

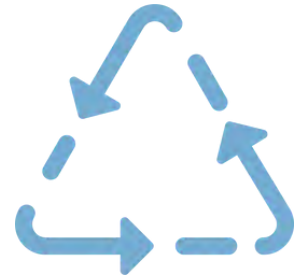
2023

BIG SKY COMMUNITY WASTE COMPOSITION ASSESSMENT



PUBLISHED BY BIG SKY SUSTAINABILITY NETWORK ORGANIZATION

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Acknowledgements

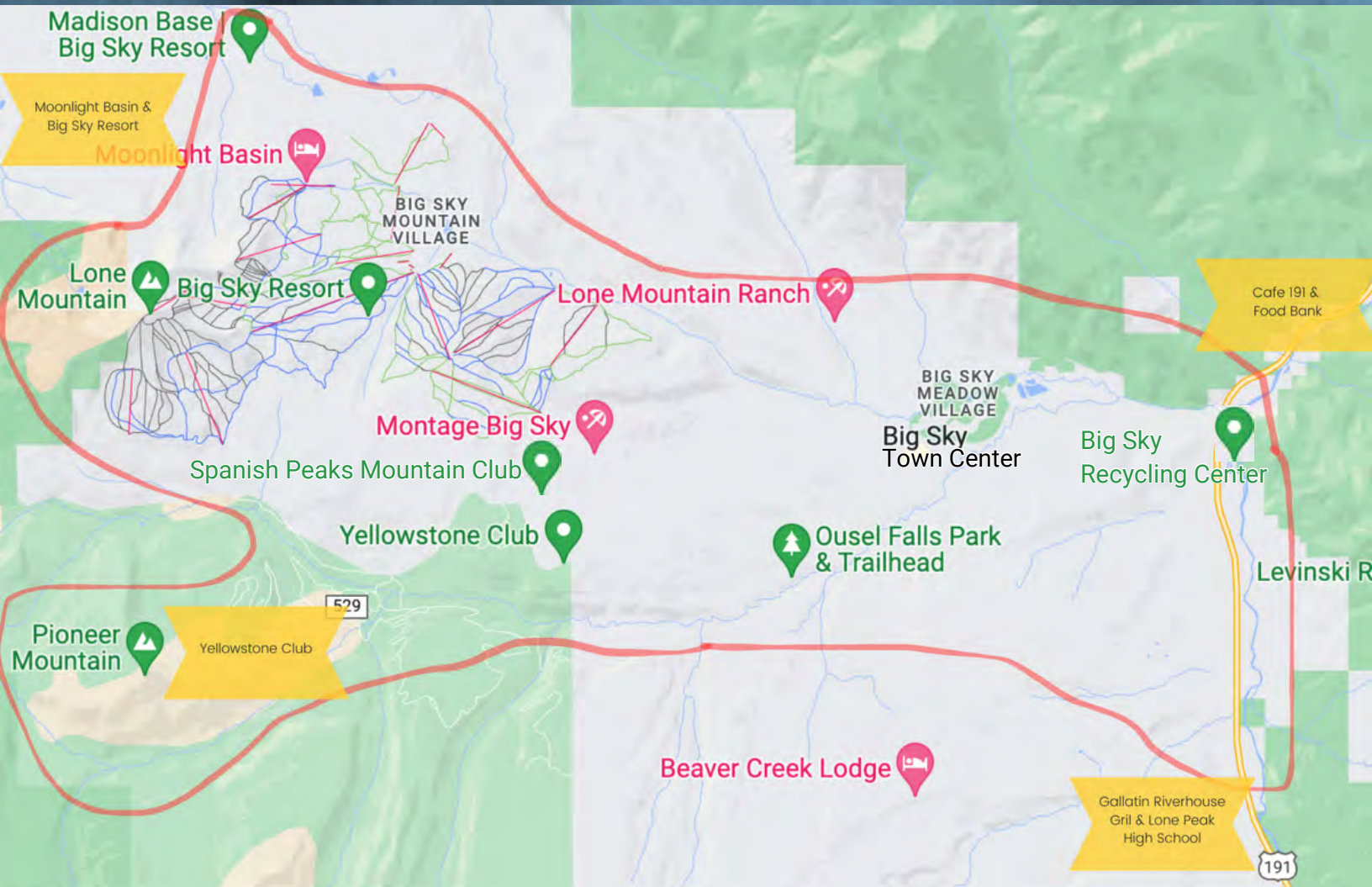
The Big Sky Community Waste Composition Assessment was made possible by funding from the Big Sky Resort Area District (BSRAD), the Rieschel Foundation and Moonlight Community Foundation. In addition, Big Sky Sustainability Network Organization (SNO), Republic Services, Gallatin Solid Waste Management District and the Gallatin County Sheriff Work Program all provided essential labor and services.

Specifically, we want to recognize the tremendous amount of hours put in by Lizzie Peyton from SNO, Alexis Alloway from Republic Services, Patty Howard from Gallatin Solid Waste Management District, and Bernadette Beausoliel from Gallatin County Sheriff Dept.

Thank you to our site sponsors, TMC Gravel Pit and Eagle Mount, as well as materials donors YES Compost, WeRecycleMT and Simkins-Hallin. We are appreciative of all of the individuals and businesses who gave us permission to audit their waste, including larger organizations such as the Yellowstone Club, Moonlight Basin, Town Center Owners Association, and various Meadow Village Owners Associations. And finally, we want to recognize all of the individual workers who were willing to spend their day sorting through community garbage. This project could not have been completed without the support of all those listed above. Thank you!



Executive Summary



The red outlines the area of waste collection lying within the Big Sky Resort Area District.

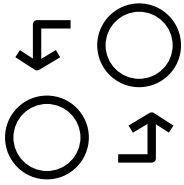
The Big Sky Community Waste Composition Assessment is an analysis of the estimated amount and composition of the community's municipal solid waste stream. Annual tonnage data were compiled from local haulers and composition was estimated by conducting 10 waste audit days. The audits sampled approximately 7,700 pounds of garbage from four different demographic sectors, sorting the materials into 30 different categories to determine the composition by weight.

Objectives & Procedures



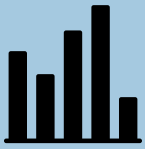
The objectives of this study were to:

- Identify opportunities for landfill diversion to help reduce greenhouse gas (GHG) emissions as part of the Big Sky Community [Climate Action Plan](#) (CAP).
- Create baseline data to use in the future to measure progress in waste reduction efforts.



Methodology:

- Research waste composition study methodologies and design study.
- Conduct audit days to sample and weigh garbage in order to determine waste composition.
- Acquire annual garbage, recycling and compost tonnage from local haulers.
- Analyze all data and publish final report.



For waste composition:

- Waste composition focused exclusively on garbage and did not look at the recycling or compost waste streams.
- Four different demographic sectors were studied: single-family residential, multifamily residential, commercial and vacation homes.
- Ten waste audit days were chosen throughout the year in order to ensure random sampling and to account for seasonal variations.
- Garbage was sorted into 30 different materials categories and weighed in order to determine waste composition by weight.
- Waste composition was determined for each demographic sector as well as for the overall combined Big Sky Community.

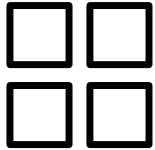


Wholly edible food waste sorted from the single family residential sector in October 2022.

Results



- An estimated 6,515 tons of garbage, 672 tons of recycling and 108 tons of compost were collected from Big Sky in 2022. These numbers do not include construction and demolition waste and the amount of garbage is an underestimate due to gaps in data collection systems.
- The waste tonnage estimates from this study put Big Sky's overall diversion rate at 10.68%, compared to a national average of 32.1%.
- In Big Sky, 69.4% of the garbage could have been recycled or composted instead of sent to the landfill. This is close to the national average (75%).
- Over a third of Big Sky's waste (36.1%) could have been composted in existing commercial compost systems instead of sent to the landfill.



This study sampled waste from four different demographic sectors (single family residents, multifamily residences, commercial institutions and vacation homes) and saw similar compositions between the different sectors. Wasted food, inedible food scraps and glass were in the top five materials among all sectors.



- Wasted food (food that could have been eaten) is the most common material in Big Sky's garbage, comprising 23.2% of the overall waste stream.
- Wasted food was the most common material across every demographic sector.
- Overall food waste (wasted food plus inedible food scraps like fruit rinds and coffee grounds) comprises 35.3% of Big Sky's garbage, compared to a national average of 21.6%. This means that Big Sky's food waste by weight is 63% higher than the national average.
- This study underestimated food waste due to data collection methods.



Glass makes up 10.2% of Big Sky's overall garbage, more than twice the national average (4.19%). Glass is not readily recyclable in Big Sky because it has to be shipped 375 miles one-way to a recycling facility in Salt Lake City, which is cost-prohibitive and produces substantial greenhouse gas emissions.

Top Five Materials by Demographic Sector

| Ranking | Overall | Single Family | Multifamily | Commercial | Vacation Rental |
|---------|-------------------------------|-------------------------------|------------------------|-------------------------------|------------------------|
| 1 | Wasted Food 23.2% | Wasted Food 27.4% | Wasted Food 24.7% | Wasted Food 21.0% | Wasted Food 32.2% |
| 2 | Food Scraps 12.1% | Glass 12.5% | Glass 13.2% | Food Scraps 13.4% | Misc. Garbage 17.6% |
| 3 | Glass 9.8% | Food Scraps 10.9% | Misc. Garbage 11.8% | Non-recoverable Paper 8.2% | Glass 9.7% |
| 4 | Misc. Garbage 9.6% | Misc. Garbage 9.5% | Food Scraps 10.5% | Other Plastics 7.1% | Cardboard 7.9% |
| 5 | Non-recoverable Paper 7.0% | Non-recoverable Paper 5.7% | Cardboard 6.6% | Glass 6.7% | Food Scraps 5.1% |
| Totals | 61.7% | 66.0% | 66.8% | 57.6% | 72.5% |

Recommendations



- Utilize the EPA's waste management hierarchy to inform waste management decisions, with a focus on source reduction and reuse as top priorities.



- Continue to conduct periodic waste composition studies in Big Sky.
- Expand data collection systems at Logan Landfill to include the geographic location where waste originates.
- Conduct a small WCA specific to Big Sky's Construction and Demolition (C & D) waste.

SHORT TERM

- Provide food waste prevention education and technical assistance.
- Fund and develop food rescue systems to help divert waste from the landfill while also feeding people or animals.
- Increase composting of organic waste.
- Increase use of commercial garbage compactors to reduce transportation emissions.
- Host Community Recycling Days for specialty recycling items such as glass, yard waste, scrap metals and electronic waste.
- Fund and provide technical assistance to help businesses prevent waste.
- Continue to educate the Big Sky community on waste reduction & recycling.

LONG TERM

- Create a commercial composting facility in Big Sky.
- Reduce community glass consumption and find local outlets for reuse.
- Further investigate options for recycling plastic films.
- Examine options for creating a centralized decision-making authority in Big Sky that could pass and enforce local ordinances.
- Advocate for legislative measures that promote sustainable materials management at a local and national level.



Increasing cardboard recycling, particularly at condo waste stations, is a low effort, good return recommendation

Total Tonnage of Big Sky's Waste Stream

2022 Garbage: 6,515 tons

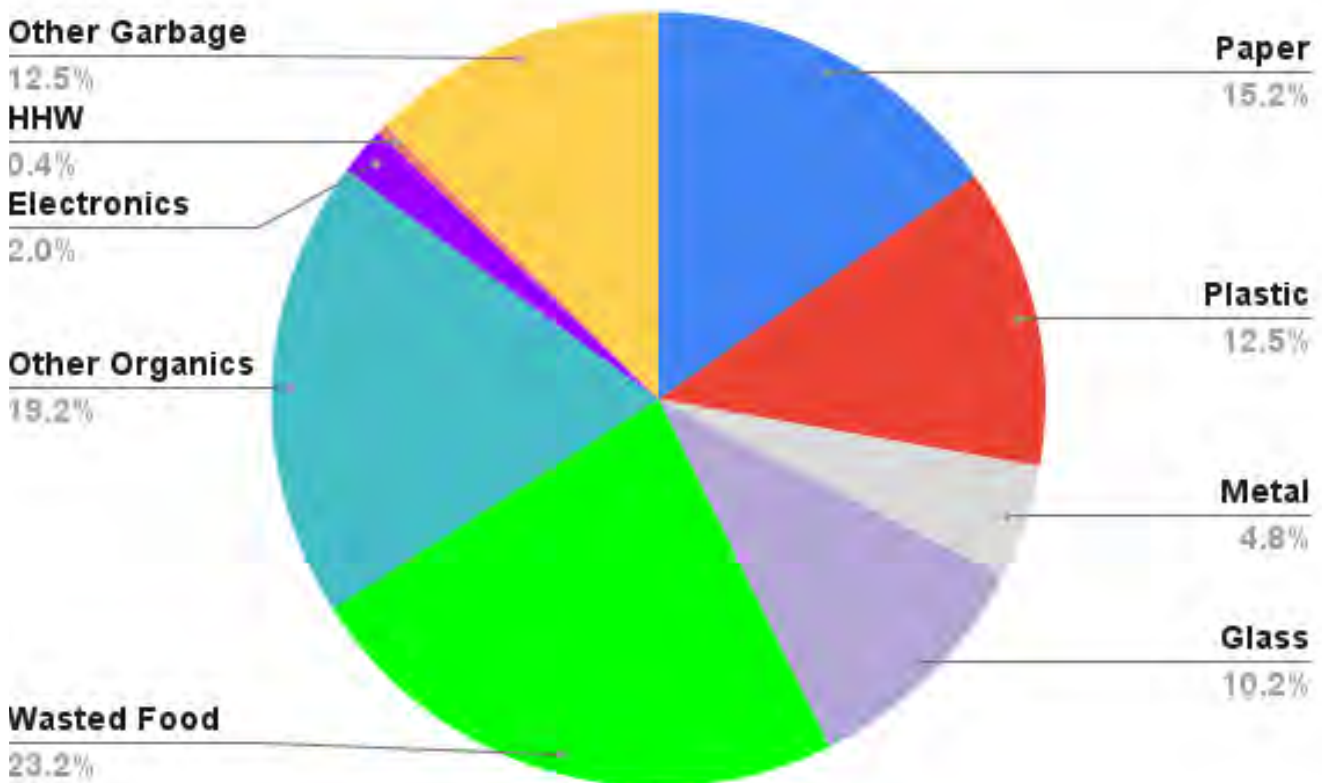
2022 Compost: 108 tons

2022 Recycling: 672 tons

2022 Diversion Rate: 10.68%

Composition of Big Sky's Garbage

Overall sample size of 7,709 lbs of garbage; data reflect all demographic sectors combined to show materials composition of Big Sky's overall trash.

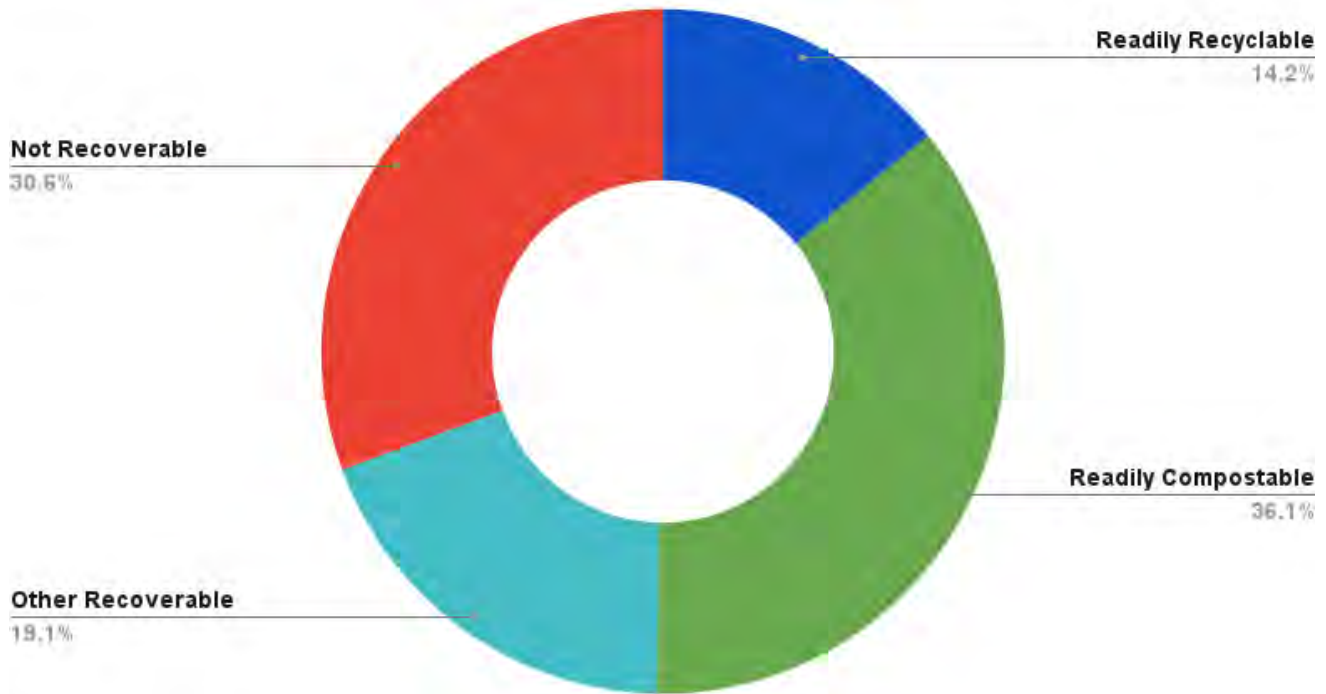


Top 10 Materials in Big Sky's Sorted Garbage

Top 10 materials accounted for 79.2% of waste sent to the landfill:

| | | | |
|------------------------|-------|-------------------------------|------|
| Wasted Food (edible) | 23.2% | Other Plastics (#3,4,6,7) | 5.5% |
| Food Scraps (inedible) | 12.1% | Cardboard/ Browns | 4.8% |
| Glass Containers | 9.8% | #2 & #4 Plastic Films | 2.6% |
| Miscellaneous Garbage | 9.6% | #1 & 2 Plastic Bottles & Jugs | 2.4% |
| Non-Recoverable Paper | 7.0% | Textiles/ Leather | 2.2% |

Composition of Garbage by Recoverability



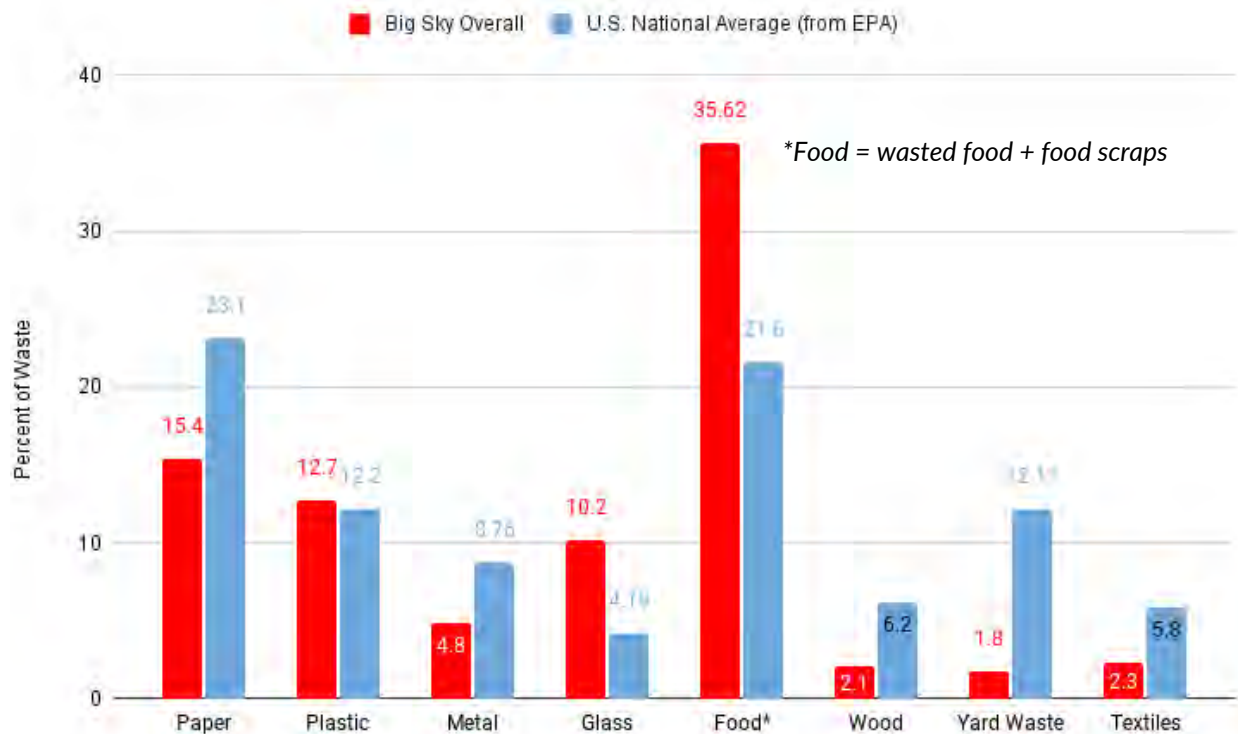
Readily Recyclable: currently recycled in existing curbside and County drop-off programs

Readily Compostable: currently collected by YES Compost curbside composting program

Other Recoverable: materials that are not accepted in curbside programs but that can currently be recycled or composted through specialty collections offered in Gallatin County (ex: glass containers, electronic waste, yard waste, clean wood, etc.)

Not Recoverable: true garbage; materials where no diversion or recycling options currently exist in Gallatin County

Comparison of Big Sky's Waste Composition to U.S. National Average



Key Terms & Abbreviations

Big Sky Resort Area District | BSRAD- The District for local administration of the Resort Tax in the Big Sky Area, a Census Designated Place. Resort Tax is collected and remitted by local businesses operating within the District. The locally elected Board of five volunteer Directors strategically invests funds to address critical community needs.

Big Sky Sustainability Network Organization | SNO- The Big Sky Sustainability Network Organization (SNO) is a 501(c)3 non-profit whose mission is to preserve and protect the Big Sky Community by advancing sustainability and environmental initiatives.

Commercial- Locations that are non-residential, such as businesses, schools, hospitals, offices and organizations.

Compactor- A special type of dumpster that contains a machine that compresses the garbage inside so that it takes up less space.

Construction and Demolition Waste | C & D Waste- Waste originating from construction and remodeling sites, in this study, specifically from privately contracted roll-off dumpsters.

E-Waste- Electronic waste at the end-of-life or discarded electrical and electronic equipment, such as household appliances, office information and communications equipment, entertainment and consumer electronic equipment, lighting equipment and electric and electronic tools.

Food Scraps- Organic materials related to food that people do not typically eat; includes fruit rinds, vegetable peels, bones, coffee and tea grounds, shells, etc.

Food Waste- Encompasses all organic matter related to food, including both wasted foods and inedible food scraps.

Garbage- For the purpose of this study, garbage is considered any waste intended for and directed to the landfill.

Greenhouse Gas | GHG- Gases in the atmosphere that absorb infrared radiation (net heat energy) emitted from Earth's surface and reradiate it back to Earth's surface, thus contributing to the greenhouse effect.

Household Hazardous Waste | HHW- Hazardous materials when disposed of, including but not limited to motor oil, antifreeze, fuel, oil-based paint (no latex), solvents, pesticides, fertilizers, batteries, pool chemicals, bleach, drain openers, aerosols and mercury thermometers.

Materials Recovery Facility | MRF- Also known as materials reclamation facility or materials recycling facility. A solid-waste management plant that processes recyclable materials to sell to manufacturers as raw materials for new products.

Multifamily Residential- Residential homes that are attached multifamily units such as duplexes, condos and apartment buildings.

Municipal Solid Waste | MSW- Also known as trash or garbage, MSW comprises the everyday items thrown away, ranging from paper to plastic to yard waste and glass. MSW comes from homes, schools, businesses and other institutions and it does not include construction and demolition (C & D) waste.

Organics- Carbon-based materials that decompose naturally via composting. Examples include food scraps, yard waste and wood waste like wood chips.

Recyclable- For the purpose of this study "recyclable" refers to materials that are currently accepted for recycling through various programs available in Gallatin County, MT.

Roll-off Dumpster- An often open-top dumpster characterized by a rectangular footprint, utilizing wheels to facilitate rolling the dumpster in place from a large truck.

Single-Family Residential- For the purpose of this study single-family homes are considered stand-alone buildings that are intended for one family to live in at a time and mobile homes.

Vacation Homes- Homes that are second homes (occupied part-time by an owner who resides primarily elsewhere) or rental homes for vacationers, similar to VRBO or Airbnb.

Waste- For the purpose of this study, waste is inclusive of garbage (landfill), recycling and composting.

Waste Composition Assessment | WCA- A study that involves physically separating, weighing and categorizing waste based on the type of material.

Wasted Food- Any food item found in the garbage that could have been eaten at some point. Includes leftover food, whole produce, rotten or moldy foods, meats, condiments, dairy products, unused cooking oils, etc.



Winter sorting setup inside Eagle Mount's Greenhouse

Introduction



Logan Landfill, located near Three Forks, is the final location for all regional garbage, including trash from Big Sky and Yellowstone National Park

Overview of Big Sky

Big Sky, Montana is a resort community nestled along the edge of Yellowstone National Park, located 45 miles south of Bozeman Yellowstone International Airport. In the winter, visitors come from all corners of the world to ski at Big Sky Resort and in the summer visitors flock to the region for world-class trout fishing, endless hiking opportunities, proximity to Yellowstone National Park and abundant wildlife. The year-round population of Big Sky is 3,591 full-time residents (2020), yet the population on any given day can be substantially higher due to visitors and second-home owners and it may reach 15,000 people per day during peak visitor periods.

Big Sky straddles two counties, Gallatin County and Madison County, and it is unique in that there is no official town or incorporated municipality- it's an unincorporated census-designated place (CDP). Outdoor recreation drives the economy, with Big Sky Resort attracting hundreds of thousands of skier visits per year. The area has been experiencing rapid population growth, with full-time residents having increased by 57% since 2010 and continuing to grow at a rate of 6% per year. The rapid population growth and increased visitation has led to a boom in the local economy. Regional growth is reflected by several metrics. In Gallatin County, land use permits increased from 146 to 521 from 2011-2021, a 257% increase over 10 years. Over the same period, the overall tons of waste from the region going to Logan Landfill increased from 108,647.37 to 186,188.76 tons, a 71% increase.

Regional waste tonnage entering Logan Landfill near Three Forks increased more than 71% from 2011 to 2021.

The rapid population growth and development in Big Sky creates both challenges and opportunities for local citizens invested in the future of this unique place. Since Big Sky is a CDP that lacks a municipal government, non-profits often provide essential leadership, collaboration and services that a municipal government might ordinarily provide. The Big Sky Sustainability Network Organization (SNO) is a 501(c)3 non-profit whose mission is to preserve and protect the Big Sky Community by advancing sustainability and environmental initiatives. SNO addresses issues such as energy and building efficiency, transportation, water conservation, ecosystem resilience and waste. SNO's Waste Reduction Committee volunteers spearhead waste prevention and recycling education, as well as annual community recycling days and Zero Waste events.

Current Waste Management Systems

In 2023, Big Sky waste management comprises of the following:

- **Garbage:** This can be picked up by two private haulers that serve the area, or it can be self-hauled to the Bozeman Convenience Site (~50 miles away) or to Logan Landfill (~65 miles away). Logan Landfill is the final destination for all of Gallatin County's garbage and anecdotal evidence suggests that few Big Sky residents self-haul.
- **Recycling:** There are two commercial recycling haulers in Big Sky. Republic Services offers curbside recycling service to residents and businesses. (cont.)



The 4 Targeted Improvement Priorities of the the Big Sky CAP are: Transportation, Natural Environment, Energy & Buildings, and Consumption & Waste.

- **(Recycling cont.)** Full Circle Recycling offers multi-stream commercial service and they even provide residential glass recycling to two of the private clubs in Big Sky. All Big Sky residents can self-haul recyclables to a free drop site provided by Gallatin Solid Waste Management District. The site is located approximately four miles away from Big Sky Town Center and 10 miles distance from Big Sky Resort. All recycling is processed at the local Materials Recovery Facility (MRF), WeRecycleMT, located about 42 miles north of the Big Sky Recycling Center. The basic materials accepted currently include mixed paper, white office paper, cardboard, Kraft paper, #1 plastic bottles, #2 plastic bottles/jugs, steel cans and aluminum cans. Note that plastics recycling is limited and glass is also not widely accepted unless a business opts to pay extra and arrange for commercial glass pickup through Full Circle Recycling.
- **Compost:** There is one hauler that provides service for homes and businesses, YES Compost. They are a commercial compost facility and accept all food scraps, plus commercially-compostable food service items. These materials are processed at a site located about 47 miles away. They do not currently accept yard waste as part of their regular pickup, but do for the annual community recycling day and upon special request.
- **Other recoverable:** There are certain materials that are not accepted in the standard recycling or composting streams but that can be diverted from the landfill through private, specialty recycling programs. Many of these materials need to go to drop locations in Bozeman (~45 miles from Big Sky) or out to Logan Landfill. These "other recoverable" items include #2 & #4 plastic films, glass containers, yard waste, clean wood, used vegetable oil, electronic waste (e-waste) and household hazardous waste (HHW).

Importance of The Waste Composition Assessment: The Why?

Big Sky is defined by its sense of place set amongst mountains, forest and streams. As a part of the Greater Yellowstone Ecosystem, residents and visitors alike have a responsibility to honor and protect this land while enjoying the beauty of the outdoors and its wildlife. Preserving and protecting this community and its valued sense of place, now and for future generations, is SNO's mission.

In February of 2023 SNO published a [Climate Action Plan](#) (CAP) that lays out a path to net zero emissions by 2050. The CAP establishes waste as a contributor to greenhouse gas (GHG) emissions.

Community stakeholders in the waste sector identified the need to conduct a Waste Composition Assessment (WCA) to gather data about Big Sky's waste stream. The purpose of analyzing the waste stream is to identify opportunities for landfill diversion, thereby helping

This report aims to be a catalyst to change the composition of Big Sky's waste stream over time.

reduce GHG emissions, and to establish baseline data to measure future progress in waste reduction efforts. It is important to study Big Sky as a unique entity, as the demographic varies over the seasons, and the economy is heavily reliant on domestic and international tourism.

The data and analysis in this report hopefully encourage the entire community to strive for responsible, thoughtful consumption and waste management in order to steward this beautiful landscape and wildlife so generations to come may enjoy it in a similar fashion. This report aims to be a catalyst to change the composition of Big Sky's waste stream over time.



Lone Peak frames Big Sky at sunset

Methodology

This section describes how the Big Sky Community Waste Composition Assessment (WCA) was performed. Overall, the process consisted of the following steps:

1. Identify goals and design methodology for the entire study;
2. Perform waste audits and collect data;
3. Analyze data and create a final report.

Details for each step are described below.

Step One: Study Design & Methods

The SNO Waste Reduction Committee decided on key goals and objectives for this study. Anticipating that the study would likely have limited funding, they decided to focus exclusively on garbage, and not the existing recycling or composting streams. The Waste Reduction Committee identified the following goals:



Goals of the Big Sky Waste Composition Assessment (WCA)

1. Determine what materials are present in Big Sky's garbage, both overall and broken down by sector (single family residential, multifamily residential, commercial, and vacation homes).
2. Estimate the annual tonnage of Big Sky's garbage by using available data from the local haulers.
3. Use the WCA data to identify opportunities to divert materials from the landfill as a way of decreasing Big Sky's carbon emissions to meet Climate Action Plan goals.
4. Use the results of the WCA to inform future waste prevention and recycling education efforts to specific sectors and materials.
5. Compare the results of a hands-on WCA to national or local waste composition data (ex: Missoula, MT published a WCA in 2020) to determine whether live audits were necessary or if modeling would have produced similar results.

There are two main ways that WCAs are performed: they are either executed by hands-on sampling and sorting of a community's actual waste stream, or by creating models using data from other communities and extrapolating that data for a given locale. The SNO Waste Reduction Committee strongly favored a live-sampling approach, recognizing significant potential for error by using models, especially given the unique demographics of Big Sky as a rural resort community and a lack of available data for demographically similar communities. To SNO's knowledge, no live-sampling WCA had been performed within the state of Montana to date, so it created an opportunity to be the first and to provide valuable data that could be shared.

After using other communities' published WCA reports to research methods, the SNO Waste Reduction Committee agreed on the following essential aspects of a WCA:

- Sample collection: many WCA studies have local haulers collect the garbage and bring it to a transfer station or landfill to sort the samples. This system would not work for Big Sky due to the distance to Logan Landfill or the Bozeman Convenience Site, the difficulty of transporting workers to the site, the late hour in the day that commercial garbage trucks from Big Sky arrive at the landfill, and the contamination of the garbage due to compaction (ex: cardboard and paper weigh more when coated in food residue and liquids; glass shatters and becomes difficult to separate). SNO decided to run their own collection routes and seek permission from residents and businesses to collect their garbage instead of relying on the haulers.

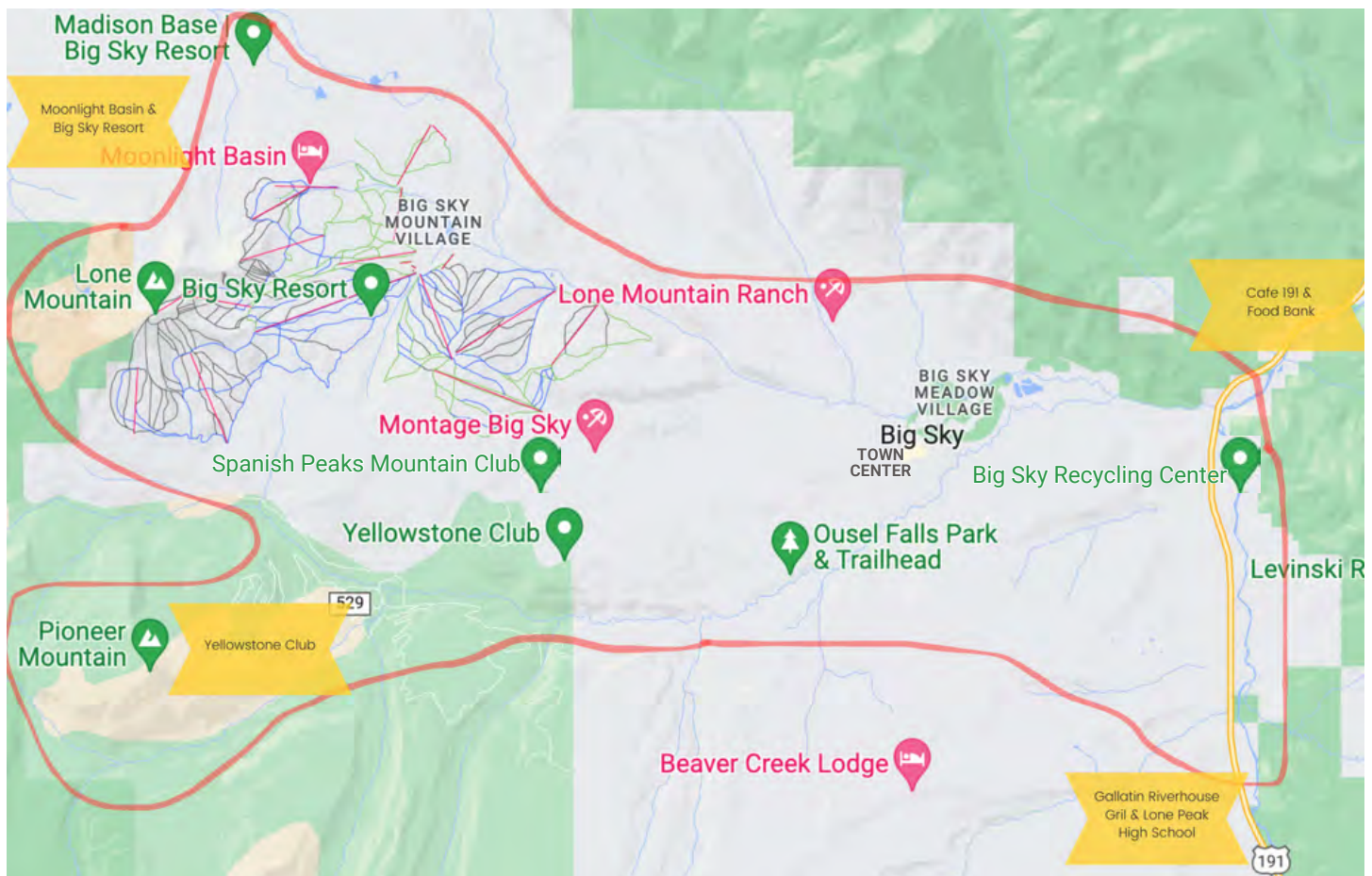


Figure 1: The red outlines the area of waste collection lying within the Big Sky Resort Area District

- Self-hauling the sample garbage allowed this study to examine different sectors with a higher level of accuracy than most studies, and at a more granular level. SNO was interested in dividing the sources of the garbage into sectors in order to see any differences and potential for targeted waste prevention education. The sectors chosen for this study were single-family residences, multifamily residences, commercial (businesses, schools and other institutions) and vacation homes (second homes and rentals). Samples were taken from locations all around Big Sky, as shown in Figure 1 on the page prior, with the red border parameters labeled with local references for additional context.
- Random sampling: Specific measures were taken in order to acquire as diverse and random of sampling as possible, including conducting audits during different months (Aug 2022 - Mar 2023) and collecting garbage from as many diverse locations as possible on each collection day. The collection team gathered as much garbage as they had the time, storage space and access to each day. One confining parameter was the size of the dumpster at the sorting site (an 8-yard dumpster).
- Materials categories: With the ultimate goal of this WCA being future materials diversion from the landfill, SNO’s Waste Reduction Committee consulted with the local recycling and composting processors to help determine the sort categories. Some studies get very granular, characterizing materials into up to 100 different categories, but this didn’t seem useful or practical for this study given budget constraints and limited access to recycling markets. SNO ultimately decided upon 30 different materials categories for this WCA, including categories for materials that are currently recyclable or compostable, materials that can be recycled or composted through specialty drop-off programs and big-picture categories of non-recoverable garbage. Recognizing the proliferation of food waste in the community from previous events, SNO chose to separate edible food waste (foods that could have been eaten at some point instead of thrown in the garbage, even if the food was moldy or rotten when sorted) versus inedible food waste (food scraps that no one is ever expected to eat, including vegetable peels, apple cores, fruit rinds, coffee grounds, etc.). Table 1 defines the recoverability categories and Table 2 shows the materials list and recoverability categories for this study. [Appendix A](#) contains a more detailed description of the materials categories.

Table 1: Materials Recoverability Definitions

| | |
|----------------------------|---|
| Readily recyclable | Materials currently accepted for recycling in Big Sky, whether using curbside recycling service or using the free recycling drop boxes provided by Gallatin County. |
| Readily compostable | Materials currently accepted in the commercial compost system run by YES Compost in Big Sky. |
| Other recoverable | Materials that are not currently accepted as readily recyclable or readily compostable, but that can still be diverted through alternative means. These alternative means can all be found within Gallatin County and include glass recycling drop-off at We Recycle Montana, grocery store drop boxes for plastic films, special collection of used vegetable oil through Full Circle Recycling, special recycling events run by Big Sky SNO and Gallatin County, and clean wood, e-waste and HHW drop-off at Logan Landfill and/ or Bozeman Convenience Site. |
| Not recoverable | True trash- materials that can not currently be diverted through existing composting and recycling systems available in Gallatin County. |

Table 2: Materials List and Recoverability Categories

| Material Type | Recoverability | Material Type | Recoverability |
|----------------------------------|--------------------|----------------------------------|---------------------|
| Paper | | Wasted Food | |
| Cardboard/ Browns | Readily recyclable | | Readily compostable |
| Newspaper/ Mixed/ Junk | Readily recyclable | Other Organics | |
| Polycoated Containers | Not recoverable | Food Scraps (inedible) | Readily compostable |
| Non-recoverable Paper | Not recoverable | Yard Waste/ Plants | Other recoverable |
| White Office Paper | Readily recyclable | Clean Wood | Other recoverable |
| Plastic | | Compostable Containers | Readily compostable |
| #1 & #2 Plastic Bottles & Jugs | Readily recyclable | Other Organics (pet waste) | Not recoverable |
| Other #1 & #2 Plastic Containers | Not recoverable | Used Vegetable Oil | Other recoverable |
| #2 & #4 Plastic Films | Other recoverable | Electronics | |
| #5 Plastic Containers | Not recoverable | Currently Recyclable E-waste | Other recoverable |
| Other Plastics (#3,4,6,7) | Not recoverable | Non-recyclable Electric Devices | Not recoverable |
| Metal | | Household Hazardous Waste | |
| Tin/ Steel Cans | Readily recyclable | | Other recoverable |
| Aluminum Cans | Readily recyclable | Other Garbage | |
| Other Recoverable Metal | Readily recyclable | Textiles/ Leather | Not recoverable |
| Non-recoverable Metal | Not recoverable | Medical Waste | Not recoverable |
| Glass | | Misc. Garbage | Not recoverable |
| Glass Containers | Other recoverable | | |
| Non-recoverable Glass | Not recoverable | | |

Once the study methods were identified, the final step was to secure funding. Many municipalities contract out waste composition studies to private consulting firms, and when SNO sought price quotes, they were told that a minimum of \$100,000 was needed. Seeing the prohibitive cost of contracting out this work, the SNO Waste Reduction Committee created a do-it-yourself study that leveraged local resources, including getting significant in-kind donations from local businesses, to keep costs down. They then proposed a grant to the Big Sky Resort Area District (BSRAD), which applies a local 4% tax on luxury goods and services collected by local businesses operating within BSRAD. In the early summer of 2022, BSRAD approved a \$25,000 grant to SNO to fund this WCA, with the final report to be completed by June 1, 2023.

The SNO Waste Reduction Committee created a do-it-yourself study that leveraged local resources, including getting significant in-kind donations from local businesses, to keep costs down.

Additional funding was received through grants from Rieschel Family Foundation and Moonlight Community Foundation to ensure funding was sufficient to see the project to completion. Additionally, members of the Waste Reduction Committee made in-kind donations through use of supplies already owned.

Step Two- Perform Waste Audits and Collect Data

Once funding was approved, the following big-picture tasks had to be completed before the first audit could take place:

1. Acquire sorting sites to conduct the waste sampling. TMC Gravel Pit in Big Sky donated use of an outdoor site for the warmer months, and a non-profit in Bozeman, Eagle Mount, agreed to provide a low-fee indoor site to be used from December through March.
2. Arrange to have garbage hauling service donated by Republic Services to bring the garbage to the landfill after it was sorted and weighed. Republic placed 8-yard dumpsters at both sorting sites and provided on-call service to dispose of the trash after each audit day.
3. Recruit workers to conduct the audits, including at least two Site Supervisors per day (waste industry professionals from Republic Services and Gallatin Solid Waste Management). Given the relatively small budget for this project, volunteer labor proved to be essential, and the Gallatin County Sheriff Work Program agreed to provide labor, where non-violent offenders work in the community instead of being sent to jail.
4. Gain permission from individuals, HOAs, businesses, and organizations to collect trash for sampling. This was done through in-person and online advertising and sign-ups, plus knocking on doors of single-family residences.
5. Acquire materials to conduct the audits (see [Appendix B](#)). Several local partners donated materials, including the usage of a box truck from Full Circle Recycling, the usage of Clear Stream containers from YES Compost, plywood to increase table surface area from Simkins-Hallin and site usage of the TMC Gravel Pit & Eagle Mount.
6. Schedule audit days from August 2022 through March 2023 and coordinate all site logistics, staffing and materials for each date.

TRASH RETRIEVAL

FOR A COMMUNITY WASTE ASSESSMENT

WHAT: SNO WILL BE
PICKING UP A FEW
BAGS OF TRASH

WHEN: AFTERNOON OF
MON, FEB 13

PLEASE HAVE 2-3
BAGS OF TRASH
READY FOR
RETRIEVAL



Curious What's in Big Sky's Trash?

Sign up to partake in an
anonymous waste
composition assessment

Details: From August 2022–
March 2023, Big Sky SNO will
be coordinating with waste
haulers, HOAs, local
businesses and resorts to
assess our community's
waste composition

Why? To better understand
what can be diverted from the
landfill and make Big Sky a
healthier place to live & play

Preserving &
Protecting
Big Sky's
Environment



Sample of literature created for community outreach: (above) a notice to business owners in preparation to participate in waste pickup; and (below) an informational flyer to invite single family homeowners to sign up, utilized at Farmer's Markets & door-to-door outreach.



Waste pickup route in February 2023- Commercial Sector

Once the big-picture logistics were in place, the first waste audit was conducted on August 28, 2022. Ten days of audits were conducted, and each audit consisted of the following steps:

1. Day before or morning of audit: one to two Site Supervisor(s) used a box truck to run a collection route for the sector being targeted. They collected as much garbage from as many different locations as possible. In the winter months, the garbage-filled truck was parked in a heated facility at YES Compost or Four Corners Recycling overnight to prevent the garbage from freezing and becoming inseparable.



Waste pickup route in December 2022-Vacation Homes Sector

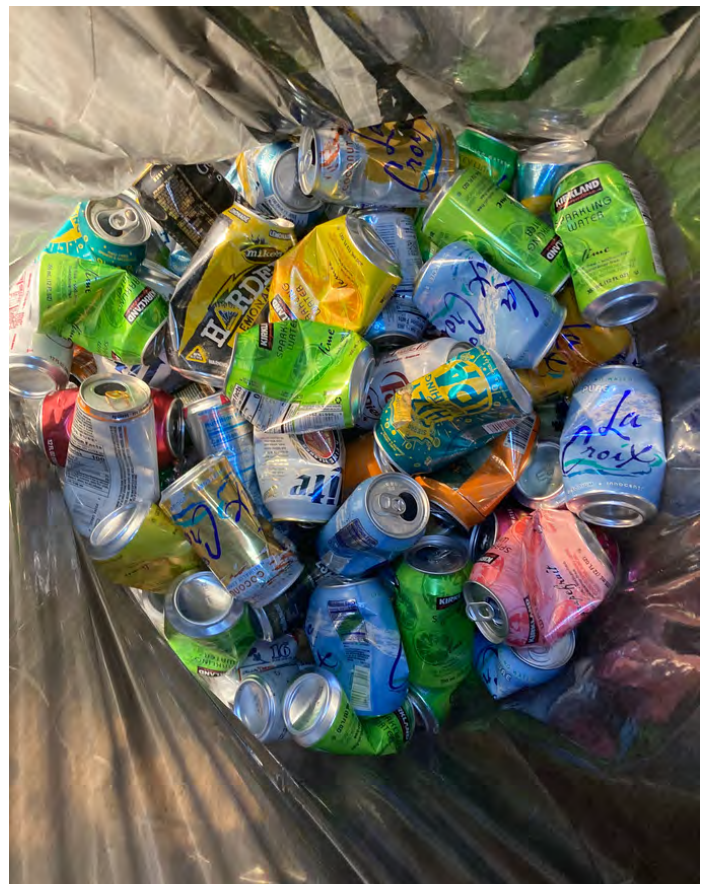
2. Day of audit: Once the site was set up and the bags of garbage were unloaded, the Site Supervisors would provide a morning briefing to the workers addressing the day's goals and priorities, safety concerns and how to properly sort. While workers sorted materials, the Site Supervisors sorted, answered questions and made regular patrols to make sure there was little to no contamination in any of the bins. After all garbage was sorted, it was weighed and data were recorded on data sheets stored in the Cloud. At the end of the day all of the garbage was placed in the dumpster and the site was cleaned and materials stored for the next assessment day.



Centralized food waste bucket on a sorting table



Sorting on a September audit day at the Big Sky TMC Gravel Pit-note all the edible food



Clockwise from top left: yard waste; other #1 & #2 plastic containers sorting; aluminum cans; weighing & recording non-recoverable paper

Step Three- Analyze Data and Write Report

After all ten audit days were completed, the data were double-checked for any entry errors and waste composition percentages were calculated using averages for each sector and a weighted average for the overall waste stream (similar to other waste assessments). The SNO Waste Reduction Committee then produced this report.



Clockwise from top left: clean steel and cardboard; "picnic a la waste assessment"-all non-expired packaged food items and basket found while sorting; a waste sorting table in action with wasted food and food scrap bins in the center; signage for homeowners and property managers to allow for clear acknowledgement and consent to partake in the WCA

Results

This section provides a written description of the results of Big Sky's Waste Composition Assessment (WCA). There are two parts to determining the waste composition: estimating annual tonnage and then determining the materials composition by weight of the garbage. Detailed methods are described in [Appendix C](#).

For the waste tonnage, the information is summarized in a table with a brief narrative description of how the estimates were made. Tonnage information includes garbage, recycling and compost.

The waste composition covers just Big Sky's garbage and the data are broken down by all four sectors and an overall snapshot that combines all four sectors using a weighted average. For each sector, the following visuals are used to help summarize the data:

- A pie chart showing the composition of the garbage for that sector, broken down by big-picture materials class (paper, plastics, metal, glass, wasted food, other organics, electronic waste, HHW and other garbage).
- A doughnut chart showing the divertibility of the materials for that sector.
- A table showing the average overall composition of that sector's garbage for all of the different materials categories, plus a summary of the top five materials found in that sector's garbage.

Waste Tonnage Estimate

24

Data were garnered from waste haulers, Big Sky Resort & Logan Landfill to estimate garbage to the landfill, recycling & compost.

Multifamily Composition

Results of data collection from two days of waste assessment of multifamily homes.

29

Overall Composition

24

Combining data from all four sectors, this provides the analysis of the overall results of the all garbage gathered.

Vacation Homes Composition

Results of data collection from two days of waste assessment of vacation homes.

31

Single-Family Composition

27

Results of data collection from two days of waste assessment of single-family homes.

Commercial Composition

Results of data collection from four days of waste assessment of the commercial sector.

33

Table 3: 2022 Tonnage and Diversion Rates of Big Sky's Waste Stream

| | |
|-------------------------------|---------------|
| Total Garbage | 6515 tons |
| Total Recycling | 672 tons |
| Total Compost | 108 tons |
| Recycling Rate | 9.21% |
| Composting Rate | 1.47% |
| Overall Diversion Rate | 10.68% |

Waste & Recycling Tonnage Estimates

Big Sky's disposal options for garbage include commercial pickup from one of two private haulers or self-hauling garbage to Logan Landfill or the Bozeman Convenience Site. The majority of households and businesses use commercial haulers due to the far distance to the landfill or Bozeman Convenience Site. Logan Landfill and the Convenience Site do not have a system for tracking where self-hauled garbage comes from, so that makes it impossible to quantify self-hauled garbage. Big Sky Resort self-hauls garbage and they were able to provide their garbage tonnage for this report, but no other self-haul data were captured.

The tonnage data provided by the haulers were fairly comprehensive, but there were some gaps in the data where estimates had to be made. It's fair to say that these data underestimate Big Sky's actual annual garbage tonnage. [Appendix C](#) gives a detailed explanation of how garbage tonnage was calculated.

Overall Waste Composition

The overall waste composition for Big Sky's garbage was determined by calculating the weighted average from all 10 data collection days, with a total of 7,709 lbs of garbage sampled and weighed. These data include all four demographic sectors combined and note that all data look at composition by weight, not volume.

As shown on the next page in Figure 2, the most common material in Big Sky's garbage is wasted food, at 23.2%. Other organics comprised 19.2% of Big Sky's garbage and paper followed closely behind at 15.2%. Figure 3 shows that approximately 70% of Big Sky's garbage could have been diverted from the landfill. 14.2% can be recycled through existing systems, 36.1% can be readily composted and 19.1% could have been diverted through other specialty recycling or composting systems currently available in Gallatin County.

The most common material in Big Sky's garbage is wasted (edible) food, at 23.2%.

Table 3 shows the total tonnage of garbage, recycling and compost hauled from Big Sky between Jan 1 - Dec 31 2022. This includes all residential, industrial and commercial hauling and it also includes commercial sector tonnage from Big Sky Resort, which self-hauls garbage to the landfill. These data do not include any Construction and Demolition (C & D) waste from the haulers or Big Sky Resort.

Figure 2: Overall Waste Composition, All Sectors

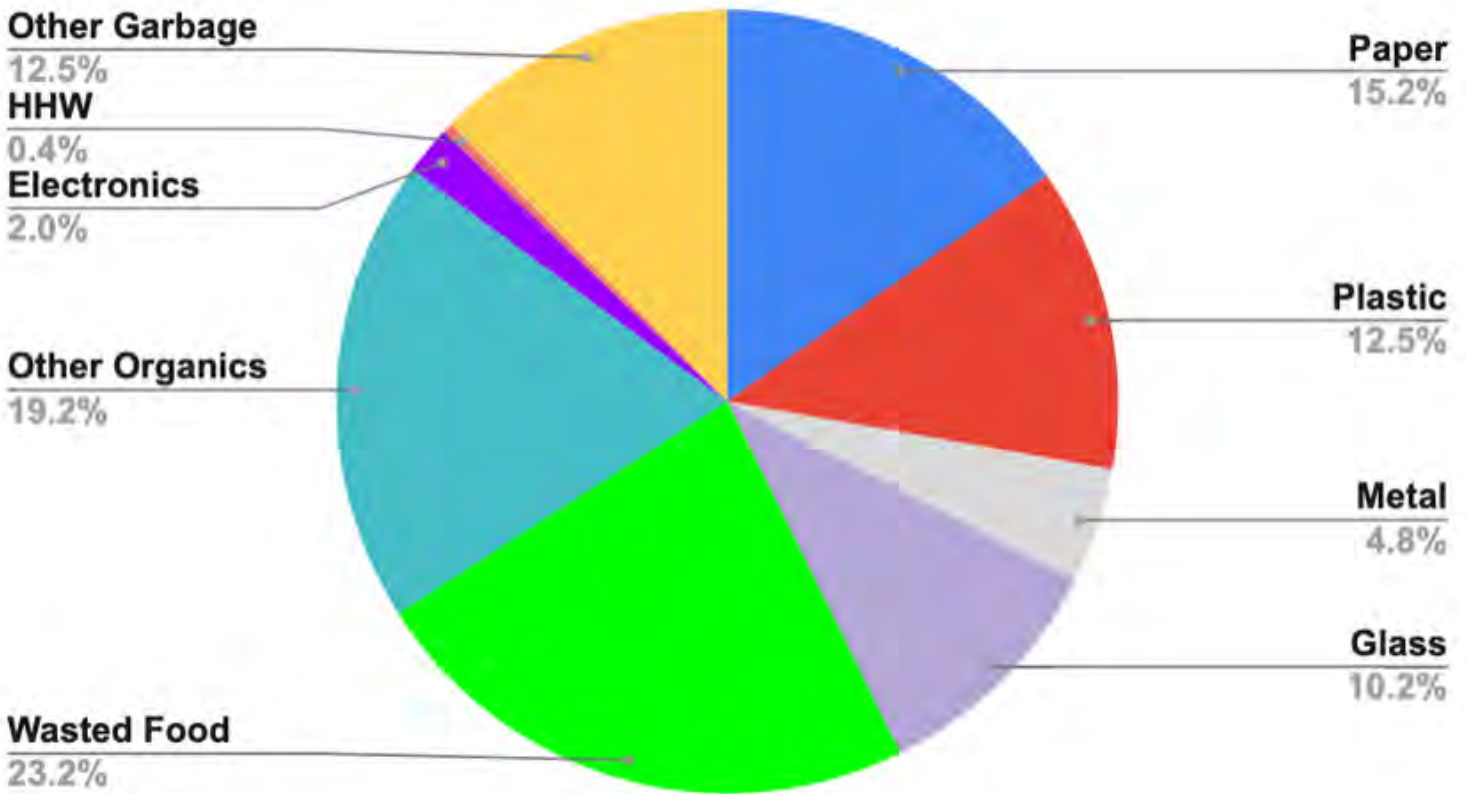


Figure 3: Divertibility of Waste Studied, All Sectors

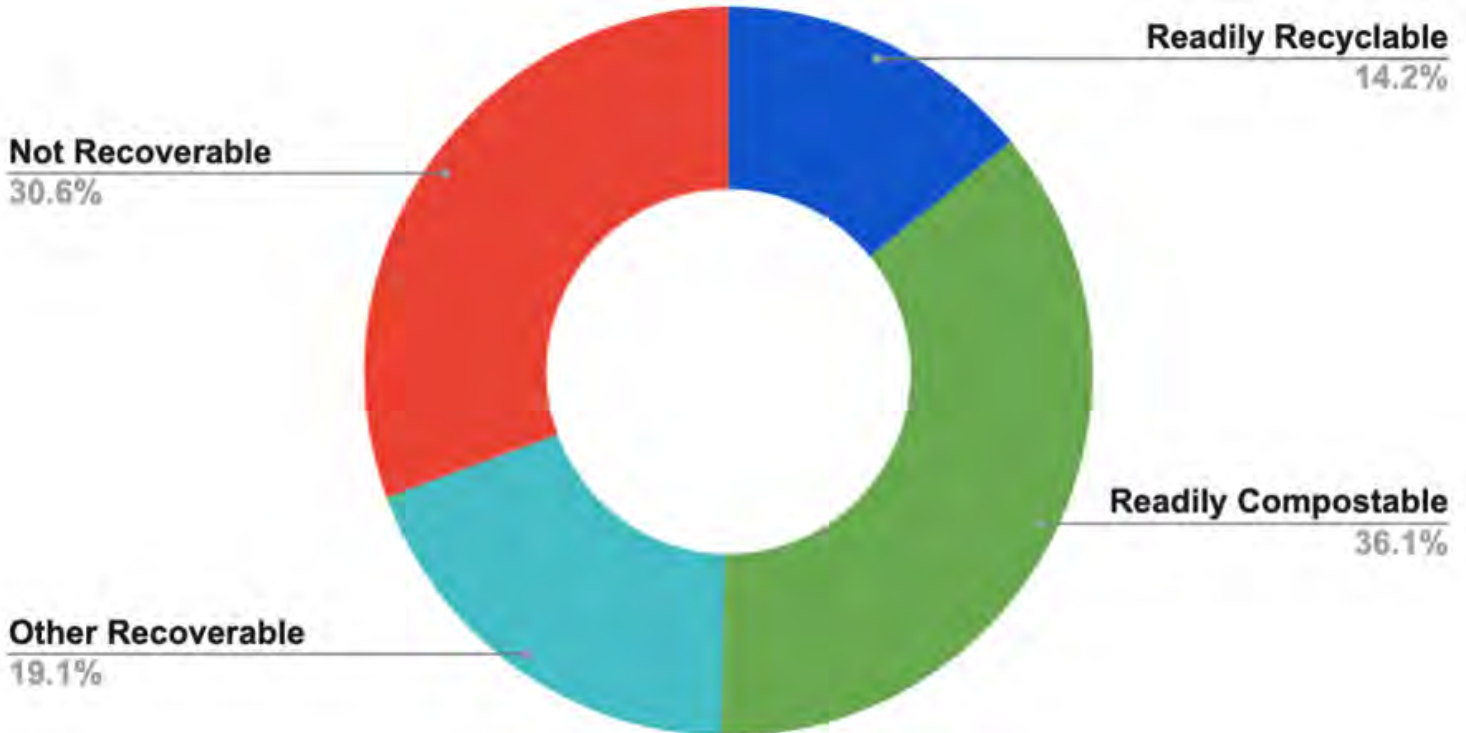


Table 4 shows a detailed look at the composition of Big Sky’s garbage when combining all sectors, including a summary of the top five materials found. Wasted food (23.2%) and food scraps (12.1%) make up over one third of Big Sky’s overall garbage. Other materials in the top five include glass containers (9.8%), miscellaneous garbage (9.6%) and non-recoverable paper (7.0%).

Table 4: Detailed Composition, Overall Waste, All Sectors

| Material | Est. % | Material | Est. % |
|--|--------------|----------------------------------|---------------|
| Paper | 15.2% | Wasted Food | 23.20% |
| Cardboard/Browns | 4.8% | Other Organics | 19.2% |
| Newspaper/ Mixed/ Junk | 1.2% | Food Scraps (inedible) | 12.1% |
| Polycoated Containers | 0.9% | Yard Waste/ Plants | 1.7% |
| Non-recoverable Paper | 7.0% | Clean Wood | 2.1% |
| White Office Paper | 1.3% | Compostable Containers | 0.9% |
| Plastic | 12.5% | Other Organics (pet waste) | 1.6% |
| #1 & #2 Plastic Bottles & Jugs | 2.4% | Vegetable (High Heat) Oil | 0.9% |
| Other #1 & #2 Plastic Containers | 1.1% | Electronics | 2.0% |
| #2 & #4 Plastic Films | 2.6% | Currently Recyclable E-waste | 1.7% |
| #5 Plastic Containers | 0.9% | Non-recyclable Electric Devices | 0.4% |
| Other Plastics (#3,4,6,7) | 5.5% | Household Hazardous Waste | 0.4% |
| Metal | 4.80% | Other Garbage | 12.5% |
| Tin/Steel Cans | 0.8% | Textiles/ Leather | 2.2% |
| Aluminum Cans (& wine caps) | 1.5% | Medical Waste | 0.7% |
| Other Recoverable Metal | 2.1% | Misc. Garbage | 9.6% |
| Non-recoverable Metal | 0.4% | | |
| Glass | 10.2% | | |
| Glass Containers | 9.8% | | |
| Non-recoverable Glass | 0.4% | | |
| Top 5 Materials Found (Total = 60.4%) | | | |
| Wasted Food | 23.2% | Misc. Garbage | 9.6% |
| Food Scraps (inedible) | 12.1% | Non-recoverable Paper | 7.0% |
| Glass Containers | 9.8% | | |

Single-Family Waste Composition

The single-family waste composition was determined by sampling 1,164 lbs of garbage collected from a variety of single-family homes and a mobile home park on two different days. The data from the two days were averaged to determine the values below.

As shown in Figure 4, the most common material in the single-family sector was wasted food (27.3%) . Other organics comprised 18.7% of single-family garbage and other garbage followed closely behind at 14.4%. Figure 5 shows that approximately 70% of single-family garbage could have been diverted from the landfill. 10.5% can be recycled through existing systems, 38.7% can be readily composted, and 20.1% could have been diverted through other recycling or composting systems currently available in Gallatin County.

Figure 4: Overall Waste Composition, Single-Family Homes

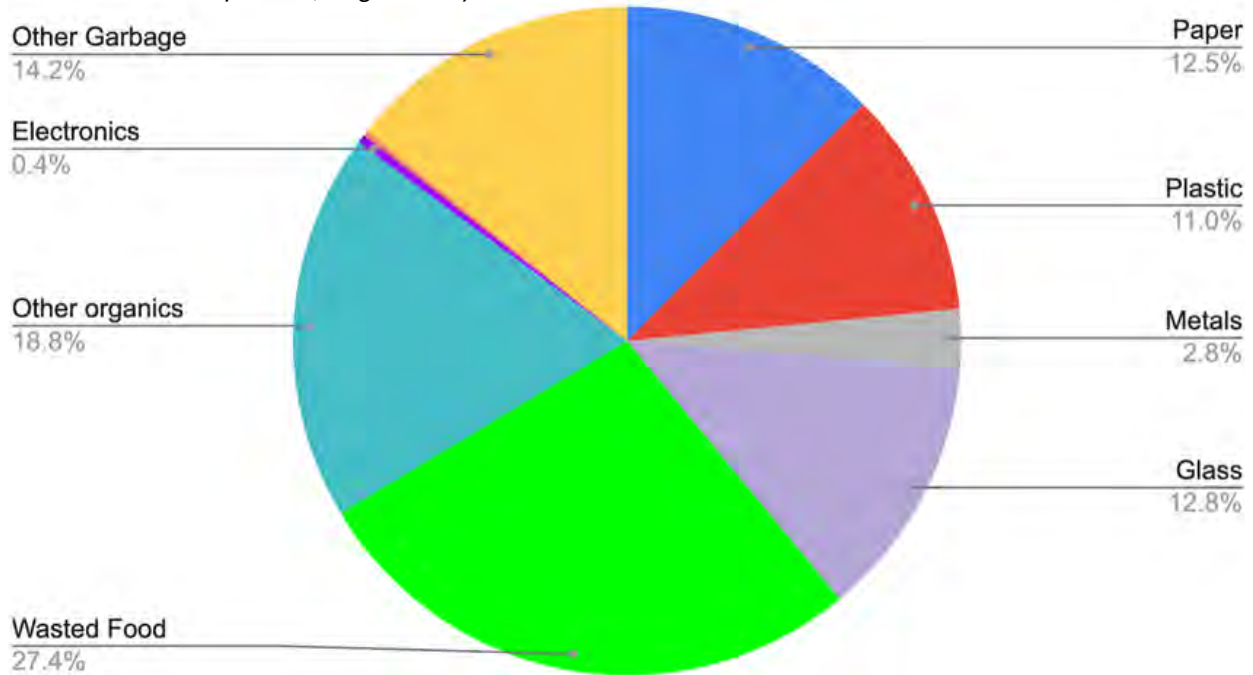


Figure 5: Divertibility of Waste, Single-Family Homes

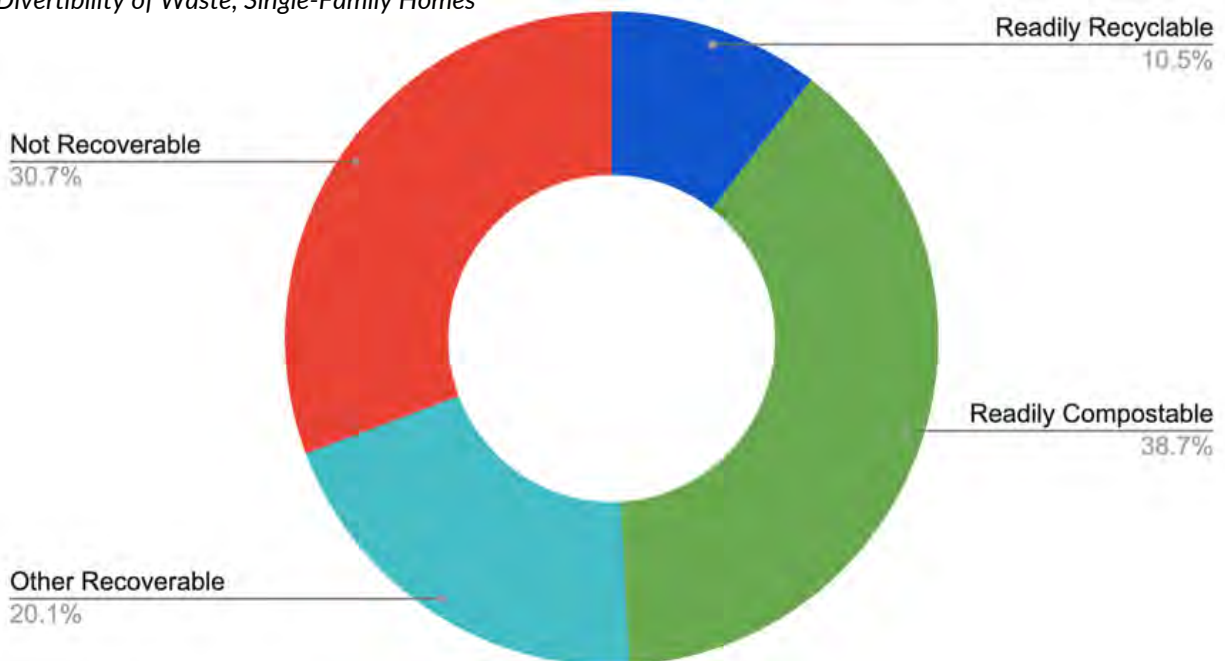


Table 5 shows a detailed look at the composition of Big Sky’s single-family garbage, including a summary of the top five materials found. Wasted food (27.4%) and food scraps (10.9%) make up almost 40% of Big Sky’s single-family garbage. Other materials in the top five include glass containers (12.5%), miscellaneous garbage (9.5%) and non-recoverable paper (5.7%).

Table 5: Detailed Composition, Single-Family Homes

| Material | Est. % | Material | Est. % |
|--|--------------|---------------------------------|--------------|
| Paper | 12.5% | Wasted Food | 27.4% |
| Cardboard/ Browns | 3.2% | Other Organics | 18.8% |
| Newspaper/ Mixed/Junk | 1.6% | Food Scraps (inedible) | 10.9% |
| Polycoated Containers | 0.8% | Yard Waste/ Plants | 4.1% |
| Non-recoverable Paper | 5.7% | Clean Wood | 1.0% |
| White Office Paper | 1.1% | Compostable Containers | 0.4% |
| Plastic | 11.0% | Other Organics (pet waste) | 2.4% |
| #1 & #2 Plastic Bottles & Jugs | 2.0% | Vegetable (High Heat) Oil | 0.0% |
| Other #1 & #2 Plastic Containers | 0.9% | Electronics | 0.4% |
| #2 & #4 Plastic Films | 2.1% | Currently Recyclable E-waste | 0.2% |
| #5 Plastic Containers | 1.0% | Non-recyclable Electric Devices | 0.2% |
| Other Plastics (#3,4,6,7) | 4.9% | Household Hazardous Waste | 0.3% |
| Metal | 2.8% | Other Garbage | 14.2% |
| Tin/ Steel Cans | 0.6% | Textiles/ Leather | 4.6% |
| Aluminum Cans (& wine caps) | 1.1% | Medical Waste | 0.1% |
| Other Recoverable Metal | 0.8% | Misc. Garbage | 9.5% |
| Non-recoverable Metal | 0.3% | | |
| Glass | 12.8% | | |
| Glass Containers | 12.5% | | |
| Non-recoverable Glass | 0.3% | | |
| Top 5 Materials Found (Total = 66%) | | | |
| Wasted Food | 27.4% | Misc. Garbage | 9.5% |
| Glass Containers | 12.5% | Non-recoverable Paper | 5.7% |
| Food Scraps (inedible) | 10.9% | | |

Multifamily Waste Composition

The multifamily waste stream composition was determined by sampling 1,606 lbs of garbage collected from multifamily housing units such as apartments and townhomes on two different days. The data from the two days were averaged to determine the values below.

As shown in Figure 6, the most common material in the multifamily sector was wasted food (24.7%), followed by other organics (16.6%) and paper (14.9%). Figure 7 shows that almost 70% of multifamily garbage could have been diverted from the landfill. 13.6% can be recycled through existing systems, 35.9% can be readily composted, and 19.7% could have been diverted through other specialty recycling or composting systems currently available in Gallatin County.

Figure 6: Overall Waste Composition, Multifamily Homes

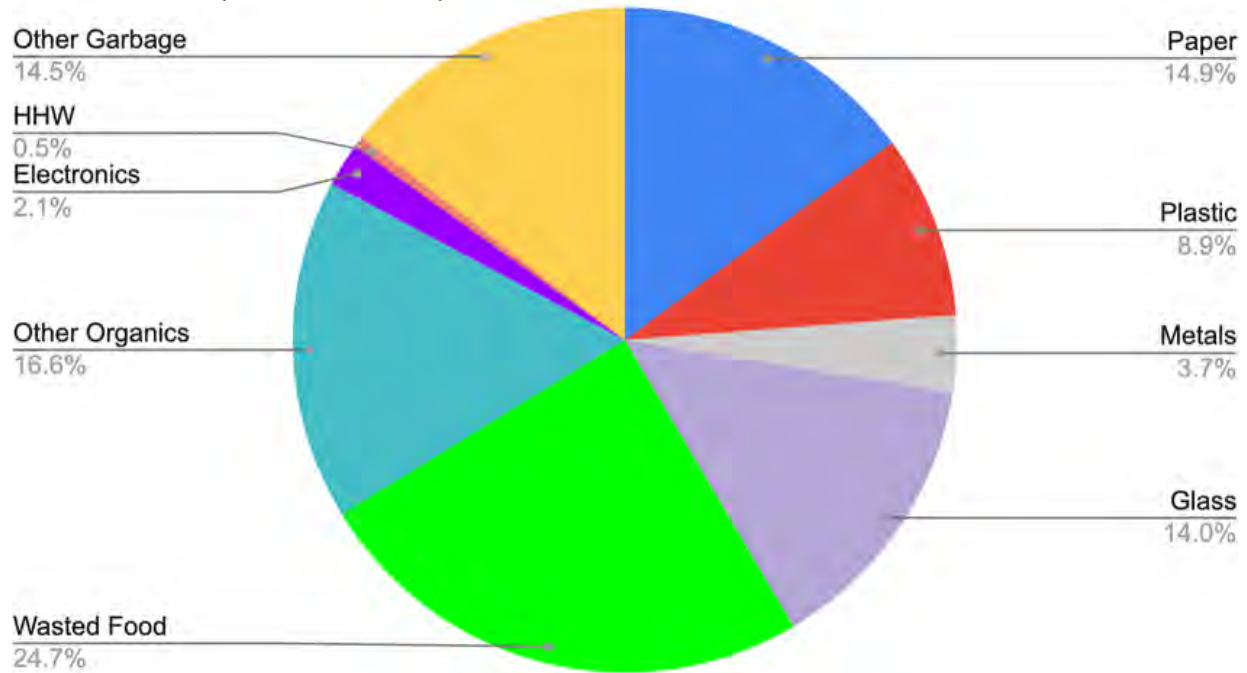


Figure 7: Divertibility of Waste, Multifamily Homes

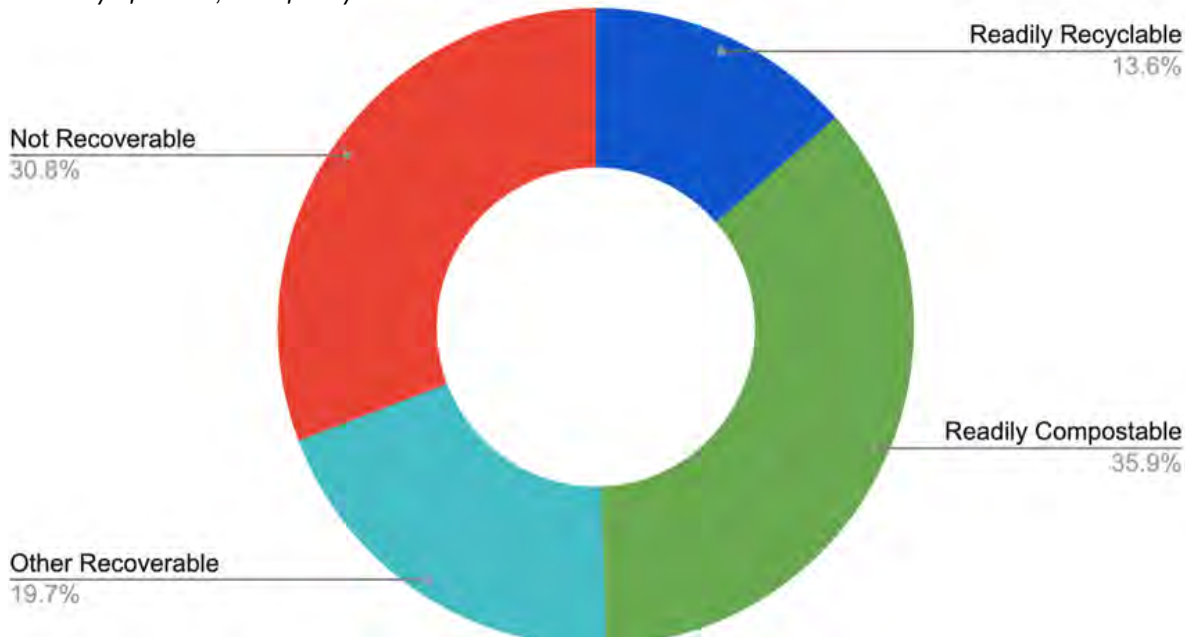


Table 6 shows a detailed look at the composition of Big Sky’s multifamily garbage, including a summary of the top five materials found. Wasted food (24.7%) and glass containers (13.2%) are the top two materials in the multifamily sector garbage. Other materials in the top five include miscellaneous garbage (11.8%), inedible food scraps (10.5%) and cardboard/Kraft paper (6.6%).

Table 6: Detailed Composition, Mutlifamily Homes

| Material | Est. % | Material | Est. % |
|--|--------------|----------------------------------|--------------|
| Paper | 14.9% | Wasted Food | 24.7% |
| Cardboard/ Browns | 6.6% | Other Organics | 16.6% |
| Newspaper/ Mixed/ Junk | 1.4% | Food Scraps (inedible) | 10.5% |
| Polycoated Containers | 0.7% | Yard Waste/ Plants | 1.8% |
| Non-recoverable Paper | 5.7% | Clean Wood | 0.4% |
| White Office Paper | 0.5% | Compostable Containers | 0.6% |
| Plastic | 8.9% | Other Organics (pet waste) | 3.1% |
| #1 & #2 Plastic Bottles & Jugs | 1.9% | Vegetable (High Heat) Oil | 0.1% |
| Other #1 & #2 Plastic Containers | 1.2% | Electronics | 2.1% |
| #2 & #4 Plastic Films | 2.0% | Currently Recyclable E-waste | 1.7% |
| #5 Plastic Containers | 0.6% | Non-recyclable Electric Devices | 0.4% |
| Other Plastics (#3,4,6,7) | 3.2% | Household Hazardous Waste | 0.5% |
| Metal | 3.7% | Other Garbage | 14.5% |
| Tin/Steel Cans | 0.6% | Textiles/ Leather | 2.7% |
| Aluminum Cans (& wine caps) | 1.5% | Medical Waste | 0.0% |
| Other Recoverable Metal | 1.1% | Misc. Garbage | 11.8% |
| Non-recoverable Metal | 0.5% | | |
| Glass | 14.0% | | |
| Glass Containers | 13.2% | | |
| Non-recoverable Glass | 0.8% | | |
| Top 5 Materials Found (Total = 66.8%) | | | |
| Wasted Food | 24.7% | Food Scraps (inedible) | 10.5% |
| Glass Containers | 13.2% | Cardboard/ Browns | 6.6% |
| Misc. Garbage | 11.8% | | |

Vacation Home Waste Composition

The vacation home waste composition was determined by sampling 1,851 lbs of garbage collected from the garbage drop-off points at several private clubs that are primarily used as second homes and vacation rentals. The data from the two days were averaged to determine the values below.

As shown in Figure 8, the most common material in the vacation home sector was wasted food (32.2%), followed by other garbage (18.8%) and paper (14.7%). Figure 9 shows that 68.5% of vacation home garbage could have been diverted from the landfill. 14.9% can be recycled through existing systems, 38.2% can be readily composted, and 15.5% could have been diverted through other recycling or composting systems currently available in Gallatin County.

Figure 8: Overall Waste Composition, Vacation Homes

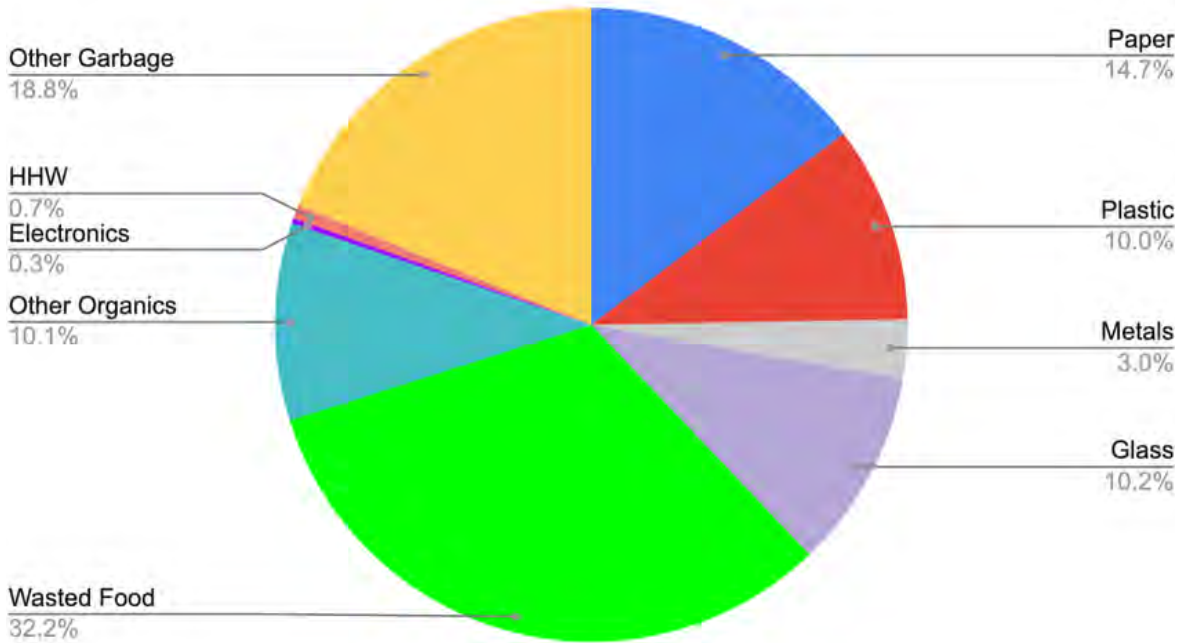


Figure 9: Divertibility of Waste, Vacation Homes

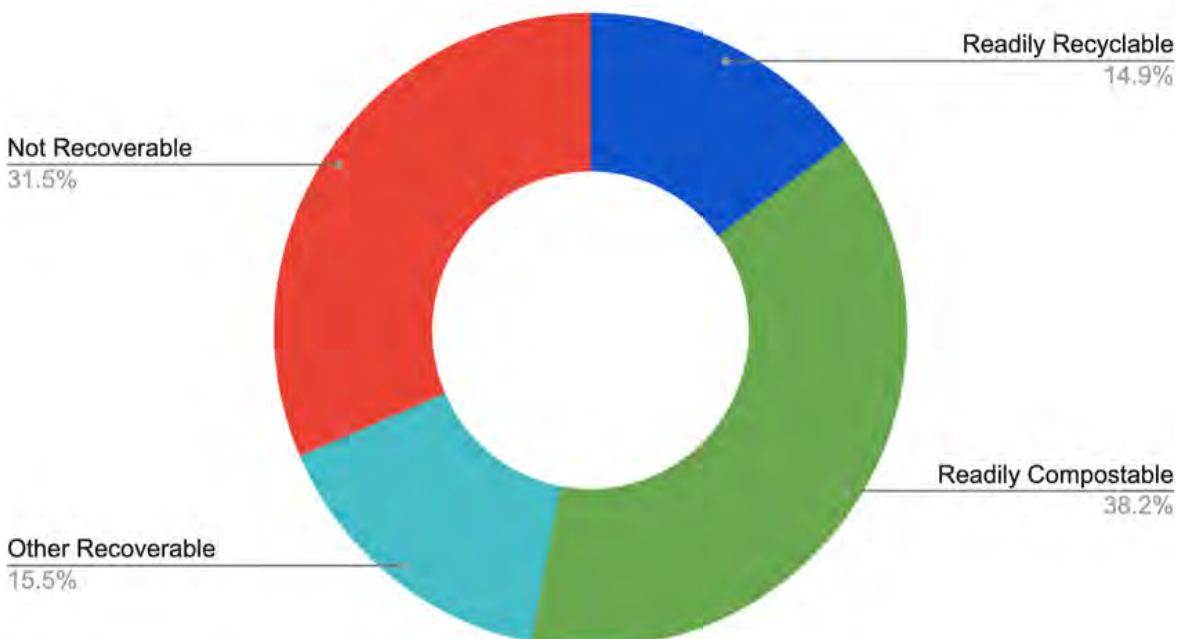


Table 7 shows a detailed look at the composition of Big Sky’s vacation home garbage, including a summary of the top five materials found. Wasted food (32.2%) and miscellaneous garbage (17.6%) are the top two materials in the vacation home sector garbage. Other materials in the top five include glass containers (9.7%), cardboard/Kraft paper (7.9%) and inedible food scraps (5.1%).

Table 7: Detailed Composition, Vacation Homes

| Material | Est. % | Material | Est. % |
|--|--------------|----------------------------------|--------------|
| Paper | 14.7% | Wasted Food | 32.2% |
| Cardboard/ Browns | 7.9% | Other Organics | 10.1% |
| Newspaper/ Mixed/ Junk | 0.6% | Food Scraps (inedible) | 5.1% |
| Polycoated Containers | 1.0% | Yard Waste/ Plants | 1.5% |
| Non-recoverable Paper | 4.9% | Clean Wood | 2.0% |
| White Office Paper | 0.3% | Compostable Containers | 0.8% |
| Plastic | 10.0% | Other organics (pet waste) | 0.6% |
| #1 & #2 Plastic Bottles & Jugs | 3.5% | Vegetable (High Heat) Oil | 0.0% |
| Other #1 & #2 Plastic Containers | 0.8% | Electronics | 0.3% |
| #2 & #4 Plastic Films | 1.5% | Currently Recyclable E-waste | 0.1% |
| #5 Plastic Containers | 0.5% | Non-recyclable Electric Devices | 0.2% |
| Other Plastics (#3,4,6,7) | 3.7% | Household Hazardous Waste | 0.7% |
| Metal | 3.0% | Other Garbage | 18.8% |
| Tin/ Steel Cans | 0.6% | Textiles/ Leather | 1.3% |
| Aluminum Cans (& wine caps) | 1.3% | Medical Waste | 0.0% |
| Other Recoverable Metal | 0.7% | Misc. Garbage | 17.6% |
| Non-recoverable Metal | 0.5% | | |
| Glass | 10.2% | | |
| Glass Containers | 9.7% | | |
| Non-recoverable Glass | 0.5% | | |
| Top 5 Materials Found (Total = 72.5%) | | | |
| Wasted Food | 32.2% | Cardboard/ Browns | 7.9% |
| Misc. Garbage | 17.6% | Food Scraps (inedible) | 5.1% |
| Glass Containers | 9.7% | | |

Commercial Waste Composition

The commercial waste composition was determined by sampling 3,088 lbs of garbage collected from various businesses, restaurants, churches, schools and other non-residential institutions on four different days. The data from the four days were averaged to determine the values below.

As shown in Figure 10, wasted food and other organics tied for first place in the commercial sector garbage, with each coming in at 21% for a combined total of over 40%. The Site Supervisors noted on all four days that the amount of wasted food in this study is lower than reality due to the collection time. They were only able to collect samples in the late morning to mid-afternoon due to logistics, and many restaurants did not yet have a significant amount of garbage at that time since dumpsters had been emptied from the night prior. Paper came in third place, at 16.3%. Notes from the sorting days also stated that the non-recoverable paper included a substantial amount of paper towels and non-compostable food service containers.

Figure 11 shows that 69.5% of commercial garbage could have been diverted from the landfill. 15.6% can be recycled through existing systems, 35.6% can be readily composted, and 18.4% could have been diverted through other specialty recycling or composting systems currently available in Gallatin County.

Figure 10: Overall Waste Composition, Commercial Sector

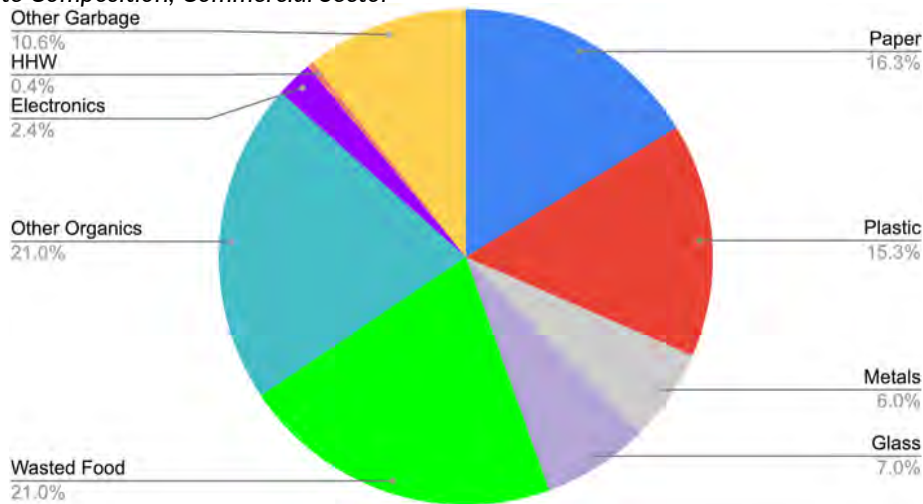


Figure 11: Divertibility of Waste, Commercial Sector

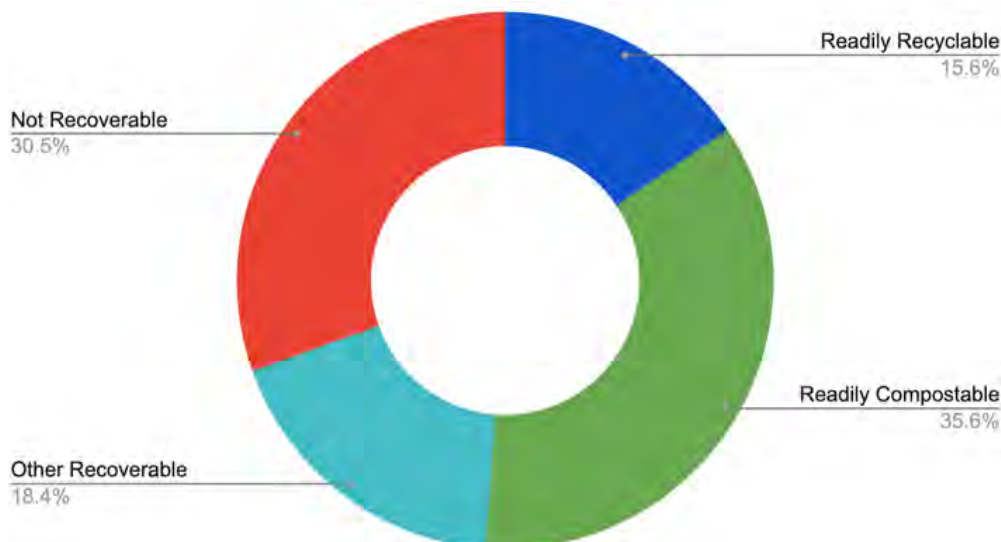


Table 8 shows a detailed look at the composition of Big Sky’s commercial garbage, including a summary of the top five materials found. Wasted food (21%) and inedible food scraps (13.4%) are the top two materials in the commercial sector garbage. Other materials in the top five include non-recoverable paper (8.2%), other plastics (7.1%) and glass containers (6.7%).

Table 8: Detailed Composition, Commercial Sector

| Material | Est. % | Material | Est. % |
|---|--------------|----------------------------------|--------------|
| Paper | 16.3% | Wasted Food | 21.0% |
| Cardboard/ Browns | 4.2% | Other Organics | 21.0% |
| Newspaper/ Mixed/ Junk | 0.9% | Food Scraps (inedible) | 13.4% |
| Polycoated Containers | 1.1% | Yard Waste/ Plants | 1.0% |
| Non-recoverable Paper | 8.2% | Clean Wood | 3.4% |
| White Office Paper | 1.9% | Compostable Containers | 1.1% |
| Plastic | 15.3% | Other Organics (pet waste) | 0.3% |
| #1 & #2 Plastic Bottles & Jugs | 2.9% | Vegetable (High Heat) Oil | 1.7% |
| Other #1 & #2 Plastic Containers | 1.1% | Electronics | 2.4% |
| #2 & #4 Plastic Films | 3.1% | Currently Recyclable E-waste | 2.0% |
| #5 Plastic Containers | 1.0% | Non-recyclable Electric Devices | 0.4% |
| Other Plastics (#3,4,6,7) | 7.1% | Household Hazardous Waste | 0.4% |
| Metal | 6.0% | Other Garbage | 10.6% |
| Tin/ Steel Cans | 0.9% | Textiles/ Leather | 1.2% |
| Aluminum Cans (& wine caps) | 1.6% | Medical Waste | 1.2% |
| Other Recoverable Metal | 3.2% | Misc. Garbage | 8.2% |
| Non-recoverable Metal | 0.4% | | |
| Glass | 7.0% | | |
| Glass Containers | 6.7% | | |
| Non-recoverable Glass | 0.2% | | |
| Top 5 Materials Found (Total =) | 56.4% | | |
| Wasted Food | 21.0% | Other Plastics (#3,4,6,7) | 7.1% |
| Food Scraps (inedible) | 13.4% | Glass Containers | 6.7% |
| Non-recoverable Paper | 8.2% | | |

Discussion

This Waste Composition Assessment (WCA) provides a baseline understanding of the materials in Big Sky's trash, as no previous study has been conducted in this community.

Strengths of This WCA

- Self-hauling garbage instead of sampling compacted garbage from commercial trucks made for more accurate and meaningful data compared to other studies. Self-hauling minimized contamination that happens from garbage compaction in commercial trucks (liquid waste was emptied into buckets and the weights were not counted since they were so minimal). Self-hauling ensured good accuracy in identifying the exact geographic location and sector the garbage came from and it allowed the study of more specific sectors such as vacation homes, which is important in the tourism-heavy economy of Big Sky.

- The data quality from the composition analysis is exceptional due to live sampling and strong site supervision from waste industry professionals. Results were consistent throughout sampling. Comparing the results of this study to national data from the EPA and to a recent WCA from the closest available neighbor, Missoula, MT shows that these results were quite different from existing data (Figures 12-16). Missoula's WCA relied on modeling as opposed to live-sampling. The waste stream is unique for each individual town/city due to location, demographics, climate, the local economy and diversion opportunities. Montana towns trend rural and geographically isolated. With no known existing data from live audits in Montana, modeling the waste stream based on distant cities doesn't seem productive. This WCA showed that it is possible for small communities to conduct their own waste studies without needing a six-figure budgets to produce consistent and meaningful results.

Figure 12: Single Family Waste Composition for Big Sky vs. Missoula

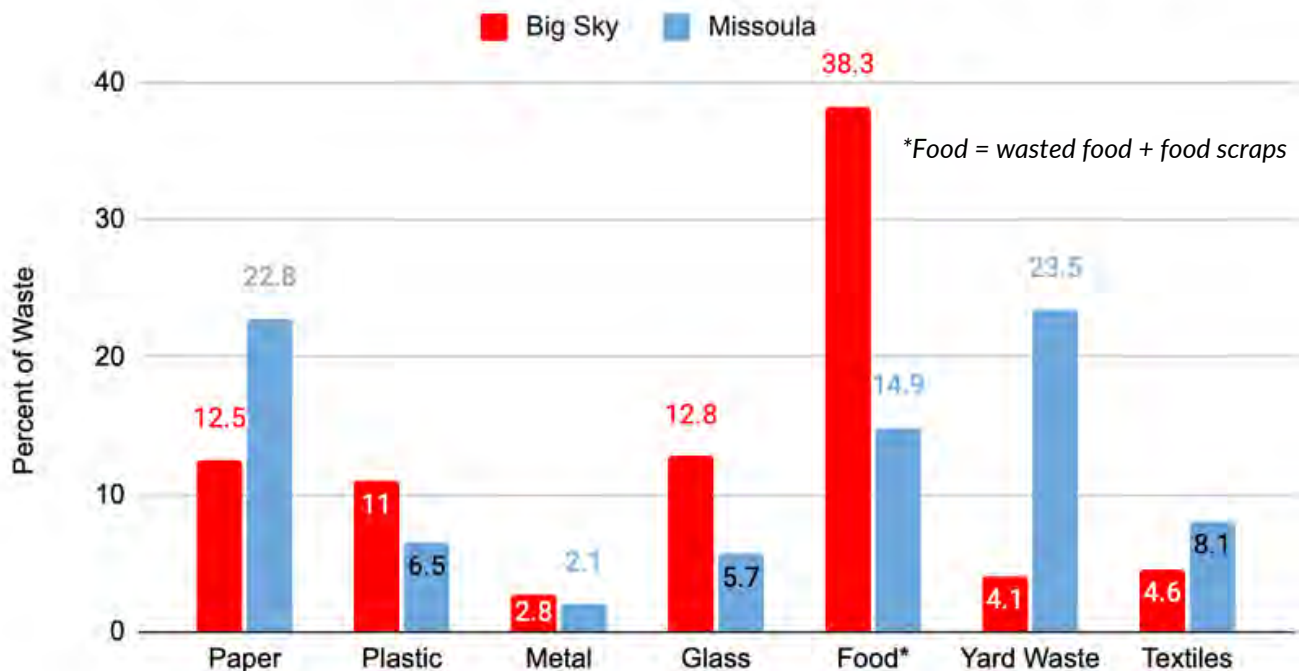


Figure 13: Multifamily Waste Composition for Big Sky vs. Missoula

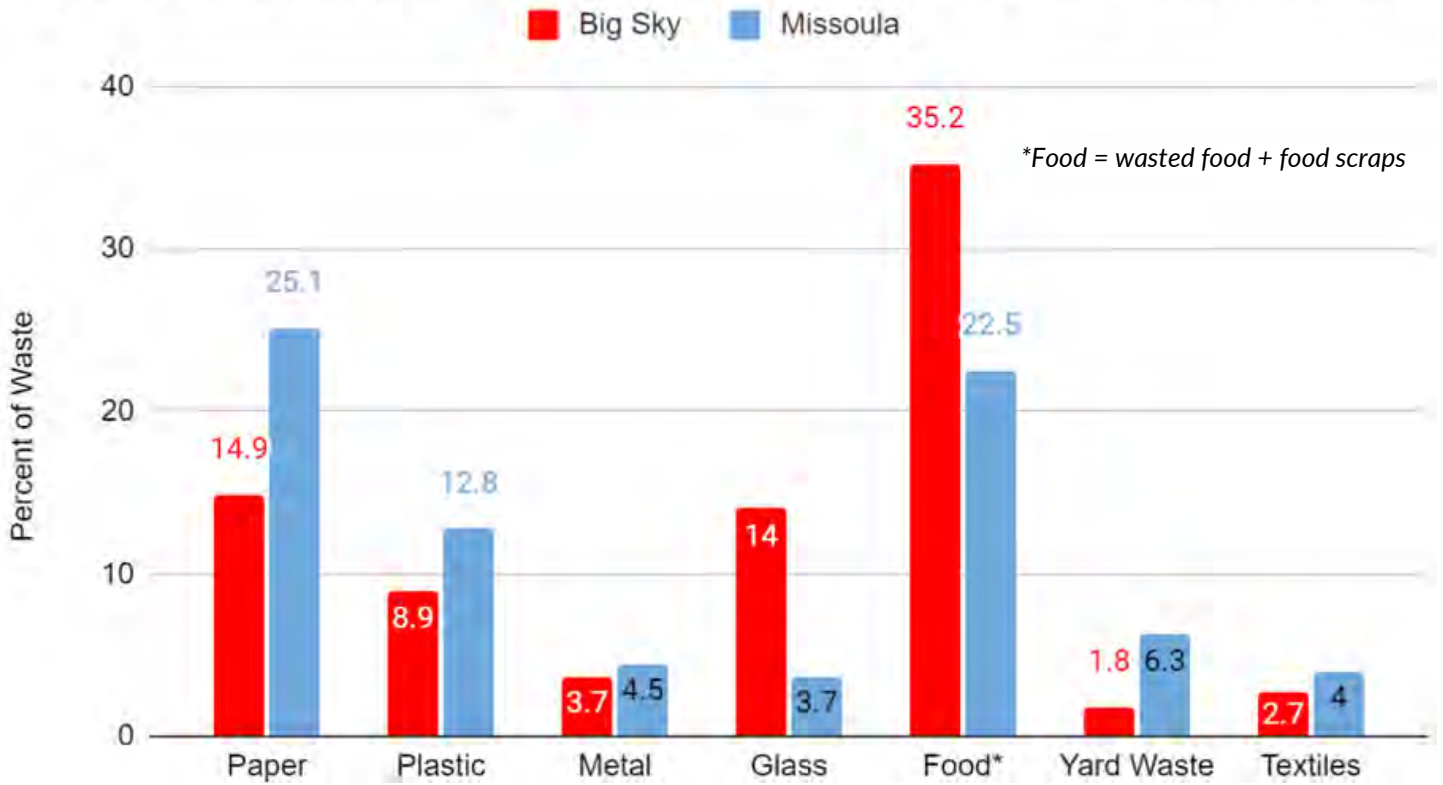


Figure 14: Commercial Waste Composition for Big Sky vs. Missoula

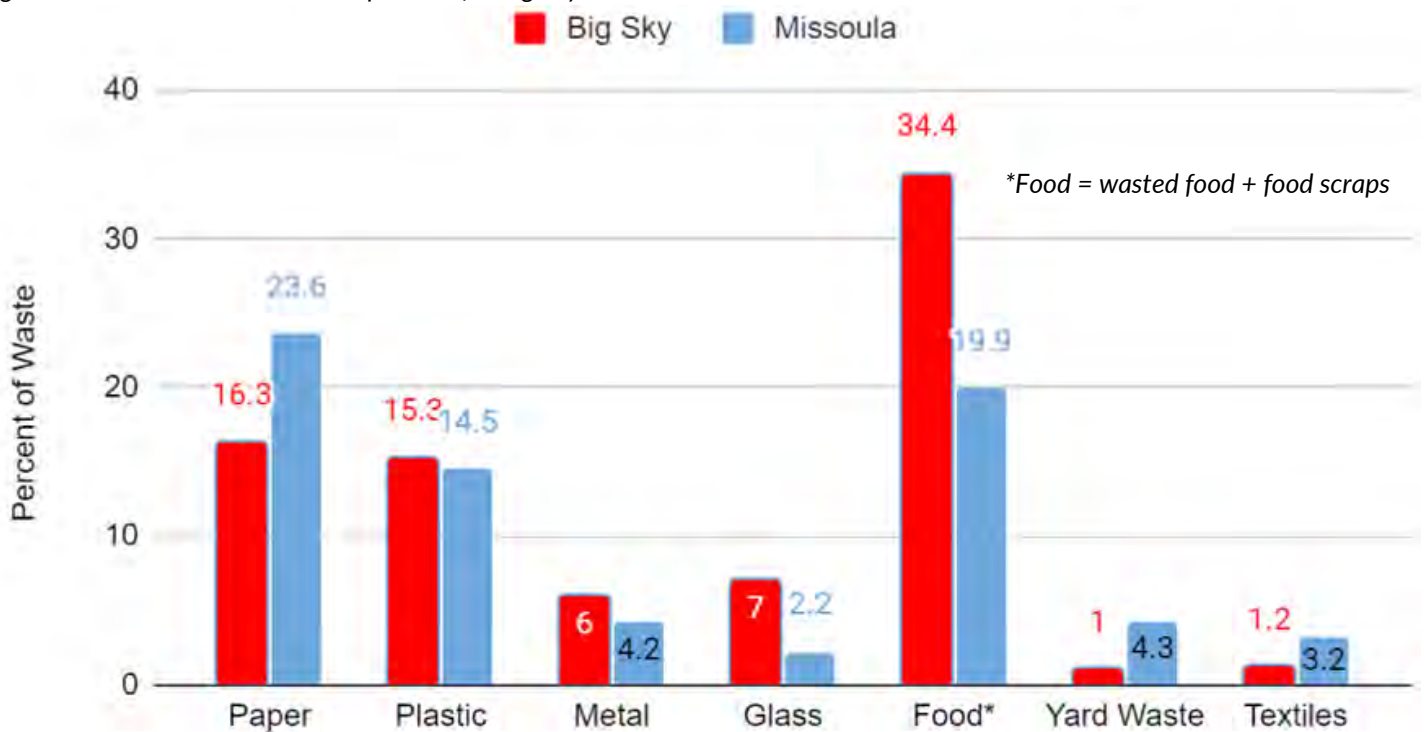
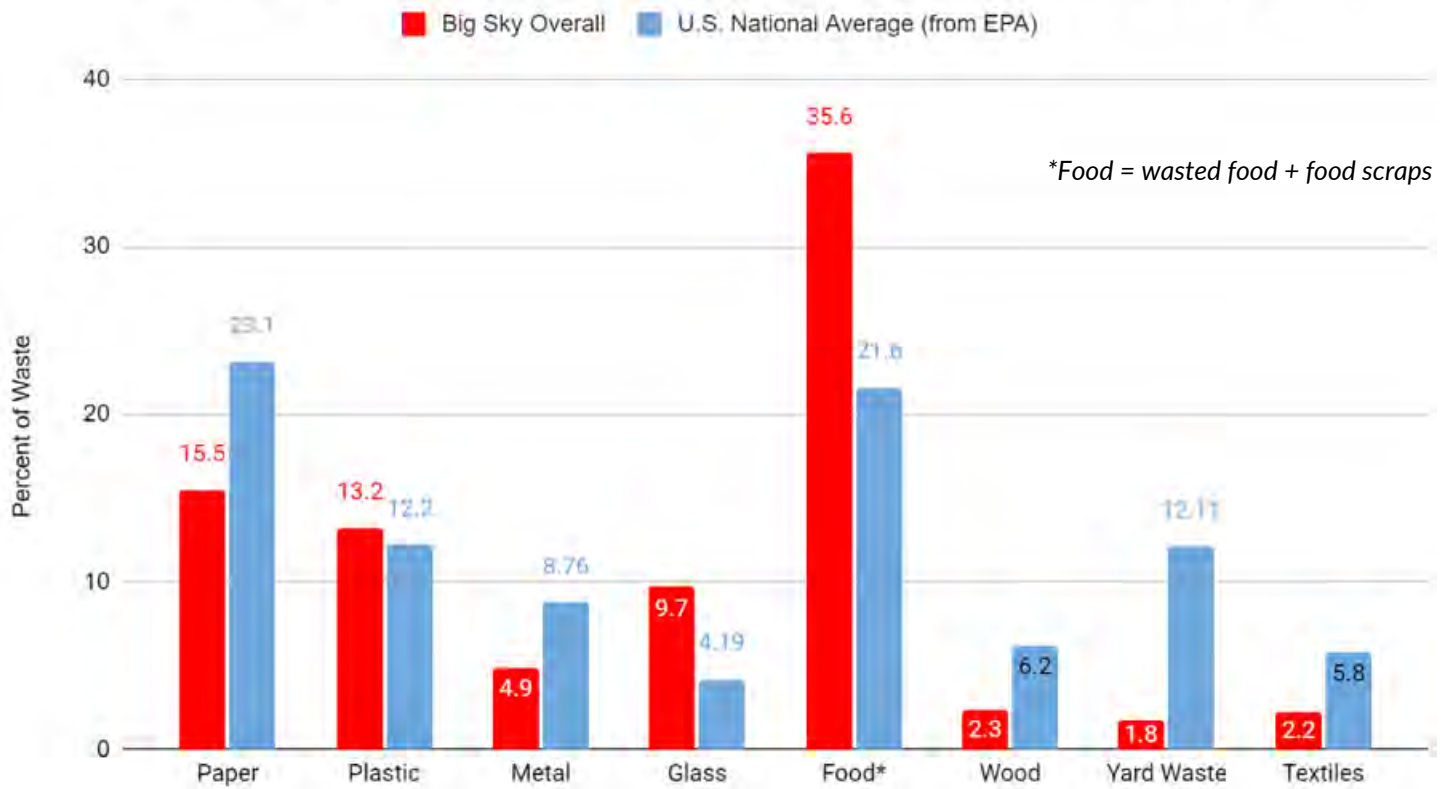
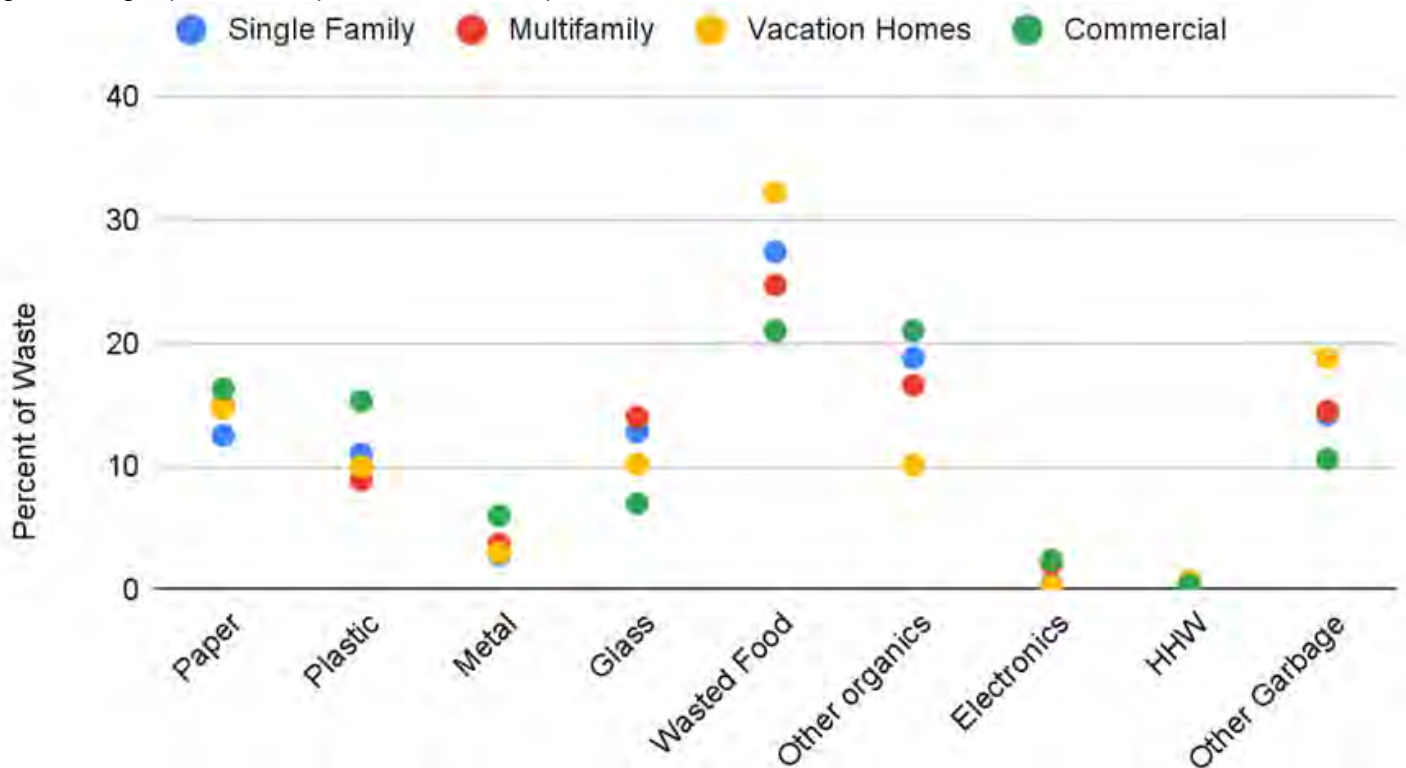


Figure 15: Big Sky Waste Composition vs. the US National Average



- Examining different demographic sectors provided insights that will help effectively target waste reduction efforts. Examining four different sectors showed some differences in the materials composition of the garbage between sectors and sector-specific data will be helpful when developing targeted outreach efforts to increase diversion.

Figure 16: Big Sky Waste Composition, Sector Comparison



Limitations of This WCA

- This study most certainly underestimates Big Sky's overall annual garbage tonnage. The only data available from the haulers with regards to Big Sky is annual tonnage for commercial and residential routes. Those data involved some estimates due to collections systems (see [Appendix C](#)). Additionally, the hauler data do not capture self-haul or temporary roll-off containers, which means the estimate does not include most C & D waste and some commercial garbage. The haulers were also not able to pull every single industrial roll-off account due to the time-consuming nature of that task, so that category shows an underestimate of tonnage.
- This study ignores Big Sky's C & D waste, which most certainly comprises a substantial part of the total waste stream given that nationwide, the U.S. generates more than twice as much C & D waste as Municipal Solid Waste (EPA 2018). The large majority of Big Sky's C & D waste is either self-hauled or hauled by the private haulers using 30- or 40-yard roll off containers. The current data collection systems cannot track self-hauls from Big Sky or Big Sky roll-off dumpsters serviced by the haulers, so that means there is no way to capture C & D tonnage. With the rate of rapid development in Big Sky it's a given that C & D debris is a large portion of Big Sky's garbage, yet this study sheds no insight into that sector.
- Live assessments were performed on garbage going to Logan Landfill and did not provide a composition or contamination analysis of the current recycling and composting systems. The only data for the latter is total hauling tonnage from the recycling and the composting facilities.

Waste Collection October 2022 - Commercial Sector



- This study looked at a limited sample size of approximately 7,700 pounds of garbage. In some ways sample size will never be sufficient so it would not have hurt to conduct more audit days. However, given the consistency of results across the different days and even sectors, the amount and methods of sampling seem appropriate.
- This study most certainly underestimates Big Sky's commercial sector food waste and overestimates non-recoverable paper across all sectors. Logistics and work schedules dictated limited hours to run garbage collection routes for the samples used in this study, and on each commercial collection day the restaurants did not have much garbage to contribute due to the time of the day the garbage was collected. This means that the commercial sector garbage was lighter on restaurant waste and hence food waste. With regards to non-recoverable paper, it was repeatedly noted by sorters that there were a lot of wet paper towels and food-service containers in that category, and the water weight slightly skewed the results heavier.

Recommendations

The purpose of conducting the first-ever Big Sky Community Waste Composition Assessment was to gather baseline data about what is in Big Sky's garbage to inform future waste diversion efforts and help reach climate change mitigation and adaptation goals.

In examining the results of this study, the following are recommendations for next steps:

Future Waste Tonnage Estimates

- **Conduct periodic waste composition studies on an ongoing basis**, recognizing that the waste stream changes over time (especially with a growing population), and also as a means to track progress toward Climate Action Plan goals.
- **Expand data collection systems at Logan Landfill to include the geographic location where waste originates.** Logan Landfill does not track where waste originates and that made it impossible to get any self-haul data for this study. The two private haulers were able to provide annual tonnage for Big Sky's residential and commercial routes, but they did not have a way to provide tonnage for roll-off dumpsters (which encapsulate C & D debris as well as some commercial waste from places that use certain compactors). Having Logan Landfill record waste origin location data would allow a better geographic understanding of the County's waste stream.

- **Conduct a small WCA specific to Big Sky's construction and demolition (C & D) waste.** EPA data show that the U.S. produced more than twice as much construction and demolition (C & D) waste in 2018 compared to the municipal solid waste stream. This fact, and the rate of new construction in Big Sky, warrants further investigation into Big Sky's C & D waste stream, both tonnage and composition.

Landfill Diversion

- **Use EPA's waste management hierarchy (Fig. 17) to inform Big Sky's waste management decisions, with a focus on source reduction and reuse as top priorities.** A study that focuses on diversion can get people thinking heavily about composting and recycling options and it can be easy to lose sight of the more important concept that source reduction and re-use are more beneficial than recycling and composting.



Figure 17: EPA's Waste Management Hierarchy, 2023. The hierarchy ranks the various waste management options from most environmentally preferred to least preferred. At the time this report was published, the hierarchy was under review by the EPA to see if changes should be made based on the latest available data.

Short Term Action (low to medium effort, good return):

- Prioritize food waste prevention education and technical assistance to help reduce Big Sky's GHG emissions.** Edible food waste is clearly the number one item in Big Sky's garbage across all sectors, and it is preventable through education & behavior change, the latter of which is no small task. Preventing food waste would have a positive impact on reducing greenhouse gas (GHG) emissions since the process of producing, transporting, handling and landfilling food generates significant greenhouse gas emissions at every step. Note that food waste prevention is not the same thing as rescuing wasted food- the utmost importance is that people stop purchasing unneeded food and wasting food in the first place.
- Fund and develop food rescue systems to help divert food waste from the landfill while also feeding people or animals.** While waste prevention is most important, some food waste is inevitable, and some of that waste could go to the Big Sky Community Food Bank instead of Logan Landfill. Note that there also could be opportunities to divert uneaten food to local farmers in the Gallatin Valley. Food rescue will not come to fruition unless specific programs are funded, developed and overseen by a dedicated organization.
- Increase composting of organic waste.** As of this report's publishing, YES Compost (the sole curbside compost provider in Big Sky) has 28 commercial participants and 57 residential participants that collectively produce approximately 2.5 tons of food waste each week, with the vast majority coming from commercial accounts. *(cont.)*
- (cont.)* Given that 36.1% of Big Sky's garbage is compostable, increasing the number of compost participants will help reduce GHG emissions, because composting waste has lower overall greenhouse gas emissions than landfilling it. Providing resources and education about at-home composting systems can also help divert landfill waste and decrease emissions.
- Increase use of commercial garbage compactors.** During the garbage audits it was noticeable how bulky certain materials were and how much dumpster space they consumed, including plastic films, #1 and #2 plastic bottles, cardboard and yard waste. All of these materials are either readily recyclable or otherwise recoverable and they shouldn't be in the garbage in the first place- this highlights an educational opportunity to focus on diversion. Regardless, non-compacted garbage requires more dumpster servicing, meaning more trips to Logan Landfill (with an average round-trip distance of 166 miles driven each trip, according to Republic Services' data). Besides the GHG savings of reduced landfill trips, additional benefits of using garbage compactors include that they are bear and pest proof, odor proof, they eliminate illegal dumping, vertical compactors take up less physical space than large dumpsters, and they save businesses money on garbage hauling fees over the long term. They also increase safety by not having heavy metal lids for workers to open and by decreasing the amount of service days needed by commercial garbage trucks.

Edible food waste is clearly the number one item in Big Sky's garbage & it is preventable through education & behavior change, the latter of which is no small task.

Vertical compactors not only reduce GHG emissions from fewer trips to the landfill; they also increase site safety, cleanliness, animal-proofing and space efficiency.



- **Continue to host Community Recycling Days.**

For the past several years, Big Sky SNO has been hosting Community Recycling Days once or twice a year, providing free collection of specialty recycling items such as glass, yard waste, scrap metal and electronic waste. The Recycling Days have already proven to be successful in landfill diversion and should continue into the future.

- **Fund and provide technical assistance to help businesses and institutions prevent waste.**

While sorting garbage, it was evident that an overwhelming amount of Big Sky's garbage is composed of disposable products that could easily be replaced by reusable alternatives. Examples include paper towels, coffee cups, Keurig pods, creamer pods, yogurt tubs, utensils, cups, condiment packets, zip top bags, grocery bags, etc. Offering technical assistance to help businesses make more sustainable purchasing decisions can decrease waste while also saving money.

- **Continue to encourage and educate the Big Sky community about recycling.** This study showed that 14.2% of Big Sky's overall garbage is readily recyclable, meaning that an estimated 1,850,260 lbs of recyclable material are going to the landfill each year. Cardboard ranked as the 7th most common material in Big Sky's garbage, and given its bulk, improved recycling rates would help with landfill diversion and reduced transportation emissions.

Long-Term Actions (greater effort, high return):

- **Create a commercial composting facility in Big Sky.** Creating a composting facility in Big Sky would significantly reduce community greenhouse gas emissions, and it doesn't require a great deal of land or infrastructure to get started. Organic materials generate methane gas when landfilled and there is also substantial GHG emissions in shipping Big Sky's organics all the way to YES Compost in Belgrade (90 miles roundtrip). Given that readily compostable materials make up over a third of Big Sky's garbage (36.1%), a local compost facility and increased composting would make a substantial impact on landfill diversion and GHG emissions reduction.
- **Reduce community glass consumption and find local outlets for reuse.** Glass makes up over 10% of the overall composition of Big Sky's garbage and this is significantly higher than the national average (4.19%) due to limited recyclability of glass given that it has to be shipped to Salt Lake City for processing (375 miles away). In addition to source reduction, the Big Sky community should look into alternative solutions to landfill disposal of glass, including re-use programs for glass bottles or supporting a community glass crushing facility. *(cont.)*

- (cont.) It seems likely that there would be local end markets for crushed glass given all of the construction and landscape needs.
- **Further investigate options for recycling plastic films.** Plastic films ranked as the 8th most common material in Big Sky's overall garbage, and sorters noted how bulky plastic films are (meaning they fill dumpsters quicker and require more frequent trips to the landfill because of their bulk). Plastic films can currently be dropped off for recycling at several stores in Bozeman, but it is unclear what is happening to these films and if they are actually being recycled. Further investigation is warranted to determine what the recycling options are for plastic films and whether any film recycling could be initiated in Big Sky.
- **Examine options for creating a centralized decision-making authority in Big Sky.** When looking at communities that have made significant progress toward Zero Waste (San Francisco, New York, Austin, Fort Collins, San Diego and more) a common theme is that local ordinances were used to drive results. Examples of ordinances include universal recycling and composting ordinances, single-use products and packaging ordinances, C & D ordinances, pay-as-you-throw ordinances and more. The current lack of a municipal authority in Big Sky presents many challenges to making progress on waste and other community-wide issues, and as Big Sky continues to grow and face new challenges, alternative governance systems should be examined.
- **Create a Big Sky Integrated Community Waste Management Plan.** Waste management is typically overseen at a local level and currently there is no collaborative, cohesive vision or plan for how waste should be managed as Big Sky grows and develops. It is unlikely that the current system will produce sustainable results or emissions reductions without a dedicated plan and oversight. The Community Waste Management Plan could address issues such as the feasibility of building a Convenience Site or Transfer Station in Big Sky, expansion of the free recycling drop-off site, creation of a composting facility, creation of a glass-crushing facility, etc.
- **Advocate for legislative measures that promote sustainable materials management at a local and national level.** Sorting community garbage illustrated the myriad barriers to achieving landfill diversion and highlighted the need for local and national policies that will support more sustainable materials management. Extended Producer Responsibility (EPR) policies exist in many countries and even some U.S. states, and they are proven to increase recycling rates, improve recycling access, create jobs and reduce greenhouse gas emissions. The Montana Legislature passed HB 407 in 2021, a bill that bans communities from passing bans on plastic bags or other materials. While recent state legislation has made it more difficult for Montana communities to have local oversight, advocating for legislative measures at the state and national level can help drive positive changes in the long term.

Appendix

Appendix A

| Recoverability | Material |
|--------------------|---|
| PAPER | |
| Readily Recyclable | Cardboard/ Browns- plain, unwaxed corrugated cardboard; kraft linerboard; kraft paper bags; brown packing paper. Includes beer boxes, egg cartons, cereal boxes and other materials that tear brown. |
| Readily Recyclable | Newspaper/ Mixed paper/ Junk Mail- newspapers and inserts; magazines and catalogs; junk mail; phone books; neon/colored office paper. |
| Not Recoverable | Polycoated Containers- polycoated paper and aseptic cartons (milk, juice and ice cream cartons). |
| Not Recoverable | Non-Recoverable Paper- all paper that is not accepted by the local MRF or commercial composter. Includes napkins, tissues, paper towels, non-compostable food service/ takeout containers, plastic-coated paper plates, waxed cardboard, coffee cups, photographs and frozen pizza and food boxes. |
| Readily Recyclable | White Office Paper- non-glossy white or lightly colored bond or stationary paper. Includes printer paper, notebook paper, white envelopes & ledger paper. |
| PLASTICS | |
| Readily Recyclable | #1 & #2 Bottles & Jugs- includes #1 plastic bottles and jugs with a neck. Examples: #1 soda and water bottles; #2 milk, water and laundry detergent jugs; #2 shampoo, cleaning chemical and juice bottles. |
| Not Recoverable | Other #1 & # 2 Containers- non-bottle-shaped #1 and #2 plastics; includes clamshell containers, fresh fruit containers, takeout containers and plastic cups. |
| Other Recoverable | Plastic Films- #2 and #4 plastic films. Includes grocery bags, bread bags, zip top bags, plastic mailers, bubble wrap, shipping cushions, retail shipping bags, pallet wrap, etc. |
| Not Recoverable | #5 Plastic Tubs- yogurt and dairy tubs; tubs used for olives, hummus, etc. Does NOT include #5 takeout containers. |
| Not Recoverable | Other Plastics #3 - #7- All plastics that do not fall into any of the other plastics categories. Includes vinyl, Styrofoam, non-tub #5 plastics, toys, lids/ caps, packaging, etc. |

Appendix A (cont.)

| Recoverability | Material |
|-----------------------|--|
| METAL | |
| Readily Recyclable | Tin and Steel Cans- soup and food cans. |
| Readily Recyclable | Aluminum Cans- aluminum beverage cans and wine caps. |
| Readily Recyclable | Other Recoverable Metal- miscellaneous ferrous and non-ferrous metal objects; can include pipes, gun shells, hardware, wires, cast iron, motors, bicycles, utensils and more. |
| Not Recoverable | Non-Recoverable Metal- aluminum foil; metal caps and lids. |
| GLASS | |
| Readily Recyclable | Glass Containers- bottles and jars. |
| Not Recoverable | Non-Recoverable Glass- mirrors; window glass; ceramics. |
| WASTED FOOD | |
| Readily Compostable | Wasted Food- any food item that could have been eaten at some point. Examples include leftover food, whole produce, unused cooking oils, expired foods, meats, dairy products, etc. |
| OTHER ORGANICS | |
| Readily Compostable | Inedible Food Scraps- organic materials related to food that people do not typically eat. Includes fruit and vegetable peels and rinds, bones, coffee and tea grounds, shells, etc. |
| Other Recoverable | Yard Waste/Plants- grass clippings, leaves, small branches and shrubs, houseplants, soil, prunings, etc. |
| Other Recoverable | Clean Wood- natural unpreserved lumber, pallets, branches and tree limbs. |
| Readily Compostable | Compostable Containers- any food service items that can be commercially composted; includes paper and compostable plastic takeout containers, soiled pizza boxes, soup bowls, coffee cups and utensils. |
| Not Recoverable | Other Organics- organic materials that cannot be composted and do not fit into any of the other organics categories. Pet waste. |
| Other Recoverable | Used Cooking Oil- used fryer oil from restaurants/ commercial food preparation. |

Appendix A (cont.)

| Recoverability | Material |
|----------------------------------|---|
| ELECTRONICS | |
| Other Recoverable | Recyclable Electronic Waste- electronic devices containing a significant amount of circuitry, including televisions, computers, laptops, keyboards, mice, scanners, printers, cell phones, tablets, VCRs, stereos, digital clocks, DVD players, modems, routers, servers, monitors and more. |
| Not Recoverable | Non-Recoverable Electric Devices- electric items that do not contain significant circuitry, including many household and kitchen appliances such as holiday lights, blenders, electric can openers, coffee makers, crock pots, mixers, microwave ovens, power tools, lamps, toasters, vacuum cleaners, hair dryers, electric shavers, curling irons and more. |
| HOUSEHOLD HAZARDOUS WASTE | |
| Other Recoverable | HHW includes motor oil, antifreeze, fuel, oil-based paint, solvents, pesticides, batteries, fertilizers, bleach, pool and hot tub chemicals, drain openers, aerosols, mercury thermometers and more. |
| OTHER | |
| Not Recoverable | Textiles/ Leather- leather or fake leather, fabrics of any sort, shoes, old clothing, bedding, pillows, curtains, upholstery, etc. |
| Not Recoverable | Medical Waste- pills and vitamins, tubing, sharps/ needles, patient drapes, specimen containers and other items disposed in health care settings. |
| Not Recoverable | Miscellaneous Garbage- this category was used for items that did not fit in any of the other categories. Items include mixed materials that couldn't be separated (ex: plastic & metal toys or appliances), plastic pouches made of multilayer materials (ex: Capri Sun pouches), plastic packaging with metal interior, soiled garbage bags, toys, bathroom waste (sanitary products, q-tips, floss, wipes, etc.), rubber products (inner tubes, hoses), diapers, disposable face masks, disposable gloves, photographs, painted/contaminated wood, condiment packets, mini creamer tubs and many other miscellaneous things. |

Appendix B: Tips for Conducting Waste Audits in Small Communities

Waste characterization studies can provide communities with invaluable data to help them understand what is in their waste stream, identify opportunities for increased diversion, estimate environmental and financial impacts of waste and plan for future waste-related infrastructure. While most available waste characterization studies cover large metropolitan areas or entire states, it is possible for small communities to conduct WCAs without needing to spend large amounts of money. This document offers some tips for how to replicate the Big Sky Community Waste Composition Assessment study.

Study Design

- Get all stakeholders together and determine what exactly the community is trying to learn through a waste assessment. Have clear goals that shape the study design methods.
- Decide which parts of the overall waste stream your study will focus on: garbage, recycling, composting, C & D waste, etc.
- Determine what residence sectors to target and how waste will be acquired.
- Establish permission needed: HOAs, homeowners, business owners.
- Take the time to meet with the local haulers, recyclers and landfill to understand their logistics, routes, schedules and data collection systems. Study methodology must work within the existing systems and limitations.
- When deciding upon materials categories, fewer categories will keep the study simpler and more cost efficient. Keep it simple and focus on categorizing materials that can currently be diverted in your community- there is questionable value in knowing how much #5 plastic is generated versus #6 plastic if both must go in the garbage.

- Decide whether it is feasible to sample garbage collected by the commercial haulers (noting that it will be compacted and therefore more contaminated) or if managing collection routes through alternative means is possible. There are pros and cons to each method, but for small, geographically compact communities, running a collection route independent of the hauler provides the benefit of having more granular data specific to certain demographics, plus less contamination.
- If running collection routes, make sure to inform the community about the project and pickup dates. While it is legal to take garbage once it's at the curb, it is best to ask for permission first (and most people/businesses will say yes).
- If running collection routes and sorting waste at a site other than a landfill or transfer station, be sure that the dumpster size matches the collection truck capacity. An 8-yard dumpster can handle around 1000 - 1500 lbs of MSW and sorters will need to take measures to compact garbage (prune branches, flatten cardboard, etc.).

Cost Savings

- Recruiting volunteers to sort waste can provide tremendous cost savings while still producing effective results. Possible sources of volunteer labor include your local courts and corrections programs that mandate community service, non-profit organizations, service-based organizations (Rotary, Lions Club, etc.), schools and universities.
- Once audit methods are established, seek in-kind donations from local haulers and businesses to cover as many costs as possible. If a study will require the use of dumpsters, see if the local haulers will donate service. Borrow items such as garbage cans, ClearStream containers or even the usage of a truck if self-hauling waste.

Appendix B (cont.)

Waste Audit Site Setup

- Worker comfort and safety is of utmost importance. Make sure workers are protected from the elements if outdoors, and make sure that there are bathrooms and effective hand-washing stations available. A first aid kit and fire extinguisher should be on site, as well as proper PPE for workers (items to consider include high-visibility vests, puncture-proof gloves, disposable medical gloves, eye protection, ear protection, aprons, face masks, etc.).
- Establish ergonomic sorting stations so that workers do not have to hunch, bend and lift heavy loads. Putting plywood on folding banquet tables can create the perfect workspace for sorting, and ClearStream containers are lightweight, ergonomic and hold up to wind.
- Helpful tools during sorting days include heavy-duty scissors, pruners, box-cutters, 5-gallon buckets, spatulas, heavy metal spoons, lots of spare gloves, hand sanitizer, a step stool and clear signage for each materials category. A garbage picker for end of day microtrash cleanup is also helpful.
- Use consistent bins/ receptacles for different categories as much as possible. This way the tare weight will be consistent, and it makes it easy to stack and store the bins.
- A veterinary scale is a perfect tool for weighing waste.
- Recording audit data directly to the Cloud saves time and money.

Worker Training

With proper training and supervision, volunteer sorters can produce excellent, high-quality data. Every sorting day should start with a detailed briefing that covers the following topics:

Morning guideline and safety briefing



- Welcome/ goals/ importance of proper sorting and gathering high quality data
- Intro to all the different materials categories
- Demonstration of how to sort a sample
- Emphasize that worker safety comes first and no worker has to sort or handle materials they are uncomfortable handling. Address workplace hazards such as the elements, trip hazards, vehicles, sharps, chemicals, biohazards, etc.
- Emphasize the importance of collecting quality data; when in doubt about where something should go, ask a Site Supervisor
- Each sorting day should have at least two Site Supervisors who can answer questions about how materials should be categorized. Having two supervisors allows collaboration when difficult questions arise. It's ideal if the supervisors can be waste-industry professionals, especially for the first one or two audit days, when materials are encountered for the first time.
- Site Supervisors should be readily available to answer worker questions while sorting. It's also helpful to have them continually monitor the different bins to pick out any contaminants and make sure materials are being properly categorized.
- At the end of each sorting day, host a quick debrief to thank workers, note any anecdotal evidence, challenges, efficiencies and identify any changes needed for next time.

Appendix B (cont.)

Logistics

- In the winter it is possible to encounter frozen garbage that cannot be separated. You can avoid this by collecting waste a day ahead of time and having the collection truck sit in a heated building overnight before sorting.
- It's difficult to estimate how many workers can sort through a given amount of garbage. SNO's sorting days typically had around 10 workers per day (including Site Supervisors) and it would take around 4 hours to go through 900 lbs of waste (sorting and weighing).
- A quick and easy way to wash dirty tarps, buckets, etc. after a day of audits is to bring them to a self-wash car wash facility.

Appendix C: Methods for Calculating Waste Composition

Waste Tonnage

In order to estimate Big Sky's annual tonnage of waste, the two private waste-hauling companies that service Big Sky were asked to provide tonnage for all of 2022. The haulers were unable to provide temporary roll-off container data due to the difficulty of pulling that data in an efficient manner. The haulers were able to provide garbage tonnage data for all of 2022 from residential, commercial and industrial roll-off routes, defined as follows:

- *Residential garbage* is collected from curbside bins used primarily by single family homes and some vacation homes/rentals.
- *Commercial garbage* is collected from businesses and institutions that use dumpsters or compactors that can be serviced by front-load trucks. This includes commercial businesses as well as many multifamily homes.
- *Industrial roll-off* routes service large (13 yard - 40 yard) dumpsters, including large compactors. These cover a combination of the commercial and vacation homes sector.

The data provided by Republic Services showed weekly tonnage reports that were then summarized in monthly reports. It was noted that some weeks and months showed a reading of 0 due to the fact that the trucks ran the Big Sky route, but then did not go to Logan Landfill (where tonnage is measured). The trucks were only partly full and would go on another collection route the following day, meaning the Big Sky specific tonnage was not captured. To account for these "0" readings, data from all of the existing data points were utilized to calculate the weekly average tonnage for each route, and every 0 was replaced with that average weekly number.

Republic Services' recycling data also contained some obvious errors that had to be adjusted. One problem was weeks where the route ran but no data were recorded because not enough materials were collected to warrant a trip to Four Corners Recycling (where tonnage was measured). Another issue was weeks where the data were obviously inflated due to the recycling truck already having materials from the previous day's non-Big-Sky route. For the recycling data, the average tonnage per route was calculated based on the 16 weeks where good data existed, and then that average filled in the gap for each of the 10 weeks where good data did not exist.

Waste Composition

Ten separate garbage audit days were conducted between August 2022 and March 2023, with each day sampling garbage from one unique demographic sector (single family homes, multifamily homes, commercial and vacation homes). At the end of each day, the total weight for each materials category was recorded on a spreadsheet and then the daily composition percentages were calculated.

Once all audit days were complete, the composition totals were calculated per sector by

Appendix C (cont.)

examining the data from all the audit days for that sector and taking straightforward averages.

To calculate the waste composition for the overall community garbage (the combination of all four sectors) a weighted average was used, given that there were an unequal number of audit days conducted per sector (two single family days, two multifamily days, two vacation home days and four commercial audit days). The recoverability percentage was first calculated for each sector by taking the overall weight of garbage audited from that sector and dividing it by the overall weight of garbage throughout all the audits.

Example: The audit days sampled 3,088 lbs of commercial garbage, 1,164 lbs of single family garbage, 1,606 lbs of multifamily and 1,851 lbs of vacation home garbage. The total of all these sectors is 7,709 lbs. That means the commercial sector recoverability percentage was 40% (3088/7709), vacation homes 24% (1851/7709), single family homes 15% (1164/7709) and multifamily 21% (1606/7709).



Wasted (edible) food

Once the recoverability percentage (RP) was identified, the following calculation created a weighted average for every single materials category:

$$W = \text{Sum} [(RP \times SF) + (RP \times MF) + (RP \times C) + (RP \times V)]$$

Where W is the weighted average; RP is the recoverability percentage (as calculated above); SF is the average value for that material from all the single family audit days; MF is the average value for that material from all the multifamily audit days; C is the average value for that material from all the commercial audit days; and V is the average value for that material from all the multifamily audit days.

Example: The average composition for cardboard was 4.20% of commercial sector garbage, 3.23% of single family garbage, 6.58% of multifamily garbage and 5.39% of vacation home garbage. That means the overall composition of cardboard was:

$$W \text{ cardboard} = \text{Sum} [(.15 \times .0323) + (.21 \times .0658) + (.40 \times .042) + (.24 \times .0539)]$$

$$W \text{ cardboard} = .04839 \text{ (rounded to 4.84\% overall)}$$



Non-recoverable paper (consisting of primarily paper towels)

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Gratitude

SNO would like to reiterate thanks all who contributed— funders, donors, workers, partners, participants, and especially Bernadette Beausoleil of the Gallatin County Sheriff's Department— that all made this Community Waste Composition Assessment possible. Many worked tirelessly on this project, often donating their time and resources. We wouldn't have been able to do this without you.

With Gratitude,
Alexis Alloway, Municipal Contract Administrator, Republic Services
Patty Howard, Recycling & Outreach Educator, Gallatin County Solid Waste District
& Lizzie Peyton, Director of Community Sustainability, Big Sky SNO



Zero-Waste Effort Set Up at Skijorring

SNO looks forward to scaling collaboration on community waste reduction efforts. Please reach out if interested in hosting a zero-waste effort event, resources/team trainings for reducing office waste, or how to reduce and refine a home waste stream.

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