

# **STW SOLID WASTE MANAGEMENT DROP-OFF STUDY**

Final Report

Prepared for

**Stark-Tuscarawas-Wayne Joint Solid Waste  
Management District**

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# I. INTRODUCTION

The Stark-Tuscarawas-Wayne Joint Solid Waste Management District (STW) contracted with GT Environmental (GT) to conduct a drop-off study and a recyclable materials audit to identify and target recycling behaviors. The analysis was performed over three months, beginning on April 10th, 2023, and concluding on June 20th, 2023.

The STW coordinates and oversees the recycling drop-offs in all three counties. In two of the counties, Stark and Wayne, STW directly services the drop-off program by employing drivers and owning trucks and containers. This project used a targeted approach focusing on one drop-off site location, the Buehler's Fresh Foods drop-off site located at 3540 Burbank Rd, Wooster, Ohio. This site is one of the locations serviced by the District and is within proximity to other site locations, as seen in Figure 1 below.

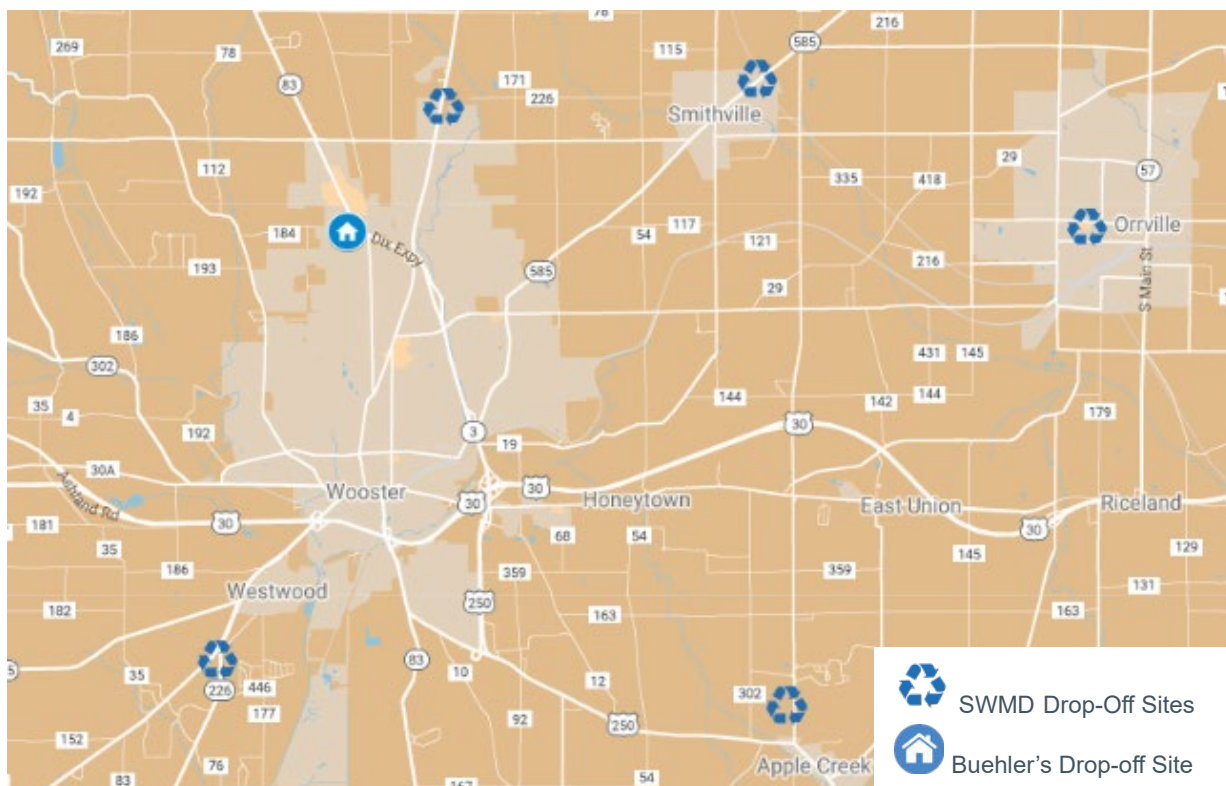


Figure 1. City of Wooster Recycling Drop-off (Buehler's Fresh Foods)

Recyclable materials collected at the Buehler's Fresh Foods drop-off site are collected in source-separated containers. Separate containers collect paper, cardboard, plastic bottles and jugs, metal cans, glass bottles, and jars.

## II. PROBLEM

One of the problematic issues for STW is the contamination of plastics. Plastic contamination in recycling refers to the presence of non-recyclable or improperly sorted plastic materials within the recycling stream. It occurs when items that are not suitable for recycling, such as certain types of plastics or plastic products with food residues, are mistakenly included with recyclable materials. Contamination in plastic containers could be food, liquids, or dirt. In addition, there is a common misunderstanding that all plastics are recyclable. Placing non-accepted plastics into the drop-off contaminants the accepted stream. Focusing on the Buehler’s Fresh Foods drop-off location in Wooster, this study targeted a pre- and post-sort of only the plastics drop-off container.

How much contamination is in the plastic stream? Establishing a baseline metric was an important step in this project. Pre-planning calls between GT and STW selected the sorting date, time, and location. To capitalize on capturing the most material STW selected a Monday sort. This would capture two days-worth of material. This study focused solely on the source-separated plastic recycling container. Pre-audit material was sourced from the Buehler drop-off site and transported to the Wayne County Fairgrounds, where the material was sorted manually into pre-defined categories and placed in containers for weighing and recording.

Audited materials were sorted into the following identified material categories:

Major Waste Fractions	Waste Component Categories	Major Waste Fractions	Waste Component Categories
<b>Plastics</b>	#1 Plastics - Bottles/Jars	<b>Paper</b>	Mixed Paper
	#2 Plastics - Bottles/Jars		<b>Metals</b>
	#1 Plastics - non-bottle/jars (Unaccepted)	Other Metals	
	#2 Plastics - non-bottle/jars (Unaccepted)	<b>Glass</b>	Glass
	# 3 Plastics (Unaccepted)		<b>Bulky Items</b>
	# 4 Plastics (Unaccepted)	<b>Organic Material</b>	
	#5 Plastics (Unaccepted)		Yard Waste
	# 6 Plastics (Unaccepted)	<b>Special Waste</b>	HHW
	# 7 Plastics (Unaccepted)		<b>Trash</b>
	Plastic Film/ Bags ( <b>Count each bag</b> )		
	Plastics - Mixed Rigids (Unaccepted)		
	Plastics -Bulky Rigids (Unaccepted)		
	Plastic Bags Containing Recyclables (Unaccepted)		
	Plastic with Liquid or Food inside (Unaccepted)		

Table 1. Audit Sample Material Categories

The team included GT personnel, District drivers, District staff, and Master Recyclers. The project manager, waste sorters, waste weighers, and data recorder were identified before the pre-audit began. GT personnel served as sorting team leaders and data collectors. The Sort Crew received protective equipment, safety instructions, and waste sorting instructions. A health and safety plan (HASP) specific to the sort was developed and implemented for the audit. The scale provided by GT was calibrated before the sort and checked.

Recyclables were dumped onto a tarp for the crew to sort. Visual observation noted recyclables in plastic bags as well as large bulky rigid plastics such as laundry tubs. For each sort, the material was categorized into individual waste component categories.



Figure 2. Sample Pile of Plastics Only Container

Photographs of sorted material categories of interest for each sample were taken. Each photo included a label identifying the waste type contained in the bin's sample label.

Please see [Attachment A](#)– Photos of Audited Materials.

### 1. PRE-AUDIT BENCHMARK OBSERVATIONS

The total amount of material generated over the two-day period was 584 pounds of materials. Unfortunately, only 87% of the materials found were plastics. Of that 87% not all plastic is acceptable in the District's recycling program.

As seen in Figure 3, of the 506 pounds of plastic sorted, 416.5 pounds or 71% is acceptable plastics (i.e., plastic bottles and jugs). The remaining 15% is non-accepted plastics. The pre-audit sort also found that recyclable materials other than plastic were in the plastic bottles and jugs only recycling containers. These other materials include paper, metals, and glass. Of the other materials

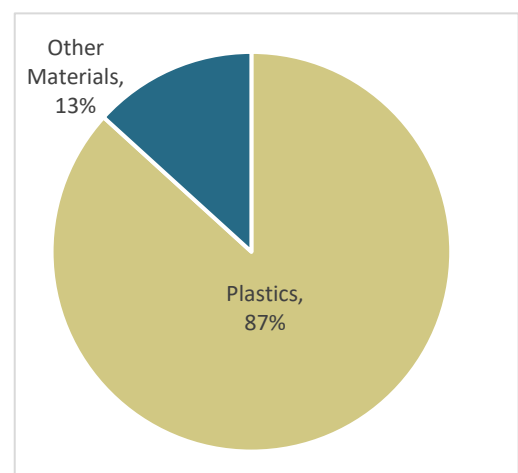


Figure 3. Plastics Drop-off Container Composition in Pre-Audit

found in the drop-off container, approximately 7.6% were recyclables accepted by the District but placed in the incorrect bin. Roughly 5.7% was general trash. This resulted in a 71% diversion rate for the pre-audit sort.

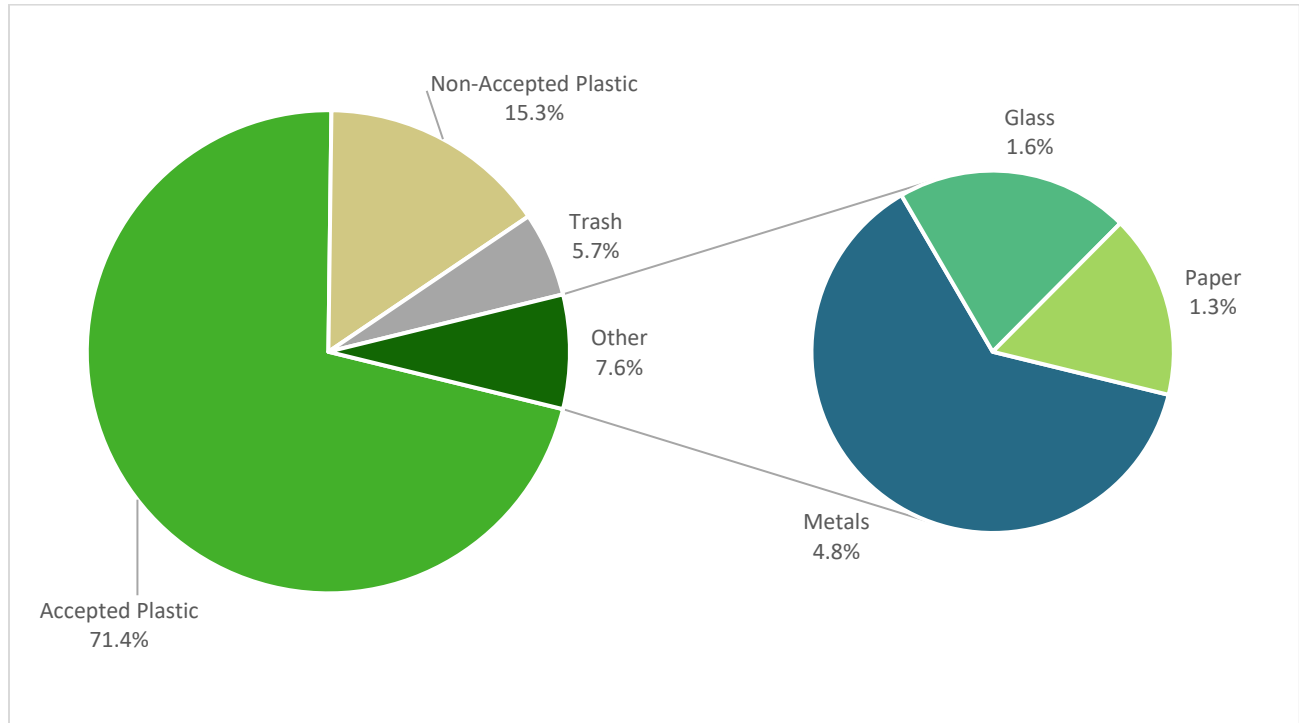


Figure 4. Pre-Audit Composition in Plastics Only Drop-off Container

Mixed paper, metals (aluminum and steel cans), and glass are other materials accepted in the District drop-off stream, just not in the plastic drop-off container. Even though these recyclables are in the incorrect drop-off container, final sorting at the material recovery facility will ensure these recyclables will be recycled.

Materials that should not be placed in the drop-off container because they are unacceptable at the material recovery facility are contaminants. The pre-audit found two categories which are contaminants: non-accepted plastic and trash. Based on the findings, the non-accepted plastics identified as contaminants include plastics #1 non-bottle, plastics #5, trash, plastic film, and plastics #2 non-bottle. The highest contaminant of non-accepted plastic is plastics #1 non-bottle and plastics #5.

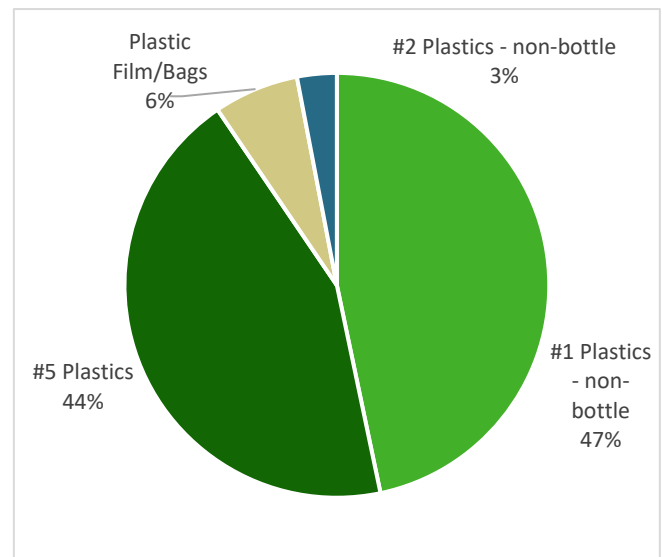


Figure 5. Pre-Audit Non-Accepted Plastics



Figure 6 shows photos of the non-accepted plastics found.

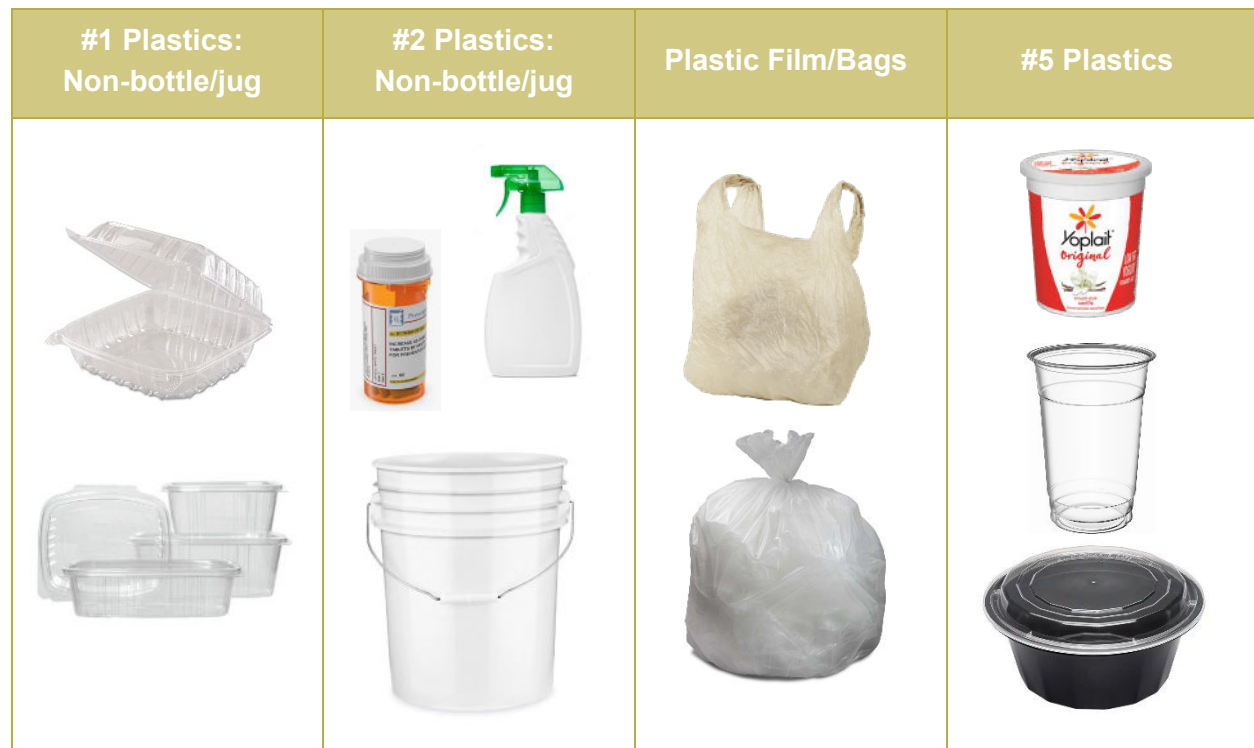


Figure 6 Non-Accepted Plastics Photos

Overall, combining non-acceptable plastics and trash shows approximately 21% of the materials by weight are considered contaminants. As previously stated, contaminants in the plastic-only container are unaccepted plastics and trash, along with mixed paper, metals (aluminum and steel cans), and glass are other materials accepted in the District drop-off stream, just not in the plastic drop-off container.

Even though these recyclables are in the incorrect drop-off container, final sorting at the material recovery facility will ensure these recyclables will be recycled. For this report and data analysis these recyclables are not considered contaminants.

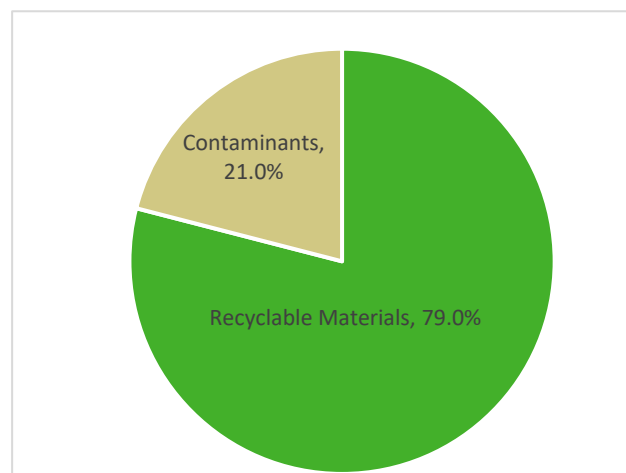


Figure 7. Contaminants in Plastics Only Container

### III. CAMPAIGN

Based on the pre-audit results, the District’s behavior change campaign targeted the exclusion of food containers, drink cups, spray bottles, plastic grocery bags, and plastic garbage and grocery bags containing recyclables and non-recyclables. An advertisement in the Wooster Daily Record was posted on four consecutive Sundays, educating residents about acceptable and non-acceptable items that can be placed in their recycling bin or drop-off container. Raising awareness about proper recycling practices is essential. Educating the public about what can and cannot be recycled and encouraging them to clean and sort their recyclables correctly, can help minimize contamination.

# ATTENTION

## Recyclers

# We Can Do Better!

### Not All Plastics Are Recyclable

✓

### RECYCLABLE

**Plastic Bottles & Jugs ONLY**

*Clean, Dry, and Empty*



Water &  
Soda Bottles



Milk Jugs



Laundry  
Detergent  
Jugs and  
Bleach Jugs

✗

### KEEP THESE OUT



NO Food Containers



NO Drink Cups



NO Spray Bottles



Do Not  
Bag Recyclables  
(no trash)

## When in doubt, leave it out!



For more information on STW's recycling efforts, scan the QR code on your smart phone camera.



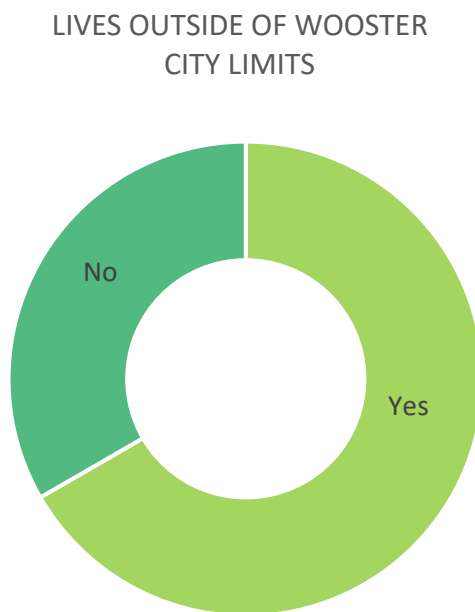
Figure 8. Media Campaign



In addition to the media campaign, the District also deployed face-to-face engagement at the Buehler drop-off site to engage with community members and eliminate recycling confusion and contamination. Households visiting the site were handed acceptable material lists and taught proper recycling. As part of this engagement, the volunteers conducted a survey to better understand utilization patterns. Prior to the outreach a list of survey questions was compiled for consistency in data analysis. The survey consisted of four questions.

The District utilized Master Recycler volunteers and staff for the in-person engagement and to perform surveying tasks. Outreach was performed for two-months occurring twice a week on Wednesdays and Saturdays for 7-10 hours per week. The face-to-face outreach connected with two hundred ninety-four drop-off users. Users were asked a series of questions regarding their drop-off site usage frequency, commute time, and how they typically access information.

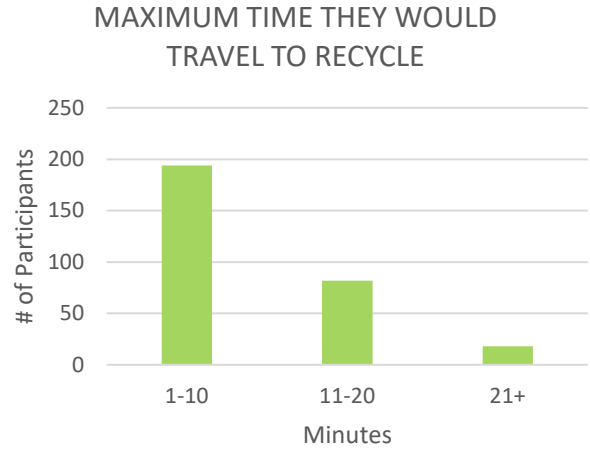
### QUESTION 1: DO YOU LIVE OUTSIDE OF WOOSTER CITY LIMITS?



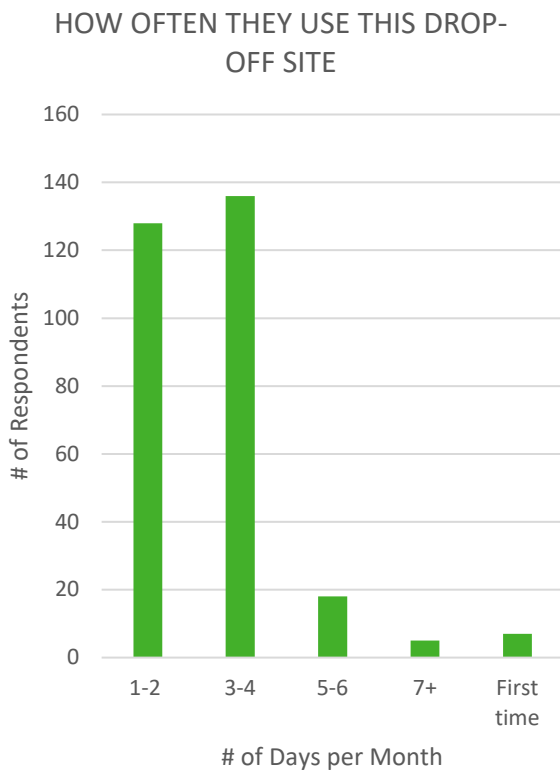
Roughly 33% of the households using the site come from the City of Wooster. Since the City of Wooster has curbside services available to residents, this data may suggest the households within the city limits use the drop-off for overflow or from multi-family units. This location appears to mostly serve households outside of City limits, suggesting users are making a trip into the City and using this location. The survey results found roughly 67% of the users reside outside the city limits of Wooster. This data shows the drop-off site services a larger population area. Should this drop-off site be removed, it would impact the 33% living in the City. Also, since this site is frequented mainly by households from outside the City, a location within the drive patterns would need to be considered. Although most users reside outside the City of Wooster, the drive time is relatively short. The following survey question below outlines the user drive times.

**QUESTION 2: WHAT IS THE MAXIMUM AMOUNT OF TIME YOU WOULD TRAVEL TO RECYCLE?**

Survey results found most users would travel ten or fewer minutes to recycle. Roughly 28% of users' travel time is eleven to twenty minutes, and 6% is 21 minutes or more. The closer recycling drop-off sites are to people's homes or workplaces, the more likely they are to participate in recycling programs. Convenience plays a significant role, and individuals may be more willing to travel shorter distances if recycling options are readily available nearby.

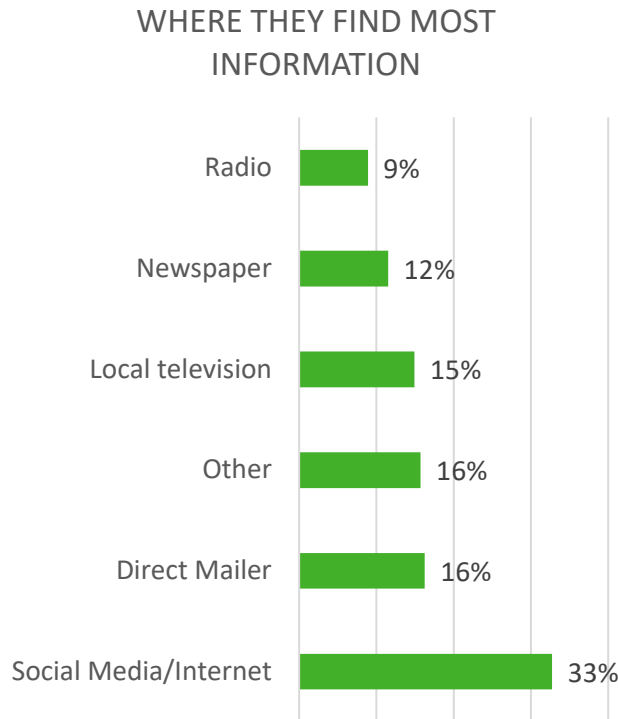


**QUESTION 3: HOW MANY TIMES PER MONTH DO YOU USE THIS DROP-OFF SITE?**



The survey results found that most users travel and use the drop-off site 1-2 or 3-4 times monthly. Roughly 46% visit the Buehler drop-off site three to four times per month, 44% visit one to two times, while the remaining users either use the site five to seven or this is their first time. Correlating the data with Question 1, leads to the assumption that those within the City of Wooster are infrequently visiting and primarily for overflow. Better correlations could have been made if the questionnaire added demographic details such as the type of housing unit. An assumption could also be made that the households visiting one to four times a month are coming from outside the City.

**QUESTION 4: WHERE DO YOU GET MOST OF YOUR INFORMATION FROM?**



The final question on the survey asked users what platform(s) they use to access most of their information. Based on the responses, most (33%) of users said they get most of their information from social media and/or the internet. The increase in social media and the internet has profoundly impacted various aspects of society, including communication, information sharing, connectivity, and how we interact with the world. While social media and the internet can enable individuals, organizations, and businesses to reach a global audience, generational gaps come with it. The digital divide between older and younger generations can have barriers that limit access. Advertising in the Wooster Daily Record newspaper and digitally will help to bridge the digital divide and promote inclusion for older generations.

This campaign disseminated information through the newspaper and face-to-face. Based on these findings, households gather information from a variety of platforms/sources.

# IV. FINDINGS

## 1. POST-AUDIT RESULTS

The post-audit sorted 648 pounds of material, approximately 64 more pounds than the pre-audit sort. Of the 648 pounds that were sorted in the post-audit, 90% were plastics, and the remaining 10% were other materials. As stated above, of that 90%, not all plastics were acceptable materials that can be recycled.

As seen in Figure 10, of the 648 pounds of plastic sorted, 447 pounds, or 69%, are acceptable plastics (i.e., plastic bottles and jugs). Approximately 21% are non-accepted plastics. The post-audit sort also found that recyclable materials other than plastic were in the plastic bottles and jugs, only recycling containers. These other materials include paper, metals, and glass. Of the other materials found in the drop-off container, approximately 4% were recyclables accepted by the District but placed in the incorrect bin. Roughly 5% was general trash. This resulted in a 69% diversion rate for the post-audit sort.

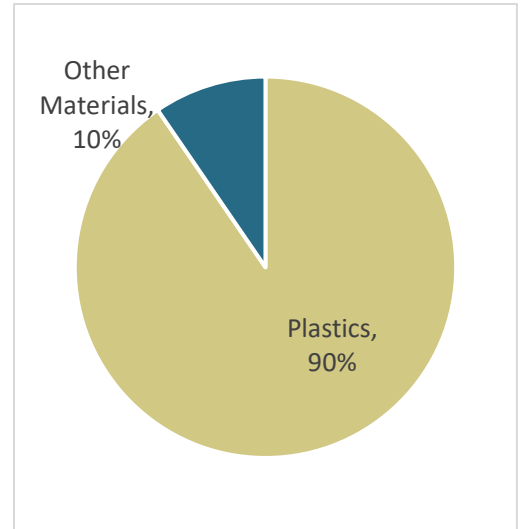


Figure 9 Contamination in Plastics Drop-off Container Post-Audit

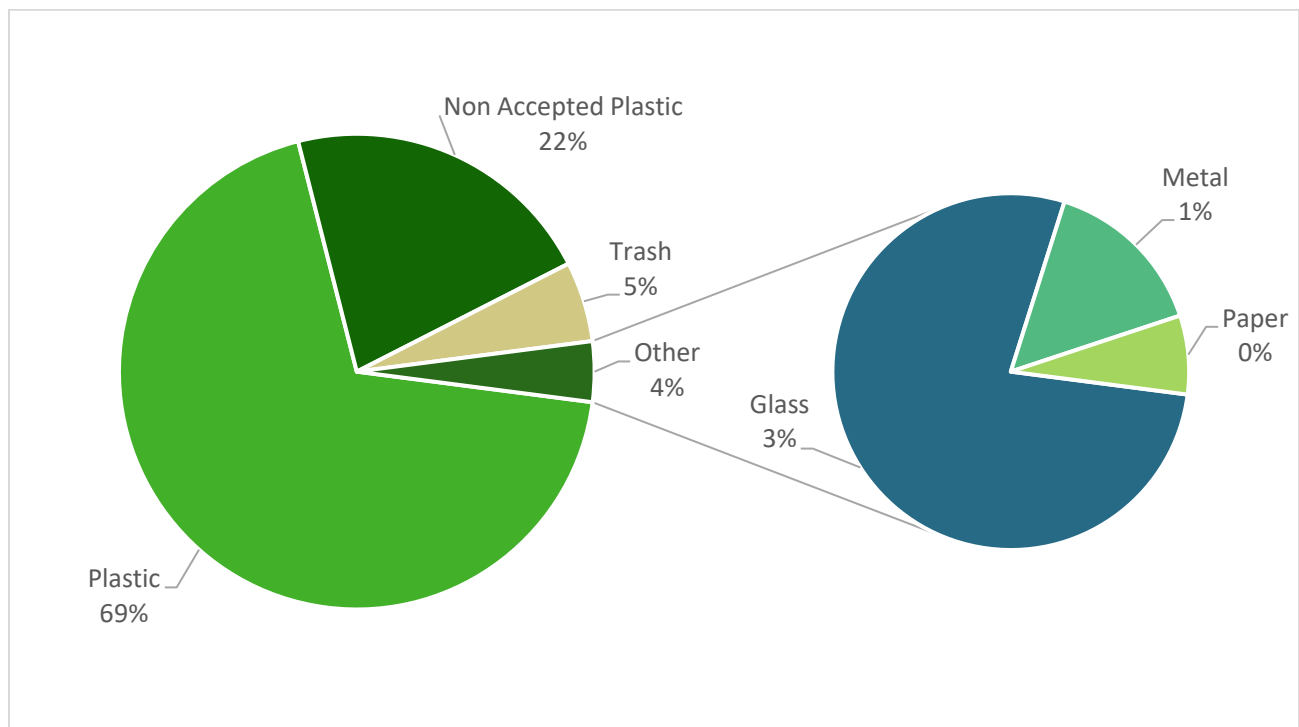


Figure 10 Plastics Drop-off Container Composition in Post-Audit

Material Category	Pre-Audit		Post-Audit	
	Percent of Stream	Net weight (pounds)	Percent of Stream	Net weight (pounds)
<b>Plastics</b>	<b>87%</b>	<b>506</b>	<b>90%</b>	<b>586</b>
Plastics #1 - Bottles/Jugs	41.3%	240.9	43.6%	282.1
Plastics #2 - Bottles/Jugs	30.1%	175.9	25.4%	164.6
Plastics #1 - non-bottle	7.2%	41.8	4.0%	26.1
Plastics #2 - non-bottle	0.5%	2.7	0.7%	4.5
Plastics #5	6.7%	39.2	5.5%	35.3
Plastics #7	0%	0	0.1%	0.8
Bulky Rigids	0%	0	8.1%	52.4
Plastic with Liquid or Food Inside	0%	0	0.4%	2.7
Plastics - Mixed Rigids	0%	0	0.7%	4.5
Plastic Film/Bags	1.0%	5.8	1.3%	8.1
<b>Paper</b>	<b>1%</b>	<b>7</b>	<b>0%</b>	<b>2</b>
Mixed Paper	1%	7.3	0%	1.9
<b>Metals</b>	<b>5%</b>	<b>28</b>	<b>1%</b>	<b>4</b>
Aluminum Cans	1.1%	6.5	0.2%	1.3
Other Metals	3.7%	21.5	0.4%	2.7
<b>Glass</b>	<b>2%</b>	<b>9</b>	<b>3%</b>	<b>21</b>
Glass bottles, jars, and other glass	1.6%	9.3	3.2%	20.7
<b>Trash</b>	<b>6%</b>	<b>33</b>	<b>5%</b>	<b>35</b>
Bagged household trash, Styrofoam, HHW Materials (lightbulbs, batteries), items less than 3 in, items with food/liquid inside	5.7%	33	5.5%	35.30
<b>Total</b>		<b>584</b>		<b>648</b>

Table 2. Composition of Material in Plastic Only Container: Pre-Audit vs. Post-Audit

Table 2 above shows the breakdown of materials by material type in the plastic drop-off stream between the two audit sorts. In the post-audit sort, a total of 648 pounds of material was generated and sorted, a 3% increase from the pre-audit sort. The pre-audit data measured: 506 pounds of plastics (87%), 7 pounds of paper (1%), 28 pounds of metals (5%), 9 pounds of glass (2%), and 33 pounds of trash (6%). On the other hand, the post-audit data measured: 586 pounds of plastics (90%), 2 pounds of paper (0%), 4 pounds of metals (1%), 21 pounds of glass (3%), and 35 pounds of trash (5%).

Comparing the two sorts, the post-audit sort measured improvement in recyclable materials other than plastic: paper, metals, and glass. Overall 4% less other recyclable materials were found, demonstrating the education and outreach efforts were successful in communicating “plastic only”. Though there was a reduction in trash the differential was minimal comparatively.

Post-audit results show less acceptable plastics than measured by weight in the pre-audit, which was unexpected following a campaign. However, the post-program audit’s waste composition showed a reduction in the top two highest contaminants found in the pre-audit sort: plastics #1 - non-bottle (food/produce containers) and plastics #5 (yogurt cups, drink cups). Plastics #1 – non-bottle had the most significant decrease between the two sorts. Plastics #1 – non-bottle from the

pre-audit sort decreased by 3.1%, followed by plastics #5 with a 1.3% decrease. This may be linked to the District’s newspaper advertisement and on-site surveying activities.

Figure 11. Contaminants Found Pre- and Post-Audit

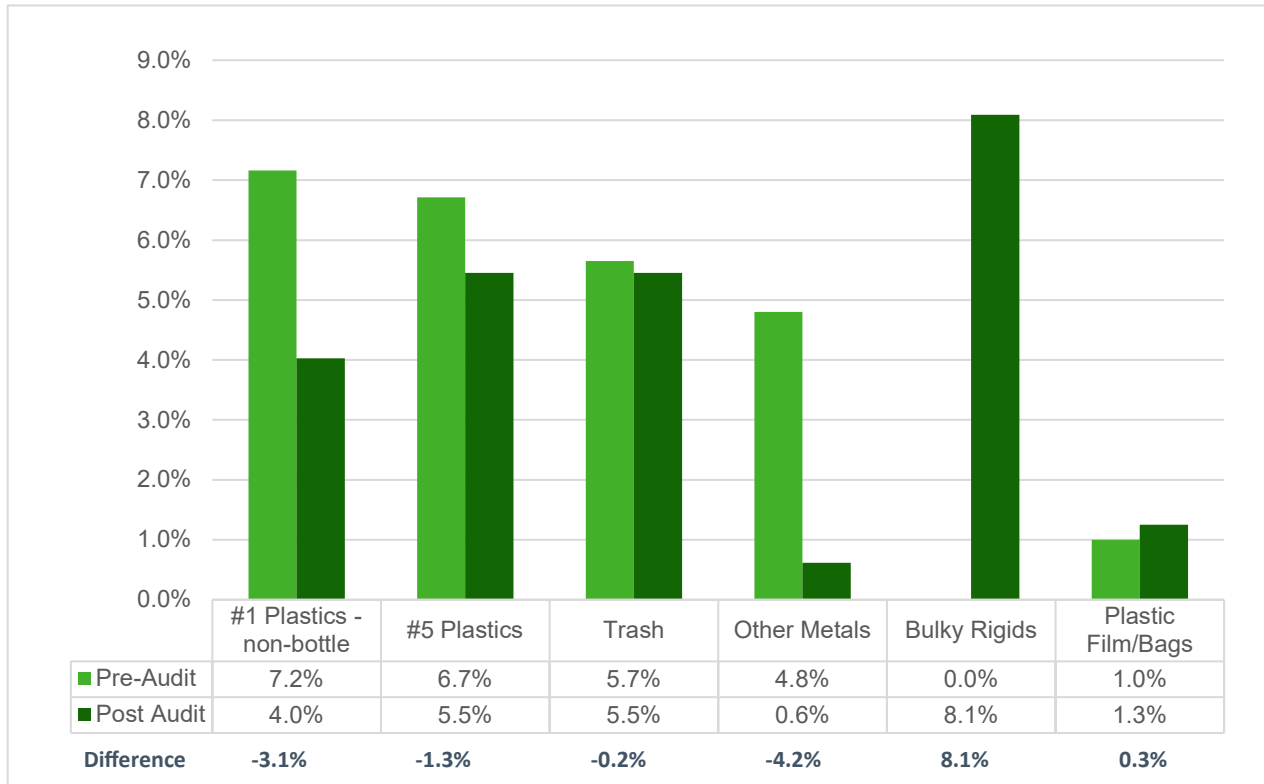


Figure 11 compares the contaminants found in the two audits. In the pre-audit, 584 pounds of material was sorted, with the highest contaminants being #1 plastics non-bottle, #5 plastics, trash, other metals, and plastic film/bags. Contaminants and materials not accepted in the District’s drop-off program in the pre-audit were mostly found to be plastics #1 non-bottle and plastics #5. The most significant difference from the pre-audit and the post-audit sort was the introduction of bulky plastic rigids. The overlying difference between the two audits is the new material bulky rigid plastic found in the post-audit. By visual observation and by weight, there was a 52.4-pound increase in bulky plastic rigids from the pre-audit to the post-audit. This may be attributed to the time of the year for spring cleaning in the community and garden and flower bed plantings. The increase in plastic bags is unexpected.



## V. CONCLUSIONS

The goals of this study were to determine if education and outreach would eliminate or improve contamination in the plastic recycling stream and if the drop-off at Buehler's Fresh Foods could service a larger area which would eliminate some operational redundancy.

More plastics were found in the container post-audit sort than pre-audit. The households reached with direct outreach changed behavior to clean up the other recyclables and trash that was seen in the pre-audit sort. However, the non-accepted plastics found in the container increased by weight. Sorted items found included laundry baskets, flower containers, etc. Bulky items like this weigh more than other plastics. Finding these types of plastics is most likely attributed to the time of the year for spring cleaning in the community and garden and flower bed plantings. Targeted education of how to recycle these types of plastics timed for the Spring would be a beneficial campaign.

By visual volume, it was noted that less plastics #1 non-bottle was being sorted post-audit, and when data was analyzed, these plastics showed a 3% reduction. Plastics #1 non-bottle predominantly found was clamshells and other food carry-out/take-out items. Keep in mind these plastics are lightweight.

Except for bulky rigid plastics all non-accepted plastics measured reduction in the post-audit with the greatest impact seen in the highest pre-audit contaminant categories: plastics #1 - non-bottle (food/produce containers) and plastics #5 (yogurt cups, drink cups). The face-to-face outreach campaign was successful measuring reduction of the materials targeted in the campaign.

It's positive to see that there has been a decrease in the highest contaminants, but it's important to address the increase in new material that could potentially be from spring cleaning activities in the community.

Here are some steps to consider:

1. Collaborate with local authorities and waste management companies: Engage with local authorities and waste management companies to address the issue. Share information about the new contaminant plastic material and work together to develop solutions. Explore possibilities for specialized recycling programs or alternative disposal methods for the specific material.
2. Raise awareness and promote responsible spring cleaning practices: Conduct public awareness campaigns and educational initiatives specifically focused on responsible spring cleaning practices. Encourage individuals to choose environmentally friendly cleaning products, reduce plastic waste, and properly dispose of materials.
3. Monitor and evaluate progress: Regularly monitor the recycling process and contamination levels during spring cleaning. Evaluate the effectiveness of the implemented measures and make adjustments as necessary to address the increase in the new contaminant plastic material.

By implementing these steps, the District can work towards addressing the increase in the new contaminant plastic material related to spring cleaning. Overall collaboration, education, and continuous improvement are essential in maintaining a sustainable and effective recycling program.

Surveys conducted resulted in showing most households using the Buehler's location reside outside the City limits. Even though they reside outside the City most users indicated they would drive a maximum of 20 minutes to a site. This indicates convenience plays a significant role, and individuals may be more willing to travel shorter distances if recycling options are readily available nearby.

The survey results found that 90% of users travel and use the drop-off site 1-2 or 3-4 times monthly. This leads to the assumption that households visiting one to four times a month are coming from outside the City because of the distance traveled and number of households residing outside the City. One could also assume those within the City of Wooster may be infrequently visiting and when they do it's primarily for overflow. The location of this drop-off site serves both City and non-City households. It is recommended the location and drive patterns be considered for any site location changes.

# ATTACHMENT A – PHOTOS OF AUDITED MATERIALS



**12**  
Plastics -  
Bulky Rigid  
*Plastics – Bulky Rigid*



**7**  
#5 Plastics  
*#5 Plastics*



**24**  
Trash -  
Diapers, Dead Animals,  
etc.  
*Trash*



**10**  
Plastic Film /  
Bags  
*Plastic Film/Bags*



**3**  
#1 Plastics -  
NON Bottles /Jugs  
*#1 Plastics – non bottle/jug*



**10**  
*Plastic with Food or Liquid*