WASTE COMPOSITION OF POLK COUNTY

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Prepared for:
Polk County

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EXECUTIVE SUMMARY

During the week of November 3rd-7th, 2025, students from the University of Florida, Florida Polytechnic University, and Florida Atlantic University performed a waste composition study at the Polk County North Central Landfill. This study was funded by the Florida Department of Environmental Protection (FDEP) through the Solid Waste Infrastructure for Recycling (SWIFR) grant[1]. The goals of this project were to: 1) provide Polk County with a current evaluation of their municipal solid waste (MSW) composition; and 2) update FDEP's *WasteCalc* tool, which relies on current waste composition studies to calculate the material composition of MSW for each of Florida's 67 counties.

Throughout the study week, 40 samples were sorted, with waste originating from residences and businesses in both the municipalities and unincorporated areas of Polk County. Incoming garbage trucks were randomly selected from each category of the sampling plan until the desired number of samples were acquired. An approximately 200-pound sample of MSW was obtained from each truck, and the waste was manually sorted into 42 different categories by undergraduate researchers from the SWIFR team. After the sample was sorted, the contents of each category were weighed and discarded. The mass-based composition of each sample was calculated, then averaged across the 40 samples to determine the overall composition of the Polk County waste stream. The results found "Food Waste" to be the largest component of Polk County's waste stream at 19.8%. Typical contents placed into this category include food preparation wastes, food scraps, and spoiled food. The results of the Polk County waste composition will be integrated into *WasteCalc* to provide more accurate and representative results for this county and other similar counties in the state.

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ABBREVIATIONS AND ACRONYMS

C&D Debris	Construction and Demolition Debris
EPA	US Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
RNG	Renewable Natural Gas
SWIFR	Solid Waste Infrastructure for Recycling

1. INTRODUCTION

Polk County, located in Central Florida, is the ninth most populous county in the state with an estimated 826,090 residents between the unincorporated areas and 17 municipalities[2]. The County owns and operates the North Central Landfill, which accepts municipal solid waste (MSW) from various businesses, single-family homes, and multifamily complexes in the County. The North Central Landfill site also includes a yard trash processing area, a transfer station for residents in smaller vehicles, a renewable natural gas (RNG) production facility, and a constructed wetlands treatment system for landfill leachate.

Residential waste hauling for the unincorporated areas is split into three collection zones as shown in **Figure 1** below. FCC works primarily in western Polk County, GFL operates in eastern Polk County, and Polk County Solid Waste hauls in southern Polk County. Businesses in the unincorporated areas contract waste collection services directly with the hauler. Many municipalities self-perform the collection of residential and commercial waste within their city limits, including the Cities of Lakeland, Winter Haven, Bartow, Auburndale, and Lake Alfred. Other municipalities, such as Lake Wales and Haines City, contract their waste collection services with private haulers. The County also accepts waste hauled by residents (especially at the on-site transfer station) and "mom-and-pop" customers (who primarily bring in bulk waste in dump trailers).

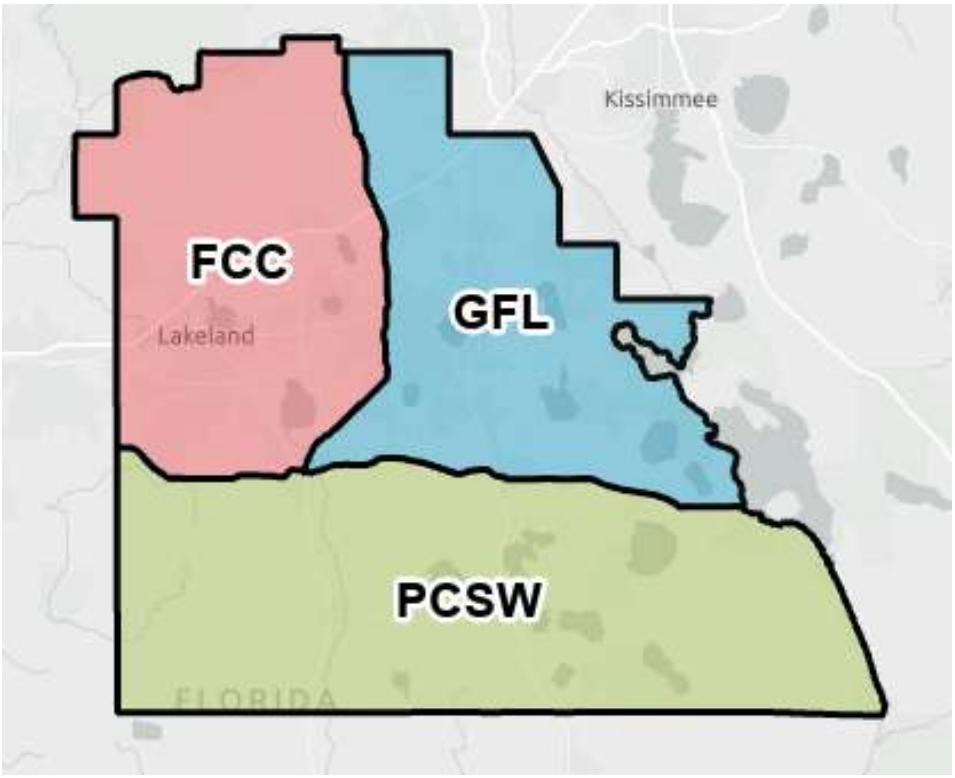

Figure 1 - Solid Waste Zones of Polk County[3]

2. METHODOLOGY

2.1 Preparation

Experience from previous waste composition studies conducted by the researchers suggested that 40 samples could reasonably be selected and sorted over the course of a weeklong waste composition study. ASTM D5231-92: *Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste*[4] was followed for development of the sampling plan and protocol.

Equation 1 was used to determine the proportion of the 40 samples that should come from residential and commercial sources. For this study's purpose, commercial waste included businesses as well multifamily residences (e.g., apartment complexes, condominiums). Residential waste strictly included curbside collection from single-family homes. Based on the tons of commercial, multifamily residential, and single-family residential waste collected in Polk County in 2024 (from the 2024 FDEP annual solid waste report)[5], it was determined that 23 samples should originate from commercial and multifamily sources and 17 samples should originate from single family residential sources.

Equation 1

$$Number\ of\ Samples = 40 * \frac{Annual\ Tonnage\ of\ Residential\ or\ Commercial}{Total\ Annual\ Tonnage}$$

Beyond separating residential and commercial waste, the sampling plan also accounted for waste originating from the different hauling zones in the unincorporated areas, as well as the County's various municipalities. The sampling plan consisted of approximately half the samples from unincorporated areas (12 commercial and 8 residential samples), and the other half from the municipalities (11 commercial and 9 residential samples).

2.2 Sampling Method

During the composition study, samples were obtained from the working face of the North Central Landfill and identified based on the type of collection vehicle and hauler. Commercial waste was collected in front-end-loaders and compactors, while residential waste was collected in automatic side loaders and rear loaders. Open-top roll-offs and "mom-and-pop" haulers disposing of C&D debris or other bulky wastes were excluded from this study due to the difficulty of manually sorting this material. The origin of the waste (i.e., unincorporated areas vs municipalities) was identified by the type of hauler, as well as conversations with the driver. For example, residential waste from the unincorporated areas was easily identifiable by the hauler (i.e., GFL, FCC, Polk County Solid Waste), as was waste from the municipalities that self-perform their own

collection. For commercial unincorporated waste and counties that contract their hauling, the driver was interviewed to determine the geographic origin of the waste.

The trucks carrying samples of interest were identified as they entered the working face, and spotters directed the drivers to back into a specified area where samples could be safely obtained. Once the trucks were emptied, a skid steer was used to randomly select an approximately 200-lb sample of waste and load the sample into 96-gallon rolling carts, as seen in **Figure 2**. The rolling carts were then labeled and transported on a flat-bed trailer to the sorting location at the retired materials recovery facility (MRF) on-site.

Figure 2 - Example of Sample Collection

2.3 Sorting Method

The sorting table was staged at the MRF to provide the researchers with a safe space to work away from landfill operations and vehicle traffic. Once the samples arrived from the working face, the sorting team weighed the carts on a floor scale until the contents of reached approximately 200 pounds. Then, the carts were lifted onto a sorting table with a two-inch square mesh top, as shown in **Figure 3**. Any material which passed through the mesh was classified as “residuals” and remained unsorted; material remaining on top of the mesh was manually sorted into 42 material categories using the list in the *Material Categories* section of the appendix. The residuals were captured on a tarp and weighed separately. A lined bin was reserved for each of the material categories, and once the entire sample was sorted, the bin liners were removed, weighed, and disposed of in a roll-off container provided by Polk County. The mass of each material

category was recorded on the sampling sheet in the appendix so the overall mass-based composition could be determined.

Figure 3 – Set-up of Polk County Waste Composition study

3. DATA AND RESULTS

3.1 Raw Data Collected

Raw data refers to the fact that this data is presented in the 42 categories decided upon by the SWIFR team and Polk County. The next section organizes the data into broader categories to give a general breakdown of the MSW stream. Each table in this section is color-coded to match the general category it falls under in *Section 3.2 Processed Data*. The percentages were based on the averages of the mass fraction for each category. The equations used, as seen below, follow the ASTM D5231 method[4].

Equation 2 was used to determine the individual mass fraction of each category in a sample.

Equation 2

$$mf_i = \frac{w_i}{\sum_{i=1}^{j} w_i}$$

Where:

$mf_i = mass\ fraction\ of\ component\ i$
$w_i = weight\ of\ component\ i$
$j = number\ of\ components$

Then, the category mass fraction for all 40 samples was averaged and multiplied by 100 to obtain a percentage, as seen in
Equation 3 and
Equation 4.

Equation 3

$$\bar{m}f_i = \frac{1}{n}\sum_{k=1}^{n} mf_i$$

Equation 4

$$Category\ Percentage = \bar{m}f_i * 100$$

Where:

$\bar{m}f_i = mean\ mass\ fraction$

Raw data from the Polk County waste sort is shown in **Table 1**. The mass fraction of the total waste stream, commercial samples, and residential samples were calculated and recorded.

Table 1 - Raw Data Collected in Polk County

WasteCalc Category	Material Category	Mass Percent		
		Total	Residential	Commercial
Newspaper	Newspaper	0.5%	0.8%	0.4%
Corrugated Cardboard	Corrugated Cardboard (OCC)	6.1%	4.9%	7.1%
Office Paper	High Grade Paper (Office Type)	2.2%	1.8%	2.5%
Other Papers	Polycoated Aseptic Containers	0.6%	0.4%	0.8%
	Food Service Containers (Polycoated)	1.3%	1.6%	1.1%
	Other Composite	1.1%	1.4%	0.9%
	Boxboards	2.0%	2.2%	1.9%
	Other Paper	8.6%	8.5%	8.8%
Glass Packaging	Green	0.4%	0.3%	0.5%
	Clear	2.3%	2.3%	2.4%
	Brown	1.2%	1.3%	1.1%
	Other Glass/Ceramics	0.5%	0.5%	0.4%
Steel Cans	Steel/Tin Cans	1.0%	1.3%	0.8%
Other Ferrous Metals	Other Ferrous Metals	1.0%	0.4%	1.4%
Aluminum Cans	Aluminum Cans/Foil	1.2%	1.3%	1.1%
Non-Ferrous Metals	Other Non-Ferrous	0.5%	0.8%	0.3%
Textiles	Clothing, Footwear, Other Textiles	4.9%	4.8%	4.9%
Yard Trash	Yard Waste	1.8%	3.2%	0.7%
Food Waste	Food Waste	19.8%	15.2%	23.2%
Plastic Containers	#1 PET Bottles	2.3%	2.3%	2.2%
	#2 HDPE Bottles - Translucent	0.6%	0.7%	0.5%
	#2 HDPE Bottles - Colored	0.6%	0.8%	0.5%
Other Plastics	#3-7 (Other Plastic Bottles)	0.2%	0.2%	0.2%
	Expanded Polystyrene (Food Service)	1.0%	0.9%	1.1%
	Expanded Polystyrene	0.2%	0.2%	0.1%
	Rigid Plastic (Tubs, Cups, Lids)	1.4%	1.3%	1.4%
	Rigid Plastic (Food Service Plastics)	1.1%	1.2%	1.1%
	Grocery Bags	1.2%	1.4%	1.0%
	Other Flexible Plastics	7.2%	5.8%	8.3%
	Other Plastics	2.8%	2.8%	2.8%
C&D	Wood	2.5%	2.5%	2.5%
	Ashphalt Shingles	0.2%	0.6%	0.0%
	Gypsum Drywall	0.1%	0.2%	0.0%
	Concrete/Bricks	1.1%	2.5%	0.1%
Other Miscellaneous	Rubber and Leather	0.2%	0.4%	0.1%
	Small Appliances/Electronics	1.1%	1.7%	0.7%
	Hazardous Waste	0.3%	0.5%	0.2%
	Lithium-Ion Battery Products	0.1%	0.1%	0.1%
	Residuals	8.5%	10.0%	7.5%
	Liquids	4.3%	2.8%	5.3%
	Animal By-Product	2.0%	3.2%	1.1%
	Other Organics	4.1%	5.0%	3.4%

3.2 Processed Data

Data presented in this section has been complied into more general groups, based on the 18 material categories in FDEP's *WasteCalc* tool. For example, the categories of "Other Paper", "Polycoated Aseptic Containers", "Food Service

Containers", "Other Composite", and "Boxboards" were compiled into the general category "Other Paper". Presenting data in this manner provides a broad overview of Polk County's waste stream and allows for harmonization with the existing *WasteCalc* tool. Processed data from the Polk County waste sort is shown in **Table 2** below. Graphical representations of each waste sort can be found in **Figure 4Figure 6**.

Table 2 - Processed Data in Polk County

WasteCalc Category	Total	Mass Percent Residential	Commercial
Newspaper	0.5%	0.8%	0.4%
Corrugated Cardboard	6.1%	4.9%	7.1%
Office Paper	2.2%	1.8%	2.5%
Other Papers	13.6%	14.0%	13.4%
Glass Packaging	4.4%	4.4%	4.4%
Steel Cans	1.0%	1.3%	0.8%
Other Ferrous Metals	1.0%	0.4%	1.4%
Aluminum Cans	1.2%	1.3%	1.1%
Non-Ferrous Metals	0.5%	0.8%	0.3%
Textiles	4.9%	4.8%	4.9%
Yard Trash	1.8%	3.2%	0.7%
Food Waste	19.8%	15.2%	23.2%
Plastic Containers	3.4%	3.8%	3.2%
Other Plastics	15.0%	13.8%	15.9%
C&D	4.0%	5.8%	2.6%
Other Miscellaneous	20.6%	23.7%	18.2%

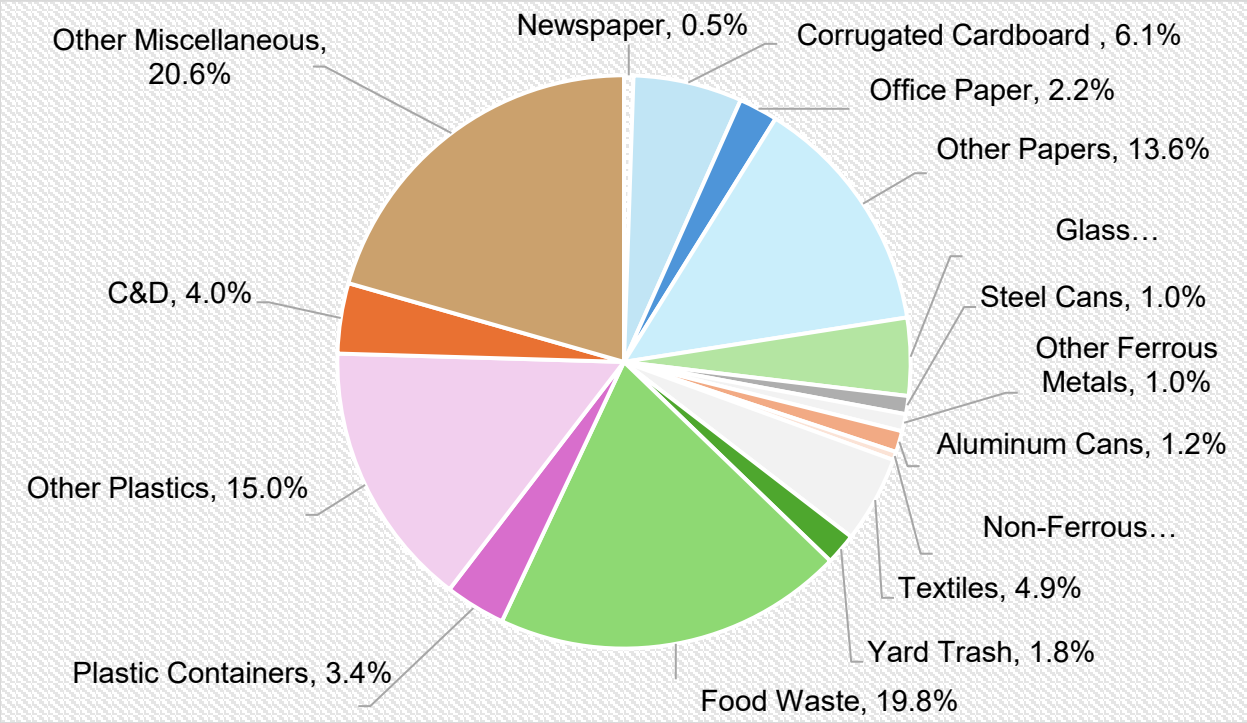

Figure 4 – Total Waste Composition

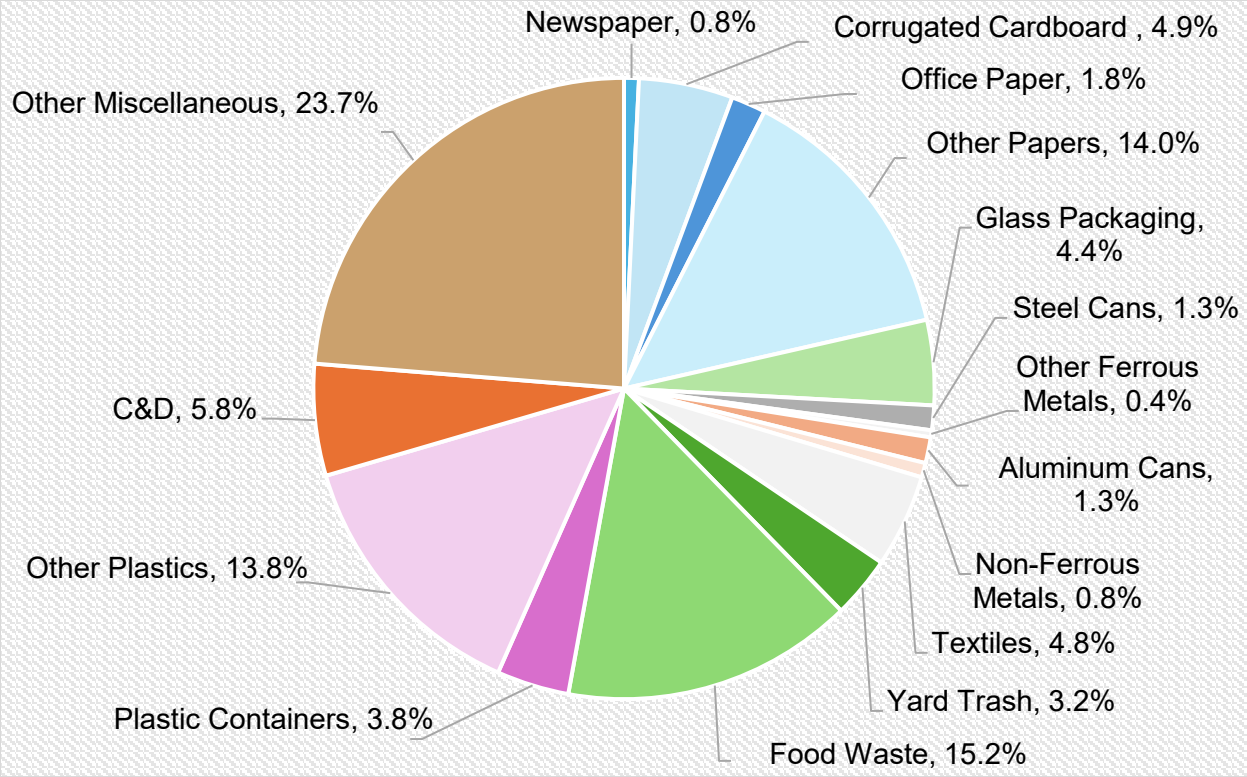

Figure 5 - Residential Waste Composition

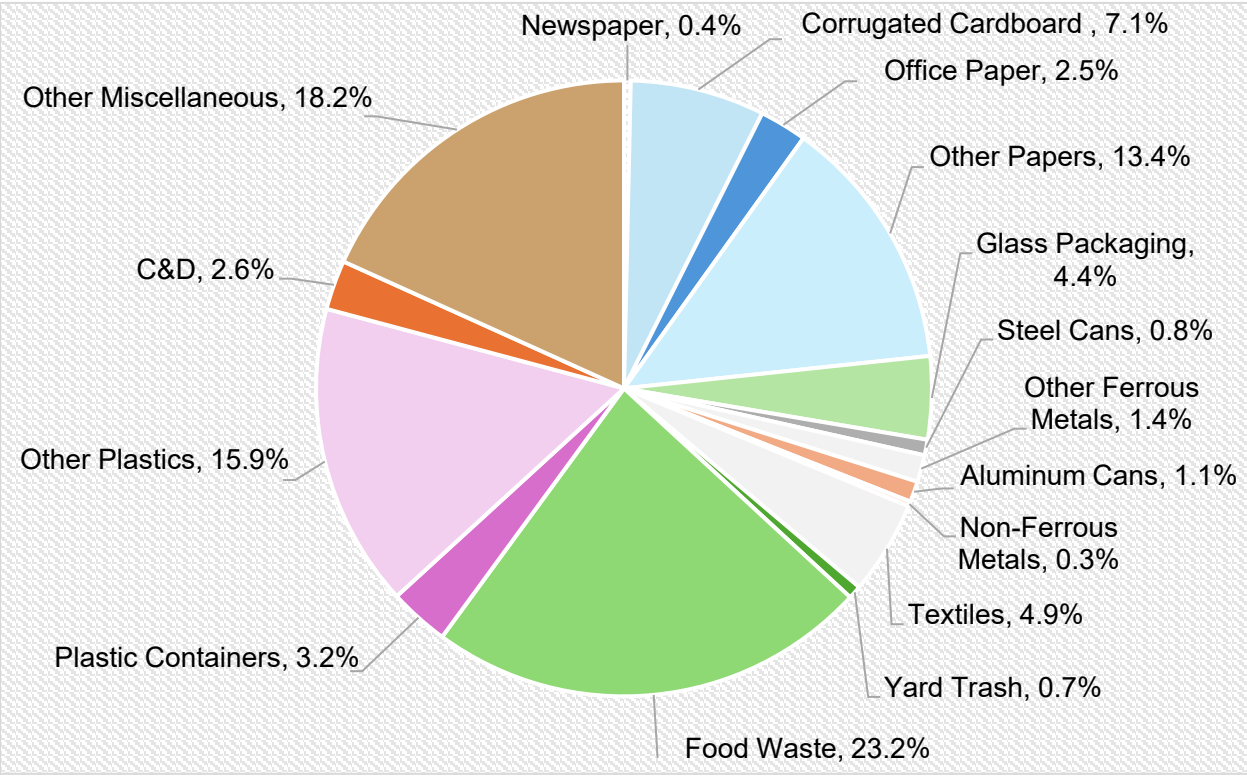

Figure 6 - Commercial Waste Composition

Besides “Other Miscellaneous” materials, the largest component of the overall waste stream in Polk County was “Food Waste” at 19.8%. This includes food preparation wastes, scraps, and spoiled food. In the US Environmental Protection Agency’s (EPA) Advancing Sustainable Material Management: 2018 Fact Sheet, the highest component of US MSW landfilled in 2018 was “Food” at 24.1%, so the results for Polk County are consistent with the rest of the country[6]. “Food Waste” is the highest component of both residential and commercial MSW stream at 15.2% and 23.2%, respectively. The lowest material components in this study were “Newspaper” and “Non-Ferrous Metals”, at 0.5% each. Recyclable materials, including glass, aluminum cans, steel cans, plastic bottles, corrugated boxes, newspaper, and office paper sum to approximately 18.9% of the overall MSW stream.

4. CONCLUSION

Results of the Polk County waste composition study can now be incorporated into the *WasteCalc* program that’s used in the statewide annual solid waste and recycling reports. *WasteCalc* is an online tool created by FDEP and outside contractors that allow any county in Florida to input information about the amount of waste landfilled, recycled, and combusted[7]. Currently, many counties in Florida have not had recent or any waste composition studies conducted. When this occurs, *WasteCalc* generates material composition percentages based on counties that are similar in population density to that specific county. However, it is important to conduct waste composition studies in various locations throughout Florida so *WasteCalc* can provide the counties with more accurate and representative information. The data obtained in this study will provide more accurate results for this county and counties similar to Polk County. The information provided may also help to make decisions about sustainable materials management in the future for Polk County.

5. REFERENCES

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(2) B.E.B.R. - Bureau of Economic and Business Research. *Florida Estimates of Population 2024*. https://bebr.ufl.edu/florida-estimates-of-population-2024/ (accessed 2025-12-16).

(3) *Polk County Solid Waste | Waste Collection Update*. Polk County Government. https://www.polk-county.net/services/polk-county-solid-waste/waste-collection-update/ (accessed 2025-12-16).

(4) ASTM International. *ASTM D5231-92: Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste*. https://store.astm.org/d5231-92r16.html.

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(6) US EPA, O. *Advancing Sustainable Materials Management: Facts and Figures Report*. https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/advancing-sustainable-materials-management (accessed 2025-12-16).

(7) Florida Department of Environmental Protection. *Waste Calc Introduction*. https://prodapps.dep.state.fl.us/wastecalc/ (accessed 2025-12-16).

APPENDIX

Material Categories

Category		Detailed Description
1	Newspaper	High cellulose content, high photo degradation paper
2	Corrugated Cardboard (OCC)	Corrugated cardboard packaging (e.g., Amazon boxes)
3	High Grade Paper (Office Type)	Manila envelopes, note cards, printer paper, tablets with binding, mail envelopes without a plastic window
4	Polycoated Aseptic Containers	Bleached and unbleached paperboard coated with HDPE used as food/beverage containers (e.g., ice cream cartons, milk cartons, juice boxes)
5	Food Service Container (Polycoated)	Takeout containers and cups with a waxy coating; does NOT include pizza boxes.
6	Other Composite	Any other containers composed mostly of paper with other materials attached (e.g., pringles cans, gum wrappers, tissue boxes, mail envelopes with a plastic window)
7	Boxboards	Cereal boxes, egg cartons (not coated with wax, plastic or metal).
8	Other Paper	Paper towels, paper plates, waxed paper, tissues, and other papers that are soiled with food during use (e.g., pizza boxes); brown paper bags and kraft paper; junk mail, carbonless paper, envelopes with and without windows, toilet paper cores and other mixed recyclable papers; Magazines, phone books, glossy paper; anything that does not fall into the above categories.
9	#1 PET Bottles	Clear and colored bottles with necks
10	#2 HDPE Bottles- Translucent	Milk, beverages, water bottles and other products with necks
11	#2 HDPE Bottles- Colored	Liquid detergent bottles, some hair care bottles and cleaning products bottles with necks
12	#3-#7 (Other Plastic Bottles)	#3-#7 plastic bottles with necks
13	Expanded Polystyrene (Food Service)	Polystyrene drink cups and food containers
14	Expanded Polystyrene	Styrofoam products such as packaging peanuts and blocks
15	Rigid Plastic (Tubs, Cups, Lids)	Wide mouth cups and tubs (without a neck) and lids (e.g., solo cups; yogurt or sour cream containers; fruit clamshells)
16	Rigid Plastic (Food Service Plastics)	Plates, bowls, takeout clamshells, salad trays, microwave trays, utensils, takeout cups and lids, straws and stirrers
17	Grocery Bags	Shopping bags used to transport merchandise from the place of purchase, given out by the store.; does not include produce bags

18	Other Flexible Plastic	Bags intended to contain produce, bread, newspapers and sandwiches (e.g., Ziploc bags); films that contain multiple layers of film or other materials that have been fused together (e.g. potato chip bags, food wrappers such as candy-bar wrappers, metalized film); photographic negatives, shower curtains, mailing pouches, bank bags, x-ray film
19	Other Plastics	Plastic such as toys, toothbrushes, vinyl hose, and lawn furniture; items are predominately plastic with other materials attached such as disposable razors, pens, lighters, toys, and binders; anything that does not fall into the above categories. Includes flexible packaging contaminated such that it cannot be sorted
20	Green	Green glass bottles, containers, and green cullet (broken glass pieces)
21	Clear	Clear glass bottles, containers, and clear cullet (glass pieces); mirrors, glassware, crystal, Pyrex and corning ware, laminated curved glass such as windshields, flat auto, clear or tinted window, door, shelf, tabletops
22	Brown	Brown glass bottles, containers, and brown cullet (broken glass pieces)
23	Other Glass/Ceramics	Glass not otherwise classified, ceramics, structural ceramics like pottery and porcelain, and engineered ceramics such as refractory and abrasive materials.
24	Aluminum Cans/ Foil	Cans and bi metal cans (nonmagnetic); food containers, trays, pie tins, and foil pieces
25	Steel/Tin cans	Tin and steel food, pet food, and other containers, including bi-metal cans mostly of steel; does NOT include aluminum
26	Other Ferrous Metals	Ferrous and alloyed ferrous scrap metals that a magnet will adhere to
27	Other Non-Ferrous	Non-ferrous metal scrap such a brass, copper, or other non-magnetic metal; includes aluminum products such as window frames and cookware
28	Yard Waste	Grass clippings, twigs, branches, leaves, etc.
29	Food Waste	Food preparation wastes, food scraps, spoiled food
30	Animal By-Product	Animal carcasses not resulting from food storage or preparation, animal wastes, and kitty litter
31	Other Organics	Combustible materials including wax, bar soap, cigarette butts, feminine hygiene products, disposable diapers, vacuum cleaner bag contents, leather, briquettes, and fireplace, burn barrel, and fire-pit ash, and other organic material not classified elsewhere
32	Wood	Clean wood (e.g., 2 x 4's and 2 x 6's and sheets of plywood, strand board, and particleboard)
33	Asphalt Shingles	Asphalt roofing shingles
34	Gypsum Drywall	Gypsum wallboard
35	Concrete/bricks	Rocks, concrete and bricks
36	Rubber and Leather	Rubber gloves; finished products and scrap materials made of natural and synthetic rubber, such as bathmats, inner tubes, rubber hoses, and foam rubber and leather items

37	Clothing, Footwear, other textiles	Shoes, tennis shoes, fabric materials and clothing including natural and synthetic textiles such as cotton, wool, silk, woven nylon, rayon, and polyester; includes non-rag stock grade textiles such as heavy linens and draperies (e.g., pillows, blankets, towels, sheets)
38	Small appliances/ Electronics	Toasters, stereos, other small appliances and electronic equipment (non-refrigerant); computer related electronics (e.g., Laptops, monitors, printers, mouse, stereos) and personal portable products (e.g., cell phones, chargers, camcorders, gaming devices, cameras)
39	Hazardous Waste	Automotive products and fluids (e.g., oil filter, motor oil/diesel oil, and containers contaminated with oil), paints and solvents, pesticides, herbicides and fungicides, household cleaners, lead acid batteries and other types of batteries (excluding lithium-ion), mercury containing products (e.g., fluorescent bulbs, barometers, thermostat switches, thermometers, car switches, blood pressure cuffs), cathode ray tubes (large monitors), pharmaceuticals, hypodermic needles, needle covers, medical tubing, articles contaminated with red (blood) colored substances, and medical device packaging
40	Lithium-Ion Battery Products	Products which contain lithium-ion batteries, such as cell phones, tablets, laptops, electric scooters and hoverboards, e-cigarettes, handheld power tools, rechargeable power banks, and rechargeable headphones
41	Residuals	Unsorted materials which pass through the 2” x 2” mesh table
42	Liquids	Bottled liquids

Example Sampling Sheet

Sample #	2
Date and Time Pulled:	11/3 10:37 AM
Date Sorted:	
Hauler:	City of Winter Haven
Hauler Truck #:	6260
Truck Weight (inbound):	
Truck Weight (outbound):	
Total Sample Weight (lbs):	87.0 + 81.6 + 85.4 + 91.6
Description of Sample:	
Waste Stream (commercial or residential):	Residential
Origin of Waste (incorporated or unincorporated):	incorporated (Winter Haven)

Notes
tare : 40.0 + 44.2 + 39.4 + 44.4 Any bulky items or white goods? none Approximate area of collection: Notes/observations from driver about load:

Example Data Collection Sheet

Category		Material	Weight (lbs)	Category		Material	Weig (lbs)
Newspaper	1	Newspaper	3.8	Other Plastics	23	#3-7 (Other Plastic Bottles)	0
Corrugated Cardboard	2	Corrugated Cardboard (OCC)	1.4		24	Expanded Polystyrene (Food Service)	0.8
Office Paper	3	High Grade Paper (Office Type)	2.4		25	Expanded Polystyrene	0
Other Papers	4	Polycoated Aseptic Containers	1.6		26	Rigid Plastic (Tubs, Cups, Lids)	3.8
	5	Food Service Containers (Polycoated)	3.2		27	Rigid Plastic (Food Service Plastics	2.0
	6	Other Composite	1.4		28	Grocery Bags	3.6
	7	Boxboards	1.4		29	Other Flexible Plastics	1.2+0.4=1.6
	8	Other Paper	6.8+14.2=21.0		30	Other Plastics	3.4
Glass Packaging	9	Green	1.2	C&D	31	Wood	0.4
	10	Clear	3.4		32	Asphalt Shingles	0
	11	Brown	2.8		33	Gypsum Drywall	0
	12	Other Glass/Ceramics	0.4		34	Concrete/ Bricks	0
Steel Cans	13	Steel/Tin Cans	0	Other Miscellaneous	35	Rubber and Leather	0
Other Ferrous Metals	14	Other Ferrous Metals	0.4		36	Small Appliances /Electronics	0.2
Aluminum Cans	15	Aluminum Cans/Foil	3.4		37	Hazardous Waste	1.2
Non-Ferrous Metals	16	Other Non-Ferrous	9.6		38	Lithium-Ion Battery Products	0
Textiles	17	Clothing, Footwear, Other Textiles	17.6		39	Residuals	14.6
Yard Trash	18	Yard Waste	1.8		40	Liquids	4.2
Food Waste	19	Food Waste	28.2		41	Animal By-Product	2.4
Plastic Containers	20	#1 PET Bottles	3.6		42	Other Organics	14.0
	21	#2 HDPE Bottles - Translucent	1.0				
	22	#2 HDPE Bottles - Colored	3.6				