

Green House Gas Reduction Assumptions

Impact Analysis Methodology from City of Helena Strategic Plan for Waste Reduction

Overview

A diversion potential and greenhouse gas (GHG) emissions reduction analysis was conducted to estimate the possible tons of landfill materials and GHG emissions that can be diverted and reduced through the chosen initiatives. The City of Helena and Tri County Disposal/Valley View Landfill provided landfill tonnage data used in this analysis. This analysis required the landfill data to be divided into material types based on a material characterization study. The material characterization data used in this analysis were from Cascadia Consulting's Baseline Waste Composition Study for the City of Missoula.¹

The Baseline Waste Composition Study is a material composition report characterizing Missoula, Montana's discarded material stream. In developing the study for Missoula, Cascadia relied on comparable data from similar communities across the region. This regional analysis provides a good approximation of landfill disposal composition for Helena.

Along with landfill tonnage data and material characterization data, GHG emission factors by material type were used in this analysis. The emissions factors used in this analysis were from the US EPA Waste Reduction Model (WARM) tool and the national average emission estimates were utilized.² Two GHG emission factor categories were used: source reduction and recycling/composting. For each ton of material type, WARM has identified the metric ton of carbon dioxide equivalent (MTCO₂e) either reduced or produced depending on the management pathway (i.e., source reduction, recycling, landfill, composting, anaerobic digestion, or combustion). The GHG emission factors used in this analysis are a combination of the MTCO₂e reduced from either source reduction, recycling, or composting 1 ton of that material plus the emissions associated with landfilling 1 ton of that material.

The emissions associated with landfilling materials were used to estimate the full benefits of changing the management pathway from landfilling to either source reduction, recycling, or composting. The US EPA estimated landfill GHG emissions for each material type in WARM based on the methane produced during anaerobic decomposition in landfills, transportation emissions and emissions from landfill equipment use, carbon stored in the landfill, and avoided emissions through landfill from energy recovery.^{3 4} The emissions from landfilling some material types occur from only transportation and landfill equipment use (e.g., glass, metal, plastic, tires, asphalt, concrete, aggregate, electronics, textiles, and carpet). Other material types, such as paper products, food, yard debris, and wood, incorporated the emissions from anaerobic decomposition, transportation, carbon storage, and avoided emissions from energy recovery to estimate their landfill emission factors.⁵ These factors used to estimate landfill emissions resulted in some material types being carbon sinks (e.g., some paper material types, yard debris, some construction material types, and wood) and do not produce emissions when landfilled. For the material types that create emissions when landfilled, their emissions are a small portion of this analysis.

The initiative and material type dictated which GHG emissions factor was used (i.e., source reduction or recycling/composting). The more conservative GHG emissions factor was used if there was any uncertainty. The recycling and composting emission factors were used more

frequently than the source reduction emission factors. When there was a material type without a directly related emission factor (there are 60 factors in WARM), appropriate proxies were used in their place.⁶ In this analysis, the carpet emission factor was used as a proxy for textiles, the dimensional lumber factor was used as a proxy for bulky items, and the mixed plastic factor was used as a proxy for other recyclable plastics, shopping bags, other film, and non-recoverable plastics. When analyzing compostable paper, the source reduction newsprint factor was used and the food scraps composting factor was used.

Each initiative was analyzed to estimate the diversion potential (tons) and the reduced GHG emissions (metric ton carbon dioxide equivalent – MTCO₂e). This analysis begins by estimating the capture rate for each material type for an initiative. The capture rate estimation was based on knowledge from other community initiative implementations, published reports, or best estimates and leaned on the side of a conservative estimate. The estimated capture rate for each material type corresponding to the initiative was multiplied by the GHG emission factor (source reduction or recycling/composting). This estimated the GHG emissions that were reduced by the initiative. This method was repeated for each material category that related to the initiative.

For each initiative, the tons estimated to be diverted by material type were added up to show the total tons estimated to be reduced for that initiative; and the GHG emissions estimated to be reduced by material type were added up to show the total MTCO₂e reduced for that initiative. Next, each initiative's capture rates were calculated by dividing the total tons estimated to be diverted by the total tons going to the landfill.

The last step in this analysis combined the total capture rate, total estimated tons diverted, and total estimated GHG emissions reduced among initiatives. These data showed the potential diversion and potential GHG emission reduced per year once all initiatives are in place.

[Baseline Waste Composition Study](#), Presented to Missoula, Montana

² [US EPA Waste Reduction Model \(WARM\)](#) – version 15

³ [Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model \(WARM\) Background Chapters](#)

⁴ [Documentation for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model \(WARM\) Management Practices Chapters](#)

⁵ [Documentation Chapters for Greenhouse Gas Emission, Energy and Economic Factors Used in the Waste Reduction Model \(WARM\)](#)

⁶ [Using WARM Emissions Factors for Materials and Pathways not in WARM](#)

Initiative: 2.5 – Recycling & Composting Infrastructure

Initiative Type: Infrastructure

Hierarchy Level: Recycle/Compost

Initiative Background and Essential Information

Background:

Communities that wish to divert materials from landfill disposal require sufficient local capacity to manage those diverted materials. The City of Helena must arrange for sufficient organics and recycling processing capacity to accommodate the increase in compostable and recyclable materials that will be diverted as the City moves toward its waste reduction goal.

Lewis and Clark County currently has a composting operation at the County-owned landfill that composts City yard debris. While the compost product has historically been used within the landfill for different purposes, the current operation could be expanded to accept food scraps and refocused on creating a valuable soil amendment.

Local and Regional Examples:

In 2016, the year the ZERO by FIFTY goal was adopted, the **City of Missoula, MT** (population 73,489) purchased an existing privately-owned biosolids composting operation adjacent to its wastewater treatment plant. State-of-the-art upgrades included installation of an aerated static pile system. Along with biosolids, the facility, now called [Garden City Compost](#), accepts all food scraps, BPI-certified compostable items, pallets, untreated wood scraps from deconstruction projects, yard debris, and land clearing debris. The facility is operated by City staff and is open to the public for drop-off and for purchase of finished compost March through December. The facility is open to commercial organics haulers like Missoula Compost Collection year-round.

The composting operation at the [Pitkin County Solid Waste Center](#) on the Pitkin County Landfill in **Pitkin County, CO** (population 17,767) processes yard debris and food scraps to create a nutrient-rich compost that is sold back to the community. This conserves the environment and extends the life of the county landfill by reducing waste generation through education, recycling, and reusing valuable commodities with innovative programs and providing safe and ethical disposal for all other materials.

Montana's recycling processing facilities are primarily owned and operated by the private sector. Some processors are locally-owned and operated, such as [Helena Recycling](#), which opened a recycling facility near the gates of the Valley View Landfill in East Helena in 2016 and [Pacific Steel & Recycling](#). Others include [Earth First Aid](#) in Billings and [Four Corners Recycling](#) in Bozeman. Larger national companies have invested in such facilities as well, such as Waste Connections, which owns [Valley Recycling](#) in Kalispell, and Republic Services, which owns a number of recycling facilities across the state. The Lake County Transfer Station & Recycling Center in Lake County, MT (population 30,013) is a municipal drop-off center that markets materials directly from the County-owned facility. Every ton diverted saves the facility \$52/ton in avoided disposal costs. According to Mark Nelson, Lake County Solid Waste Manager, those savings are what covers labor and capital costs. Processing costs are estimated to be \$40/ton and include labor, transportation, power, and equipment costs. Due to the volatility of recycling markets, revenue from recycling is seen as a bonus.

National Examples:

The [Dalton-Whitfield Solid Waste Authority](#) in **Whitfield County, GA** (population 104,628) constructed a \$2 million, 40,000 square foot materials recovery facility (MRF) at the county landfill funded by the Authority's enterprise fund. Although the facility was primarily designed to divert carpet industry solid waste from the Subtitle D landfill, the MRF currently processes and markets #1 & #2 plastic bottles & jugs, newspaper & magazines, mixed paper, bi-metal cans, telephone books, cardboard, aluminum cans, glass (clear, brown, blue, & green) as well as carpet, carpet pad, and tubes, cores, and cones from the carpet industry. The MRF utilizes four full-time employees and an inmate labor crew. The MRF can process over 100 tons per day, store up to 20 trailer loads of baled recyclables, and can deliver 25 to 50 trailer loads to market each month.

Initiative Proposed Action**Proposed Action:**

The following proposed actions are Phase 1 planning and development activities. The implementation of the resulting facilities will occur in Phase 2.

- **Develop or contract for development of a materials recovery facility (MRF)** that will meet Helena's recycling needs for up to the next 20 years.
- **Develop or contract for development of a state-of-the-art composting operation** that will meet Helena's composting needs for up to the next 20 years (possibly at the county landfill in partnership with Lewis & Clark County)
 - A key consideration in evaluating the type of organics processing capacity to be developed will be the type of feedstock that can be processed at the facility or facilities. Facility feedstock requirements will directly impact how organic materials are collected in the community and will need to inform development of the [Universal Residential Curbside Collection program](#) for organics diversion. The biggest question is whether to collect yard debris and food scraps in the same container, as food scraps need to be collected year-round on a weekly basis, and yard debris only is collected seasonally.

Metrics

2.5 - Recycling and Composting Infrastructure	Phase 2 (2025-30)
Diversion Potential (Tons)	850
GHG Emissions Reduction Potential (MTCO ₂ e)	1,330

Initiative: 2.6 – Universal Residential Curbside Collection

Initiative Type: Program

Hierarchy Level: Reuse/Recycle/Compost

Initiative Background and Essential Information

Background:

Universal Residential Curbside Collection programs make diversion accessible to all by providing affordable collection of compostable and recyclable materials separate from trash as a base level of service. Universal Residential Curbside Collection programs address barriers to participation, such as cost, thereby making diversion as convenient as wasting. A key outcome of these programs is a reduction in wasted material directed to landfill disposal.

The City of Helena currently provides weekly curbside trash collection to all residents in housing with 4 units or fewer. This is commonly referred to as “single family residential.” Trash collection is paid for through an annual waste assessment of \$176.10 on each residential property. Residents interested in curbside recycling or composting collection must opt-in on a subscription basis through the City-contracted service providers. Helena Recycling provides bi-weekly curbside source-separated recycling of 5 streams: glass bottles and jars, steel and aluminum cans, #1 and #2 plastic containers, mixed paper, and cardboard. That service is subsidized at \$4/month through the annual waste assessment; customers pay an additional \$8/month out-of-pocket. [Better Roots Composting](#) and [406 Compost](#) provide curbside organics collection services. Those services are not subsidized; customers pay an additional \$15-\$20/month out-of-pocket for those organics’ diversion services. Under the current system, customers who choose to divert through curbside services pay far more than those who choose to send all discards to landfill. This discrepancy creates a strong disincentive to divert. The single-family residential sector is responsible for 31% of Helena’s landfill disposal.

Local and Regional Examples:

The City of **Spokane, WA** (population 217,353) provides solid waste collection services with unit-based pricing (aka Pay As You Throw, PAYT) for residential customers. Households can choose between 3 sizes of garbage carts: \$19.18/mo. for a 32-gallon cart, \$34.71/mo. for a 68-gallon cart, or \$50.68/mo. for a 95-gallon cart. Garbage collection in those carts occurs weekly. Included with that cost, all customers are provided with a 65-gallon cart for [single-stream recycling](#). Recycling collection occurs every other week and recyclables are taken to a materials recovery facility owned and operated by Waste Management. Spokane also provides an [optional yard waste and food scraps collection service](#). Customers pay an additional \$18.31/mo. for weekly collection. The service runs from March through November, and is suspended during December, January, and February. Off-season collection can be provided for an additional cost of \$4.58 per collection. Collection occurs on the same day as garbage pickup. Annual cost for the 32-gallon garbage cart with optional organics seasonal collection is approximately \$450/household.

The curbside collection services provided to residents of the City of **Boise, ID** (population 226,115) through its Curb It program include weekly trash, every other week recycling, and weekly compost. [Pricing](#) is structured to incentivize the adoption of diversion behaviors. The cost for weekly 95-gallon cart trash service only is \$33.49/mo. per household. However, the cost for weekly 95-gallon trash, every other week recycling, and weekly composting altogether is \$21.77/mo. per household. Those prices are reduced slightly if a customer opts

for a smaller 48- or 64-gallon trash cart (\$32.20 and \$20.48 respectively). The City offers monthly collection of glass in 65-gallon carts for an additional \$7.09/mo. per household. Annual cost for the 48- or 64-gallon trash cart with recycling and composting is approximately \$275/household without glass and \$360/household with glass.

The City of **Salem, OR** (population 179,522) in Marion County has a franchised hauler system for single family residential collection in which the community is divided into districts. Each district is serviced by a different hauler. One contracted hauler, [D&O Garbage & Recycling](#), services approximately 15,000 residential households in Salem. All customers pay a rate of \$32.05/mo. for a 35-gallon garbage cart, a 95-gallon mixed organics cart, a 95-gallon mixed recycling cart, and an 18-gallon bin for the source-separated collection of glass. Customers can also set out additional materials for recycling (oil, coolant, transmission fluid, and batteries) and reuse (latex paint). A [2017 report](#) shared by a Marion County representative indicated that the contamination rate for single family residential recycling in the Portland Metro area, where similar services are offered, was 9%. Annual cost for the 35-gallon garbage cart with optional organics seasonal collection is approximately \$385/household.

The City of **Bellingham, WA** (population 88,764) contracts with [Sanitary Service Company](#) (SSC) to provide curbside collection services for approximately 20,000 single-family residences and multi-family units (1-4 units). Services include trash, weekly recycling, and every-other-week (EOW) organics collection. SSC offers EOW or once-a-month (OAM) trash collection for customers who wish to reduce their trash service.¹ Since the late 1980s, SSC's curbside recycling program has been source-separated. It currently collects mixed paper and commingled bottles, cans, glass, & plastic containers in open-style 18-gallon bins as well as flattened cardboard, scrap metal, used motor oil, automotive batteries, and cords, wiring and holiday lights.² All customers pay \$6-7/month for recycling service embedded in their trash bill whether they choose to use it or not. SSC reports a recycling participation rate in the "high 90s" and a contamination rate of approximately 1 percent.³

The City of [Renton, WA](#) (population 101,484) pioneered an innovative contract with its private hauler that cost-effectively transitioned the community from weekly collection of recycling and garbage to every other week collection of recycling and garbage and weekly collection of compostable materials. In 2008, the City, which had not adjusted garbage rates since 2000, was facing a potentially large rate increase. Residents had manual collection of garbage from customer-provided containers and a source-separated, three-bin recycling collection system. The community wanted uniform cart-based collection, expanded recycling, and curbside compost collection that included food scraps. The City and Waste Management reduced overall system costs by transitioning to every other week collection for recycling and garbage, and weekly collection of compostable materials. In addition, the system reduced truck traffic, associated greenhouse gas emissions, and wear and tear on the roads and collection vehicles. From 2008 to 2010, residential recycling tons increased 27%, organics tons increased 44% and garbage tons decreased 18%.

In March 2022, citing safety, efficiency, cost, abuse, and service consistency, the City of **Billings, MT** (population 109,595) [replaced all 300-gallon shared bins with 90-gallon carts](#). The City estimates between 20-25% more garbage in areas where there are 300 for residents compared to 90s for residents. The difference the City considers "abuse" by residents, businesses, out-of-town persons who illegally dispose of refuse in the bins. The City also estimates that the overall collection time will not change despite there being three

¹ Email communication between Ann Brodsky and Rodd Pemble - 8/7/20

² http://www.ssc-inc.com/recycling_commercial.php#prepare - accessed 3/27/22.

³ Email communication between Ann Brodsky and Rodd Pemble - 8/7/20

times as many bins to service due to the efficiencies gained.

National Example:

[Abington Township, PA](#) (population 55,468) provides weekly dual-stream recycling, yard trimmings, and trash collection services with municipal crews in fully automated trucks for 18,200 households. All collection services are provided on the same day. The town currently has 6 trash trucks that service 850 households per day and 6 recycling trucks that each service two routes per day (3 trucks are dedicated to paper collection and 3 trucks are dedicated to commingled container collection). The town provides dual-stream recycling in two carts (a 65-gallon cart for paper and a 35- or 65- gallon cart for commingled containers). Yard trimmings (grass clippings, leaves, small brush) collection is accepted March through January in 30-gallon brown biodegradable paper bags with a dedicated truck. Residents choose between a 95-, 65-, or 35-gallon cart provided by the Township for trash. The town has a high participation of 90%+ and residents are very well-educated in recycling. This system has enabled Abington Township to achieve a 57% diversion rate.

Initiative Proposed Action

Proposed Action: *(describe the components of this initiative, a timeline if applicable, if it's ongoing or one-time, and any other implementation components)*

The key component of Universal Residential Curbside Collection is to provide and bill all residents for regularly scheduled collection for: Recycle, Compost, and Garbage. Details of each stream include:

- **Curbside collection of Recyclables**
 - Approaches to a universal recycling system for Helena are under review.
 - Expand list of acceptable materials based on Be Heard Helena survey responses, as markets allow.
- **Curbside collection of Compostables**
 - Approaches to consider:
 - Automated - Mixed organics collected weekly year-round: include food scraps and soiled paper with seasonal yard debris in 35-, 65-, or 95-gallon green carts
 - Manual - Food scraps and soiled paper collected weekly year-round in 5- or 10-gallon green buckets with lids; Yard debris collected weekly from April-October (or as seasonally appropriate) in 30-gallon brown biodegradable paper bags.
 - Hybrid - Food scraps and soiled paper collected weekly in 10-gallon green buckets with lids; Yard debris collected weekly from April-October (or as seasonally appropriate) in 35-, 65-, or 95-gallon green carts (food scraps/paper could be added to cart during automated service months)
- **Curbside collection of Garbage (materials going to landfill)**
 - Metered service (reframing trash service as a utility like electric and water - the less you use, the less you pay) with variable rates depending on how much service used (also referred to as Pay As You Throw - with smaller trash cart as the default level of service and larger trash carts available at added cost)

- Approaches to consider:
 - Switch to every-other-week collection of garbage and weekly collection of organics, which is allowable under City code. Consider offering an option for once a month (OAM) trash service (like Bellingham).
 - Maintain weekly collection and offer households with an assigned cart the option to reduce the size of the garbage cart (35- or 65-gallon)
 - Maintain weekly collection and recalculate distribution of shared. 300-gallon alley bins from 3 households/bin (100 gallons/household) to 5 or 10 households/bin (60 or 30 gallons/household); Remove surplus bins
 - Maintain weekly collection and remove shared 300-gallon alley bins; require all households to choose a desired cart size (35-, 65-, 95-gallon)

Program Considerations:

These could be implemented individually or in combination:

- Same-day-of-week collection (alternating weeks for recycle and materials going to landfill; compost picked up weekly; yard debris picked up seasonally)
- Integrate metered service with Solid Waste Fees as part of rollout of universal recycling and composting collection services.
- Implement bundled rates with the rollout of universal recycling and composting collection services (one payment for garbage, recycling and composting collection as the Solid Waste Assessment; if more services wanted, residents may pay for more services)

Additional Program Components:

- Once a month (OAM), quarterly, or on-demand curbside pickup of bulky items. Establish a system to reuse or recycle those products/materials.

Universal Residential Curbside Collection is an ongoing program.

Metrics

2.6 - Universal Residential Curbside Collection	Phase 2 (2025-30)
Diversion Potential (Tons)	5,440
GHG Emissions Reduction Potential (MTCO ₂ e)	6,940

Initiative: 2.7 – Self-Haul Diversion Options

Initiative Type: Infrastructure

Hierarchy Level: Reuse/Recycle/Compost

Initiative Background and Essential Information

Background:

Generators from multifamily, commercial, self-haul, and construction and demolition (C&D) projects are responsible for 70% of landfill disposal. Facilities currently serving these sectors include the City of Helena Transfer Station and the shared City/County drop-off sites.

Self-haul from City of Helena residents to the Transfer Station accounts for 10% of the total citywide landfill disposal. While the composition of that sub stream is unknown, waste composition studies from other communities suggest potentially divertible materials include clean dimensional lumber, new painted wood, furniture, clean engineered wood, carpet, mixed metals, mattresses, and other construction materials as well as paper, plastic, glass, and compostable organics.¹ Improving diversion opportunities at the Transfer Station for those reusable, recyclable, and compostable materials as well as hard-to-recycle materials will help the community achieve its waste reduction goal.

Local and Regional Examples:

The [Washington County Solid Waste](#) (WCSW) program in **Washington County, UT** (population 180,279) provides numerous and varied opportunities for residents to divert materials from landfill disposal. In an effort to increase access to [composting](#) for residents, WCSW accepts yard debris at no charge at the landfill, the Central Transfer Station, and the [Reuse Center](#). Composting takes place at the landfill and finished compost is sold back to the community. Additionally, the diversion programs at the landfill and transfer stations include electronics recycling, tire recycling, appliance and bulky item drop-off, car and rechargeable battery drop-off, green waste and tree limbs, residential used oil and antifreeze collection, and a paint exchange program. Finally, the [“binnie” program](#) is a network of 35 public drop-off sites across the County where glass, paper, plastic, and metal are accepted.

Boulder, CO (population 108,250) is home to [Recycle Row](#) at the center of which is [EcoCycle Center for Hard to Recycle Materials \(CHaRM\)](#), a non-profit self-haul diversion facility. This mostly outdoor facility includes a 6,000 sq foot warehouse for processing of certain materials including electronics and expanded polystyrene. There is a \$3 fee for each vehicle and [some items have an additional charge for drop-off](#). The CHaRM facility accepts traditional recyclables and compostables and is co-located with [Resource Central](#), a **non-profit building materials reuse center** operated by a separate organization. Resource Central is similar to [Home ReSource](#) in Missoula, MT.

National Examples: Operated by the Rutland County Solid Waste District, [The Recycling Center](#) in **Rutland County, VT** (population 58,191) allows residents to pay for trash drop-off by the bag and to drop off their recyclables for free with a valid RCSWD permit. The recyclables include glass, newspaper, boxboard, cardboard, tin & aluminum, mixed fiber and plastics #1, #2 & #5.

Across from the recycling center, the District also provides segregated areas where residents can drop off e-waste, textiles/clothing, tires, refrigerators, and air conditioners.

¹ [Seattle Public Utilities 2017/18 Self-haul Waste Stream Composition Study](#) - accessed 4/1/

Initiative Proposed Action

Proposed Action:

To provide sufficient waste reduction options for multifamily, commercial, self-haul, and construction and demolition (C&D) project generators, the City will implement the following infrastructure enhancements.

- **Transfer Station**

- Expand accepted materials to include more types of plastics and other materials as regional markets allow.
- Incentivize yard debris diversion and recycling (e.g., by including recycling with Solid Waste Assessment prepayment option)
- Expand upon the Queen City Wheel House bicycle reuse program to partner with other reuse organizations for other types of usable products.
- Revisit “Drop and Swap” program and research best practices.
- Provide surplus reusable materials to the community, (such as wood, supplies, and fixtures) collaborating with existing nonprofits (e.g. Habitat for Humanity ReStore).
- Explore with the Chamber of Commerce, small businesses, and nonprofit organizations if there are additional services desired that would make it easier for them to reuse, recycle, or compost at the Transfer Station.

- **Drop-off Sites**

- Add additional recycling drop-off stations for residents and businesses.
- Expand the list of acceptable materials as regional markets allow.

Initial improvements and expansion of enhanced self-haul diversion options would require significant effort to plan and implement during Phase 1. After implementation in Phase 2, they would remain an ongoing program.

Metrics

2.7 – Self-Haul Diversion Options	Phase 2 (2025-30)
Diversion Potential (Tons)	1,280
GHG Emissions Reduction Potential (MTCO ₂ e)	1,800