutions Toolbox includes a resource, Source Reduction Guidance that highlights strategies such as waste tracking, meal planning, food purchasing, and dining hall design.

Food donation provides community-wide solutions to waste as surplus edible food is redirected to hungry people. Based on CET's experience in the field it is estimated that approximately 20% of wasted food from a food business can be donated. Opportunities exist to work with area agencies to further donation. Rutgers EcoComplex can meet with these service providers to understand existing needs as well as opportunities for increased food recovery. Area agencies may be able to share information about the quantity of food that is donated, entities or sectors that are not currently reached, and infrastructure that could be developed or utilized to support these needs. Rescue agencies may also represent an opportunity for source separation as food that cannot be distributed in time may become waste.

Businesses often cite legal considerations as a barrier to donation. The Harvard Food Law and Policy Clinic has developed NJ-specific legal fact sheets on Date Labeling Laws, Liability Protections, Tax Incentives for Businesses, and Feeding Food Scraps to Animals as resources to address common concerns. An opportunity may also exist to work with the local health department to address barriers to donation and promote food recovery as a strategy embraced by health officials. CET's Food Donation Guidance is another tool that can be used to support donation in the business community.

Source separation for diversion is an additional strategy for the commercial sector. Because source separation requires few changes to current operations - placing material in a different container and adding a new collection service – this can serve as an easy entry-point for addressing wasted food. As businesses begin to understand the volume of waste that is being generated, operators may look to strategies higher in the Food Recovery Hierarchy to address waste at its source or redirect edible surplus. CET's Source Separation Guidance provides best practices for acceptable handling, storage, and hauling of material. Additionally, Hauler Contracting Guidance can be referenced as contracts with service providers are established for handling materials, including organics.

As strategies are implemented, share success stories. These spotlights can act as a motivator for businesses and institutions, demonstrating how other entities have implemented wasted food solutions, and inspiring action. Food business owners often know one another and seeing the success of a colleague can spur activity in other areas of the industry. Success stories also celebrate wins and elevate the visibility of champions who may be acting as leaders in waste reduction.

# REFERENCES

Center for EcoTechnology (CET). (2019). (tech.). *Commercial Food Waste Generation Estimate for Westchester County* (pp. 1–7). Pittsfield, MA: Center for EcoTechnology.

Hoover, D., & Moreno, L. (2017). (rep.). *Estimating Quantities and Types of Food Waste at the City Level* (pp. 1–62). New Yotk, NY: National Resources Defense Council, Inc.

SCS Engineers. (2022). (rep.). *Municipal Solid Waste Quantification and Characterization Study: Burlington, Mercer, & Passaic County* (pp. 1–71). Reston, VA: SCS Engineers.

United States Census Bureau. (2020). QuickFacts Burlington County, New Jersey. Washington D.C.; https://www.census.gov/quickfacts/fact/table/burlingtoncountynewjersey/POP060220.

United States Census Bureau. (2020). QuickFacts Mercer County, New Jersey. Washington D.C.; https://www.census.gov/quickfacts/mercercountynewjersey/POP060220.

United States Census Bureau. (2020). QuickFacts Passaic County, New Jersey. Washington D.C.; https://www.census.gov/quickfacts/fact/table/passaiccountynewjersey/POP060220.

United States Census Bureau. (2020). QuickFacts Westchester County, New Jersey. Washington D.C.; https://www.census.gov/quickfacts/fact/table/westchestercountynewyork/POP060220.

Appendix 3: NJCAT Report

REPORT TITLE: Recycling & Processing of Various Fractions of Municipal Solid Waste in Burlington, Mercer, and Passaic Counties in New Jersey

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## INTRODUCTION

New Jersey Corporation for Advanced Technology (NJCAT), functioning as a sub-awardee for the research project titled "Municipal Solid Waste Quantification and Characterization of Burlington County, Mercer County, and Passaic County", was assigned the responsibility to prepare a report on the recycling and processing opportunities associated with the various fractions of municipal solid waste (MSW) collected and characterized. This report provides insight into the various ways in which certain waste streams could be handled and processed to generate revenue streams and benefit mitigation of climate change efforts. NJCAT agrees with the assessment of published quantitative and qualitative data from many organizations of the scientific community that current methods of managing MSW such as landfilling and incineration have been ineffective at reducing greenhouse gas (GHG) emissions. The International Solid Waste Association (ISWA) Global Waste Management Outlook (GWMO) stated that the potential impact of improved waste and resource management in reducing GHG emissions could be as high as 15-20% [1,2]. To transform the current practices into sustainable and economically feasible alternatives, it would require careful characterization and separation of the waste streams into quality fractions to produce beneficial byproducts and promote effective disposal. Compostable waste materials such as food, leaves, grass, and paper, for example, present opportunities for economic benefits, which could result in establishing programs that support effective separation of these fractions from residential, commercial, and industrial waste streams. Diverting recyclable products from MSW such as cardboard, newspaper, and lumber have already been demonstrated to produce beneficial byproducts.

## SEPARATION AND RECYCLING OF WASTE STREAMS

Recycling of cardboard, newspaper, and lumber are currently done with methods that are effective to divert these waste streams from landfills. Therefore, efforts must be made to ensure that these waste streams are separated from the MSW so that they can be recycled into beneficial byproducts. Recycled cardboard, for example, greatly reduces the amount of energy, water, and raw material required for producing new corrugated packaging. It is estimated that recycled cardboard requires 90% less water and 50% less electricity than what is required for making new cardboard. Recycling of cardboard, newspaper, and lumber would result in many benefits such as water conservation, reduction of GHG and other air pollutants emissions due to the reduced amount of energy required, and reduction in the number of trees that would be required for new products.

Recycling of food and other organic waste, however, has been quite challenging due to costs, implementing collection activities, and effectiveness of adopted technologies to convert them into beneficial byproducts. The percentage of food waste in the MSW characterized at the New Jersey landfills in this study is reflective of a growing problem in the United States whereby a staggering amount is generated each year. Instead of sending to landfills, proper management of food and other organic waste could result in a circular carbon economy by converting it into byproducts such as low-carbon biofuels for energy needs, non-chemical fertilizers for agricultural crops, and compost. Methane released from the decomposition of organic waste is a potent GHG and can be used as Renewable Natural Gas (RNG) for energy needs. Therefore, landfilling and incineration of this waste should be avoided to assist in the ongoing battle to address climate change. New Jersey's Food Waste Recycling Act is an important step moving forward to divert food waste from landfills and reutilizing it as defined in the law.

To convert food and other organic waste into beneficial byproducts, care must be taken to reduce contamination with other waste streams so that there are no technical challenges during processing, and no negative impacts to the environment and human health. Currently, there is no requirement for residential food waste recycling in New Jersey. However, since the Rutgers Assessment showed that MSW contains approximately 18-20% food waste, the State may consider including residential food waste as part of this recycling effort. The State may also consider recommending that the collection of pre- and post-consumer food waste are done in accordance with acceptable waste management guidelines, which could require waste haulers to collect uncontaminated food waste in dedicated vehicles to prevent contamination from non-food waste products. Some recommendations for the separation and collection of food waste from industrial, commercial, and residential sources are as follows:

- Food scraps should be collected in dedicated airtight receptacles that control odors, and protect against insects and pests.
- Food scrap receptacles should be uniform (i.e., color, size, etc.) so as to easily be identified and not confused with other waste streams receptacles.
- Food scrap receptacles should be placed alongside other trash and recycling receptacles to make separation easy and encourage compliance.
- Food scraps should be removed from kitchens and applicable areas at the same frequency as other trash.
- Outdoor surfaces for containing receptacles should be non-permeable and sloped to drain away from buildings and sensitive areas.
- To prevent access by animals, the trash and recycling areas should be fenced or placed in the most remote areas possible.
- Dumpsters, carts, and compactors should be watertight, capable of being closed and locked, and easily accessible for cleaning.
- Food waste receptables should be cleaned periodically with high pressure pumps, steam, hot water, or detergent as necessary.

CONVERTING FOOD WASTE INTO BENEFICIAL BYPRODUCTS

Circular carbon reutilization approaches can make food and other organic waste valuable products for producing low-carbon fuels for energy needs, fertilizers for agricultural applications, and compost for landscaping. Research studies have shown that organic waste at landfills in the United States account for 18% of the methane emitted into the atmosphere, and many facilities are currently planning to divert organic waste from landfills to engineering systems that produce biogas and other beneficial byproducts. This is considered the best solution for extracting the maximum benefits from organic wastes while reducing pollutants to air, water, and soil. However, the many challenges to make this into a sustainable process include adopting effective technologies for NJ-specific organic waste streams, suitable sites to operate these processes, costs associated with infrastructure, securing a sustainable supply of clean organic waste, and acquiring the required regulatory permits (especially if planned for areas that are considered overburdened communities).

The most efficient method for treating a variety of organic wastes is anaerobic digestion (AD), which is a process that can simultaneously produce digester gas to generate electricity or satisfy heating needs, nutrient rich solid digestate for use as a soil amendment, and compost. Because it is a robust and flexible technology, AD systems can treat a wide variety of organic waste ranging

from soluble cheese whey to insoluble concentrated fats, oils, and grease (FOG). However, to ensure that organic waste streams are properly prepared and the most effective processes are used to manufacture the desired byproducts, it would require careful analysis of the organic waste streams. This would allow for the most effective AD systems and cleanup technologies to be used for manufacturing the desired byproducts, and ensuring compliance with regulatory and quality control requirements associated with the manufacture, transportation and use of the byproducts. Some of the activities that are key to the conversion of organic waste into valuable high-methane digester gas or RNG are as follows:

1. Organic feedstock preparation – This directly influences the performance of the AD systems, and therefore, assessment and preparation of the feedstock are essential for achieving steady-state operating conditions. Preparation of the feedstock would require the following:
   a. Selection of the feedstock types, either in their natural state or comingled with other organic waste, that are capable of producing high-methane digester gas or RNG.
   b. The analytical method(s) that should be used for gas sample collection and analysis to identify the constituents of the raw digester gas from the AD systems.

2. Anaerobic digestion systems - Although considered a mature technology, poor process stability can result in inefficient performance and failures of the AD systems. Systems that process food waste alone are more susceptible to poor operating stability if not monitored and managed carefully. Therefore, in addition to selecting the most effective AD systems, careful monitoring and control of key operational parameters such as temperature, pressure, moisture content, influent and effluent flow rates, etc., are critical to successful outcomes.

3. Digester gas cleanup systems – The digester gas produced from the processing of certain high quality organic waste in AD systems is composed of 50% to 60% methane, with the other constituents being carbon dioxide, moisture, ammonia, and sulfur. However, if the digester gas is produced from the treatment of wastewater alone, it could have a methane concentration of 50% or lower and contain additional impurities such as siloxanes and hydrogen sulfide. The choice of digester gas clean technologies is based on the ability to remove almost all of the impurities. Also, the components of the digester gas cleanup systems must be easily accessible to conduct cost-effective preventative and corrective maintenance.

4. Use of digester gas - The most common use of methane-rich digester gas is to fuel internal combustion engines or turbines used as simple cycle power generation or combined heat and power (CHP) systems. To ensure that these devices operate properly, they must be chosen accordingly to match the quality and energy density of the digester gas, and ensure that the resulting GHG and criteria pollutants emissions are in compliance with State and federal environmental standards. A more profitable use of digester gas is injection into the natural gas pipelines as RNG, which would require additional analyses as follows:
   a) Specific technical requirements for pipeline gas injection in accordance with standards of the State and utility companies.
   b) Federal guidelines on renewable fuel standards (RFS).
   c) Monitoring procedures for maintaining RNG quality assurance.

OPPORTUNITIES FOR REUSE OF ORGANIC WASTE

1. **Co-Digestion of Food Waste with Sewage Sludge** - Food waste produced in urban areas is commonly co-digested with sewage sludge at wastewater treatment facilities (WWTFs). Due to the low methane yield from AD systems that treat wastewater, co-digestion of food waste with sewage sludge will not only increase the methane concentration but also improve the sewage degradation. Recommended mixing ratio of food waste with sewage sludge to boost methane content is between 33.3% and 50% [3]. However, the disadvantage of co-digesting food waste with sewage sludge is that the solid digestate resulting from the digestion process may be subjected to additional regulations if used for land applications because of concerns with pathogens and heavy metals in the sewage sludge. Also, the high concentration of salt in food waste can be problematic during co-digestion and land application [4]. From an economic perspective, the ability to accommodate food waste in wastewater AD systems provides an opportunity for WWTFs to generate additional revenue from tipping fees.

2. **Co-Location of AD Systems at Landfills** - Landfills are regarded as the third largest source of anthropogenic methane emissions in the United States due to fugitive emissions and other emissions generated prior to cell closure and gas collection system installation. Current landfill designs and operational practices are generally not capable of completely collecting landfill gas (LFG) since it is generated at a high rate from highly putrescible wastes. Organic material residuals/nutrients are not recovered from landfills for beneficial reuse primarily due to the cost and difficulty of separating impurities from mixed MSW prior to disposal. Industrial scale composting of organic waste does not deliver efficient solutions either since the aerobic decomposition of the organic waste is not suitable for gas recovery. In addition, there may be pockets of anaerobic decomposition occurring during composting and, as a result, methane leakages may occur. A California air survey conducted by a team of NASA scientists showed that, in addition to landfills appearing as prominent hot spots for methane leakages, composting facilities also appeared in the survey as hot spots, despite belief that compost facilities do not generate methane [5]. Also, if not managed properly, the composting process often creates significant odor problems resulting in complaints from surrounding communities. Composting facilities should be designed as a second step after the AD process treats the waste and recovers biogenic carbon for energy uses. The digestate can then be filtered and the solids can be used as feedstock for composting processes. Neither landfilling nor direct industrial composting provide optimal reutilization of organic waste, and neither can achieve both clean energy and recycled nutrient recovery in one process to achieve the maximum GHG reductions.

   Since solid waste disposal in New Jersey is the responsibility of the counties, and most counties utilize landfills for waste disposal, owners and operators of these facilities have objected to diverting food waste from MSW due to the impact on revenue generation from tipping fees. This will be a hurdle for the State to develop efficient GHG reduction plans that involve the separation of food waste from MSW. However, landfills can be transformed into more efficient facilities from a GHG emissions perspective by banning the burying of organic waste in landfill cells along with other biomass constituents of MSW, and encouraging the siting of AD systems on the premises. Landfills hosting AD units are well positioned to receive source separated food waste since they can utilize existing waste delivery infrastructure and energy generation assets. Using this approach, landfills will be able to remove the negative stigma attached to their current practices and be transitioned into tomorrow's clean and sustainable energy

operations. Furthermore, landfills will be able to recover cleaner biogas and generate additional revenue from the production of electricity and organic fertilizers thus reducing the economic and environmental burdens for the counties in the State.

3. **Co-Digestion of Food Waste with Dairy Manure in Farms** – This is an economically viable option as food waste can be treated with existing AD systems on farms to avoid high capital investment costs. In addition to boosting gas production rates, using food waste could generate additional income for the farms from tipping fees, and production of electricity for onsite use or sold to the electric grid. The most commonly used farm waste for co-digestion is animal manure, while crop residues, waste bedding materials, and fruit and vegetable wastes have also been studied intensively. Using food waste was determined to be most beneficial to increase maximum allowable organic loading rates of the digester, provide a more stable environment for anaerobic microbes, increase the degradation of lipids, and boost biogas production [6]. Co-digestion of swine manure with food waste increased biogas production by 80-400% [7], and the sensitivity of the AD process to environmental changes was also reduced [8]. Crop residues such as corn stover and rice husks, that have high carbon to nitrogen (C/N) ratios and low degradability, have been widely studied as co-substrates for food waste. The goal is to achieve a C/N ratio of 20-40 by balancing the high nitrogen content in food waste, and reduce the overall volatile fatty acids (VFA) production rate [9]. Co-digestion of food waste with crop residues was also found to increase the AD organic loading rate [10].

REFERENCES


1. United Nations Environment Programme (UNEP) and International Solid Waste Association (ISWA) (2015). Global Waste Management Outlook. Wilson DC (Ed) Authors: Wilson DC, Rodic L, Modak P, Soos R, Carpintero A, Velis CA, Iyer M & Simonett O. UNEP International Environment Technology Centre: Osaka, September 2015.
2. Wilson, D., & Velis, C., 2015, "Waste management –still a global challenge in the 21st century: an evidence-based call for an action, Waste Management & Research, 33(12), 1049-1051.
3. Xu F, Li Y, Wicks M, Li Y, Keener H (2018) Anaerobic Digestion of Food Waste for Bioenergy Production. Adv Food Process Technology: AFPT-112. DOI: 10.29011/AFPT-112.100012.
4. Anwar N, Wang W, Zhang J, Li Y, Chen C, et al. (2016) Effect of sodium salt on anaerobic digestion of kitchen waste. Water Science Technology 73: 1865-1871.
5. MSW Management magazine January/February 2020, www.mswmanagement.com.
6. Zhang C, Su H, Baeyens J, Tan T (2014) Reviewing the anaerobic digestion of food waste for biogas production. Renewable and Sustainable Energy; Volume 38: 383-392.
7. Zhang L, Lee YW, Jahng D (2011) Anaerobic co-digestion of food waste and piggery wastewater: Focusing on the role of trace elements. Bioresource Technology 102: 5048-5059.
8. Creamer KS, Chen Y, Williams CM. Cheng JJ (2010) Stable thermophilic anaerobic digestion of Dissolved Air Flotation (DAF) sludge by co-digestion with swine manure. Bioresource Technology 101: 3020-3024.
9. Xu F, L, Y, Ge X, Yang L, Li Y (2018) Anaerobic digestion of food waste - Challenges and opportunities. Bioresource Technology 247: 1047-1058.
10. Braguglia CM, Gallipoli A, Gianico A, Pagliaccia P (2017) Anaerobic bioconversion of food waste into energy: A critical review. Bioresource Technology 248: 37-56.

11. Guran, S., 2018, “Sustainable waste-to-energy technologies-Gasification & Pyrolysis” in “Sustainable Food Waste-to-Energy Systems”, Ed. T. Trabold & Callie W. Babbitt, 141-158 eBook ISBN: 9780128111581, Paperback ISBN: 9780128111574, 811157-4.
12. Guran, S., 2018, “Sustainable waste-to-energy technologies -Hydrothermal Liquefaction” in “Sustainable Food Waste-to-Energy Systems”, Ed. T. Trabold 159-175. & Callie W. Babbitt, eBook ISBN: 9780128111581, Paperback ISBN: 9780128111574.