Efficiency Study of:

The City of Helena and Lewis & Clark County Solid Waste System

Recycling, Collections, Transfer Station & Landfill

October 29, 2014 - FINAL REPORT

Prepared for:

City of Helena and
Lewis & Clark County
c/o
Lewis & Clark County
3402 Cooney Avenue
Helena, MT 59602

Prepared by:

Blue Ridge Services
7204 Hites Cove Rd
Mariposa, CA 95338

CONTENTS

INTRODUCTION 1
EXECUTIVE SUMMARY 1
PROJECT OVERVIEW & APPROACH 2
CURRENT STATUS, FINDINGS & RECOMMENDATIONS 3
OVERALL SYSTEM 3
LANDFILL 5
RECOMMENDATIONS 5
IMMEDIATE SAVINGS: 8
ANNUAL SAVINGS: 8
TRANSFER STATION 9
CURRENT STATUS 9
RECOMMENDATIONS 13
IMMEDIATE SAVINGS: 15
ANNUAL SAVINGS: 15
COMMERCIAL COLLECTIONS 16
ANNUAL SAVINGS: 17
RESIDENTIAL COLLECTIONS 18
ANNUAL SAVINGS: 20
RECYCLING 21
FINANCIAL 22
SURVEY SUMMARY 22
IMPLEMENTATION 24
CITY 24
COUNTY 24
APPENDIX A - COMPOST ANALYSIS MODEL (NEXT PAGE) 26
APPENDIX B - DIRECT HAUL ANALYSIS MODEL 28
APPENDIX C - CITY OF HELENA COLLECTION STATISTICAL ANALYSIS RESULTS 31
APPENDIX D - OWNING & OPERATING COST SUMMARY 36
APPENDIX E - CELL CONSTRUCTION 40
APPENDIX F – SURVEY SUMMARY 45
APPENDIX G – IMPLEMENTATION PLAN 60

Introduction

The City of Helena and Lewis & Clark County, through a joint effort, hired Blue Ridge Services, Inc. to evaluate the existing Solid Waste System and identify ways to increase efficiency and reduce costs. The review was intended to be high-level (general overview) and look at many different components of the system as opposed to performing a detailed analysis on a select few. Currently, the County owns/operates the Lewis & Clark County Landfill and the City of Helena owns/operates the City of Helena Transfer Station. The city also provides residential and commercial collection services within the City limits, as well as providing various opportunities for recycling options for city and county residents.

The Lewis and Clark County Landfill (LCCL) is situated on a 160-acres located south of Deal Lane and ½ mile east of Lake Helena Drive. Approximately 80 acres will ultimately be used for solid waste disposal. The County also owns an additional 160 acres? (south of the existing landfill) for future landfill expansion. The LCCL currently disposes approximately 40,000 tons of waste per year, including MSW in the lined (Class II) portion of the landfill, and C&D waste in the unlined (Class IV) portion of the landfill.

The City of Helena Transfer Station is located at 1975 N. Benton Avenue. It currently receives approximately 40,000 tons of waste per year, including MSW, green waste, C&D waste and recyclables.

The City also provides residential collection services for City residents, and commercial collection services for many businesses within the City limits. The City also provides various recycling options for City and County residents.

The LCCL was constructed in the early 1990's to replace the historic Scratch gravel landfill. However, concerns about increased traffic to the site led to construction of the transfer station. The intent was that loads would be consolidated at the transfer station, leading to fewer truck-trips to the landfill.

Executive Summary

The current solid waste system is working, but within the system there are many opportunities for improvement. One of the most obvious is for the City and County to find a means of working together as a single entity, rather than as two separate ones. This may be accomplished by creation of a solid waste district, an inter-local agreement, or simply a memorandum of understanding. Unification will provide a number of increased efficiencies, including:

- One manager, instead of two;
- One accounting system, instead of two, depending on the type of merger agreed upon (authority, inter-local agreement, etc.). This may or may not include a single permit system;
- Sharing of equipment such as loaders, trucks, etc.;
- Sharing of administrative, management and operations staff;
- Sharing of shop/mechanic/service capabilities;
- Economy of scale such as combining engineering services for closed landfill maintenance;

We identified a number of opportunities for operational improvements at the landfill, transfer station and within the commercial/residential collections system. These include:

1. For the Landfill

a. Reduce compactor hours.
b. Eliminate compost operation and use processed green waste for mulch on landfill slopes.
c. Do not purchase a new compactor (for $647,000), but continue using the existing compactor and simply rebuild major components (i.e., engine, transmission, etc.) as needed.
d. Extend the duration of tarp placement from the current 7 days to 22 days.
e. Eliminate the wheel loader or retain as a backup for the transfer station.
f. Eliminate weekend operation.
g. Modify litter control system.

2. For the Transfer Station
   a. We suggest all trucks with consolidated loads (i.e., route trucks) direct haul to the landfill.
   b. We recommend the transfer station implement a minimum charge for all customers entering the facility.
   c. We suggest the transfer station establish a series of front-loader bins that can be used by customers with 3 bags of trash or less.
   d. Re-direct customer trailers beyond a certain size/capacity to haul direct to the landfill.
   e. If additional unloading slots are required, we recommend the loader's shed be relocated to an area east or south of its current location.
   f. Do not send the loader to push/clean the green waste (GW) area on an hourly basis. Instead, provide more tipping area for GW customers around the perimeter of the stockpile.
   g. Reduce loader hours. By instructing route trucks, selected trailers and C&D loads to haul direct to the landfill, and by eliminating some of the "lite-load" customers, the loader's annual hours are expected to drop.
   h. Eliminate 7 days per week operation. Consider closing two days per week.

Project Overview & Approach

To perform our evaluation, two members of our team spent a total of 12 days on-site. Neal Bolton was on-site 10 days, and Ron Proto was on-site 2 days. During this time, we observed various parts of the operation, took several hundred photographs, spoke with various City and County stakeholders, along with representatives from Tri-County Disposal, Helena Recycling, Montana DEQ and Pacific Steel and Recycling. We also obtained important information from City and County administrative, management and operations staff. Valuable information was also obtained through a citizen survey which posed a number questions related to the current solid waste system. Finally, we held a number of staff and public meetings in Helena to gather data and provide progress status updates on our evaluation.

We also gathered comparable data from other facilities in regard to tipping fee, tonnage, level of service for recycling, collection and disposal.

Subsequently, our team spent several weeks preparing a PowerPoint presentation, a draft report and ultimately, a final report.

We used a multi-step approach to this project, as described below:

1. Evaluate the overall system, looking for opportunities to increase efficiency through consolidation of activities, streamline material flow and reduce cost of operation. This included an evaluation of how the system could be improved by operating both the landfill and transfer station as a single system – rather than as two separate systems.
2. Evaluate the landfill operation in detail, looking at the current operation, compliance, machine utilization, labor requirements, airspace consumption, planning, safety and overall system performance
3. Evaluate the transfer station operation in detail, looking at waste flow, machine and transfer truck utilization, labor allocation, facility layout, safety, and how the overall system performs compared to similar operations.
4. Evaluate the residential collection operation, looking at level of service, overall driver/route efficiency, placement and utilization of residential containers, access issues (especially during icy winter conditions), days/hours of operation, and truck payload and cycle time.
5. Evaluate the commercial collection operation, looking at level of service, overall truck/driver efficiency, days/hours of operation, and truck payload and cycle time.
6. Evaluate the current recycling options available to local residents and businesses. This included meeting with representatives from DEQ, Tri-County Disposal, Montana Recycling, Pacific Steel and Recycling. We also reviewed and tabulated survey results from the solid waste survey coordinated by Sherrel Rhys, Manager of the Lewis & Clark Landfill.

Current Status, Findings & Recommendations

During our time on-site, we observed several days of normal operations. It was clearly evident that both the City and County staff was dedicated to doing a good job, and the equipment and facilities were all well-maintained.

During our high-level assessment, we reviewed the operations from the standpoint of measureable performance (where possible) and against industry standard operation. Neal Bolton and Ron Proto have a combined total of over 91 years of industry experience. Additionally our other team members – though not involved in on-site observations – bring decades more experience. Thus, our review and findings are based on analytical assessment, and the wisdom that only comes with experience.

Many of the normal functions we observed are appropriate and in line with industry standard practice. Accordingly, we have not commented on every aspect of the operations, but rather have focused our effort on identifying those things that can be improved.

Overall System

The overall goal of course is to encourage the efficiencies that can only be realized by operating the landfill and transfer station as a unit. For example, currently, waste that is collected by residential or commercial route trucks passes through the transfer station – at a rate of $70.75/ton. It is then dumped, pushed and loaded into transfer trailers, and hauled to the landfill. The tipping fee at the landfill is $31.25/ton.

We have identified that it would be more economical to direct haul most – if not all – of the residential and commercial collections waste to the landfill, without passing it through the transfer station (see Appendix B). However, because much of the transfer station's revenue comes from this part of the waste stream, such a change would decrease transfer station's revenue, but would make more sense for the overall system.

Alternatively, the City currently receives green waste at the transfer station. This material is stockpiled and then processed (with a grinder) 2-3 times per year. The processed material is then transported to the landfill where it is mixed with grass clippings and waste-water sludge, then composted. In this instance, the transfer station receives a tipping fee of $70.75 per ton. However, the landfill does not charge a tipping fee for this material. So, for the landfill, the cost of processing the green waste exceeds the small amount of revenue generated from selling compost.

Landfill

The Lewis and Clark County Landfill (LCCL) is a well-run facility with a focus on environmental integrity and customer service. The landfill receives both municipal solid waste (in a lined area) and C&D waste (in an unlined area). The facility accepts mostly commercial vehicles: transfer trucks (MSW) from the Helena Transfer Station and C&D – mostly from local contractors.

Recommendations

We offer the following recommendations for the Landfill:

a. We understand that some material, such as green waste, enters the Landfill without paying a tipping fee. We strongly recommend that the Landfill charge for all inbound waste material.

b. Charge a $1 surcharge for all tires entering the Landfill, regardless of how they are processed. We recommend not receiving tires …or receiving them and processing them (quartering or chipping), then Landfilling them in the C&D area. The current arrangement with the tire recycler is, in our experience, a risky one. We have often seen facilities end up with massive piles of tires when the contractor was not able to perform as promised. To prevent this from occurring, we strongly suggest the contractor be limited to a maximum number of tires on-site, and also pay the County a $1 fee for every tire that enters the Landfill.

c. Historically, the compactor pushed every load of waste as it was dumped. This required the compactor operator to be on-call continually – and the compactor to log approximately 5 hours per day. We suggested that loads be allowed to stack up, and that the compactor push when the unloading area is filled …or at the end of the day. Reducing compactor hours from 5 hours per day to 2 hours per day. At an estimated (conservatively) $100/hour (Owning & Operating cost), this will save $78,000/yr.

d. Currently, the compost operation is inefficient and costly. Grass clippings and processed green

waste from the Transfer Station is accepted at no charge. Bio-solids (sludge) from the city waste water treatment facility pays a tipping fee for screenings only. These materials are mixed (using a wheel loader), then transported up to 600 feet to a windrow area. During the time this process is continued, we recommend the inbound material be dumped where the next windrow will be placed – in order to reduce the cost of moving it with the loader. When possible, we recommend the County eliminate compost operation and use processed green waste for mulch on Landfill slopes – again the material should be dumped where it will be used to minimize hauling cost. Based on Sherrel Rhys' *Compost Financial Analysis 9.27.2011(See Appendix A)*, this will save an estimated $53,919/yr. Does not include revenue from sale of compost which is estimated at $15,000/yr. Net savings is estimated at $38,919/yr.

e. Do not purchase a new compactor (for $647,000) – but continue using the existing compactor and simply rebuild major components (i.e., engine, transmission, wheels/teeth, etc.) as needed. Once the compactor is at the end of its life, we suggest that it undergoes a Cat® Certified Rebuild. The teeth are currently worn and should be replaced within the next year or so. As a cost-saving measure, the new teeth could be purchased soon, and then replaced during the winter months as Landfill staff has time. Deferring purchase of the existing compactor saves $647,000 in 2015. We recommend the County determine its marginal cost of operation – the incremental cost of receiving additional waste tonnage. Simply stated, most of a Landfill's costs are fixed, and so receiving additional waste does not increase those costs. The Landfill's fixed costs include: buildings, scale, roads, monitoring network, staffing, machines, etc. Most of those costs would not increase if additional waste was brought in. Only the cost of producing (i.e., lining & capping) would be increased. Understanding this will help the County be more competitive for out-of-County waste.

f. We recommend the Landfill seek to use airspace as a resource. Currently, the Landfill has nearly 100 years of available capacity. We consider this to be a valuable resource, on that is unlikely to be fully utilized – since it's unlikely we'll be burying waste in 2114. To use the available airspace to its maximum potential, we recommend the Landfill continue to actively seek out-of-county waste. We also suggest that the Landfill consider options for chipped tires, residual green waste, and other *inert* waste materials that could most economically be Landfilled in the unlined C&D area. Please note: we are not recommending that recyclable materials be Landfilled when a viable "*diversion*" opportunity exists. We simply suggest that the cost of recycling be compared against the cost of disposal. For example, chipped tires could likely be Landfilled (in the C&D area) at a density of approximately 1,200 pounds per cubic yards – approximately the same density to compacted waste (in the Landfill). Thus, a cubic yard of Landfilled tire chips contains approximately 55 passenger car tires – which weigh approximately 22 pounds each. In our experience, tires can be chipped for less than $25/ton. Added to the Landfill's tipping fee of $31.25/ton, passenger car tires could be disposed in the C&D area for approximately $1 each.

g. The perimeter fence currently placed along the Landfill's southern border is an excellent fence

and appears to be properly situated to catch windblown litter. Great Job.

h. Extend the duration of tarp placement from the current 7 days …to 22 days. This will reduce the quantity of soil used for cover, resulting in fewer scraper hours and airspace savings. We estimate this will reduce soil use to a 7:1 cover ratio …from the current 3.97:1. Based on Sherrel Rhys' *Scraper Analysis*, this would reduce soil for daily and intermediate cover from 16,793cy/yr to 9,523cy/year …a savings of 7,270cy/yr. Based on an (estimated) airspace value of $7.00/cy and a cost of hauling soil of $1.72 (for total savings of $8.72/cy), the annual savings is estimated at $63,394/yr. Upon request we could provide a draft template of a letter that could be submitted to Montana DEQ, requesting the extension. Neal Bolton met with Rick Thompson (DEQ) and it appears DEQ will approve such a request.

i. Eliminating the compost operation means the wheel loader is likely not required at the Landfill. Current auction prices show that this machine could be sold for a onetime cash revenue of more than $100,000. Or, it could be retained as a backup for the Transfer Station loader.

j. Unify the Transfer Station and Landfill operations and eliminate the need for a roll-off truck at the Landfill – intermittent need for a roll-off truck could be covered by Transfer Station fleet. Could reduce annualized cost of the Landfill's roll-off truck – estimated at $10,000/yr.

k. Combine shop operations. The Landfill currently has a well-equipped shop that is used primarily for the Landfill's heavy equipment. However, we recommend that it also be used to service City trucks on an as-needed basis. Currently, City trucks are serviced/repaired by the City shop. And, while this system works reasonably well for day-to-day servicing and repairs, it is not effective when repairs must be made immediately to prepare a truck for tomorrow's route. Often, even a minor problem, if identified late in the day – simply cannot be repaired if it requires a mechanic to work beyond the normal workday. However, if the City/County were working together, the Landfill shop could be used for after-hours repairs. This would provide the waste manager the flexibility to authorize mechanic overtime if necessary. For the City to legally haul from the Marysville site, it would need to either get a Public Service Authority permit, or be part of a joint City and County Solid Waste District.

l. Eliminate weekend operation. The tonnage flow on the weekend does not justify the operational cost. TS tonnage can be held at the Transfer Station until Monday. Changing from a 7-day per week operation …to 5 days per week will provide significant benefits in terms of scheduling and reduced need for additional staff.

m. We recommend the Landfill management team re-evaluate the need for a dedicated mechanic. We expect that as the machine's hours decrease (reduced compactor hours, eliminate compost operation, reduce cover soil frequency, etc.), the need for a mechanic will decrease as well. We suggest sharing a mechanic with the City of Helena Transfer Station.

n. Modify litter control system to increase effectiveness. Consider adding more permanent littler fencing and move the existing portable litter fencing closer to the active area. We commend the use of the vacuum truck for picking up litter. This is an innovative system used by a minority of Landfills. Good Job.

Immediate Savings:

- Do not buy Compactor in 2015 …saves $647,000
- Sell John Deere 624J Loader …generates $100,000 one-time revenue

Immediate Savings: $747,000

Annual Savings:

- Charge a tipping fee for all inbound material …savings is undetermined
- Charge a tipping fee for tires …savings is undetermined
- Reduce compactor hours …saves $78,000 /yr
- Eliminate compost operation …saves $38,919/yr
- Reduce from 7-days/week to 5-days/week …savings is undetermined
- Extend duration of tarp ADC placement …saves $63,394/yr
- Share roll-off truck with Transfer Station …saves $10,000/yr

Annual Savings: $190,313/yr

Transfer Station

The Helena Transfer Station (HTS) is a clean, well-run facility. However, through our on-site observations and subsequent analysis, we did note some opportunities to increase efficiency and reduce cost. Like many other existing Transfer Stations built 15+ years ago, this facility was primarily designed to receive, process and transport waste. However, in the subsequent years, many additional activities have been added, including: recycling for used oil, green waste, paper, cardboard, metal, appliances, glass, plastics, etc. Thus, part of our goal in this study was to reduce the workload associated with waste-handling ...to allow City's limited space, labor and equipment resources to focus more on diversion.

Current Status

Inbound Tonnage

The Transfer Station transported 36,450 tons of waste to the Landfill in 2013 – waste that was received through five main tonnage sources.

- Permits (City Residence and Scratch Gravel Self Haul Customers)
- Commercial Collections
- Residential Collections
- Accounts (Business that pay on a monthly basis)
- Tri County (Local private MSW hauler)

The tonnage distribution is shown in Figure 1.

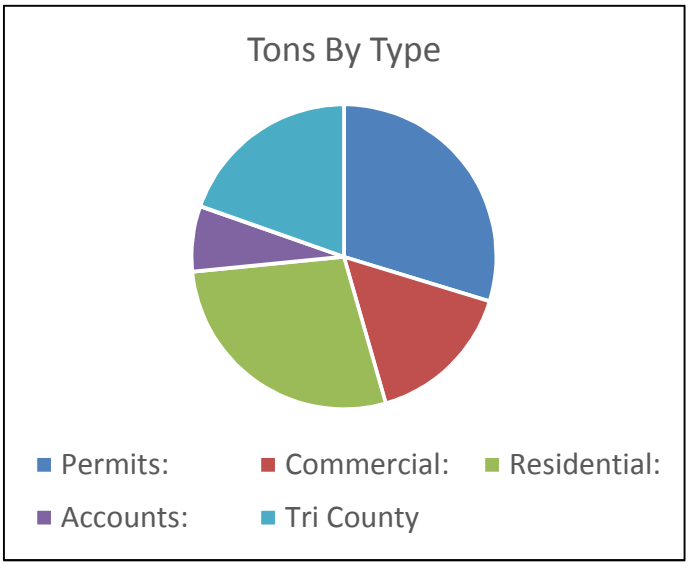


Figure 1

Figure 2 and 4 show the distribution of the weight and number of loads per year coming into the TS from City of Helena residence. The data shows an extreme positive left skew, aka most of the loads are very small (30 lbs.) and infrequent. This result follows if you look at the survey responses to Q3, Q5, and Q8 (See Appendix F). The results of these questions basically says that City of Helena residence mainly use collection for MSW disposal needs, they don't have interest in direct haul to the Landfill and the only reason

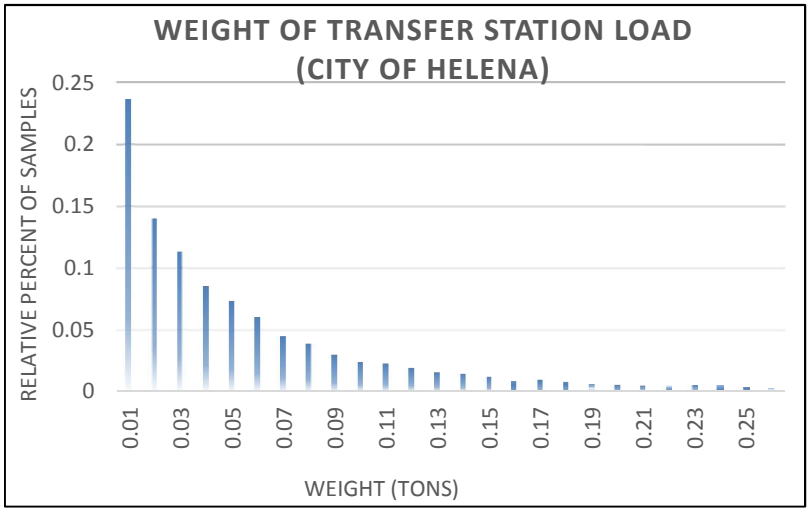


Figure 2

they take garbage to the TS is because the TS accepts waste that collection does not.

As you would expect the scratch gravel customers show slighter larger loads than City residence. However there still is a

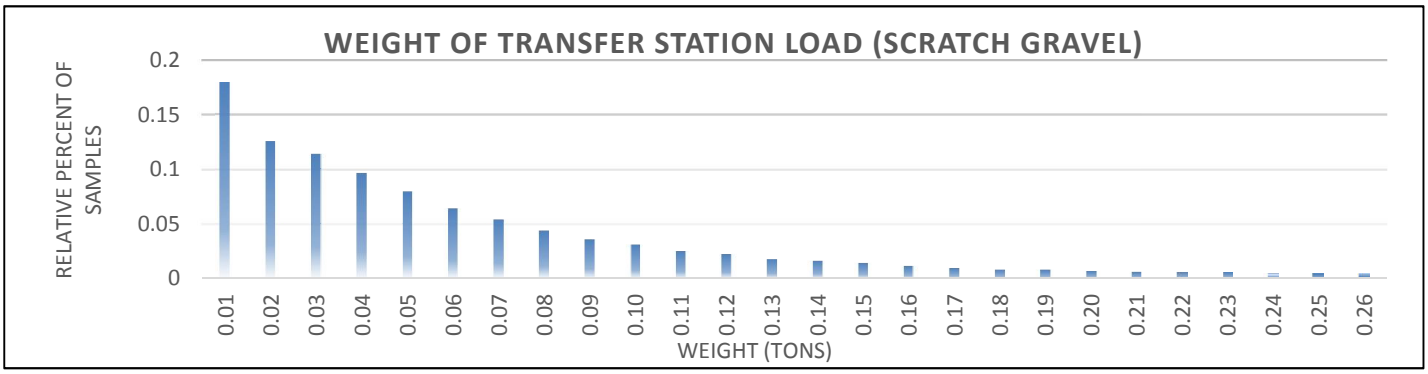


Figure 3

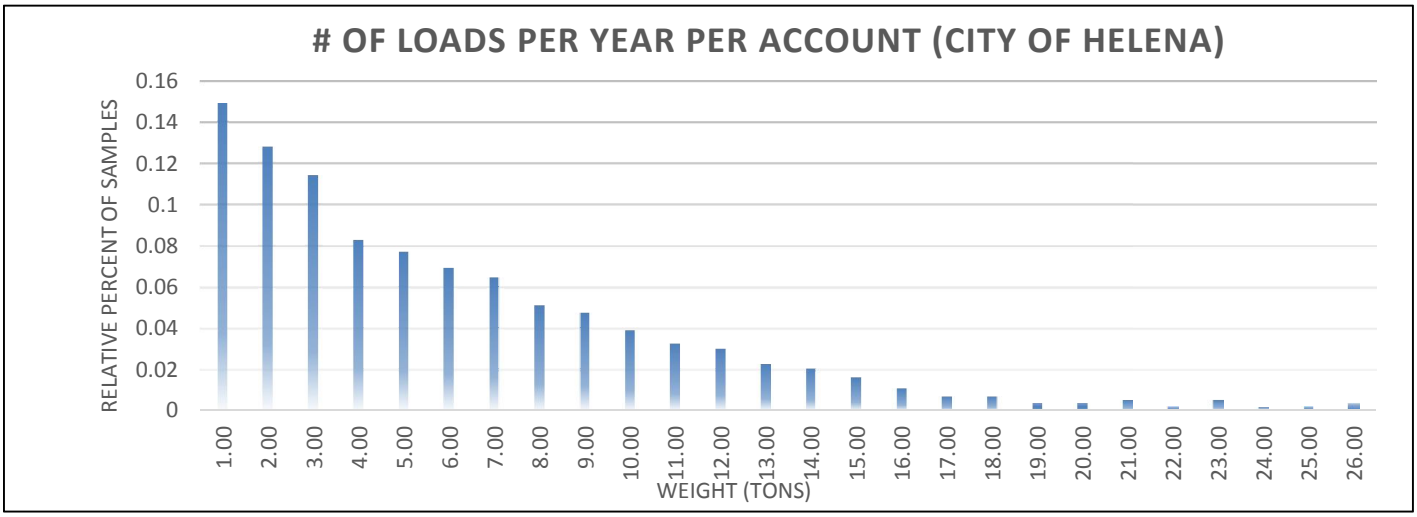


Figure 4

positive left skew.

Tons per Hour

The TS shows a typical hourly tonnage distribution with small peaks in the morning and afternoon. Figure 5 shows Tons per hour for a one week period.

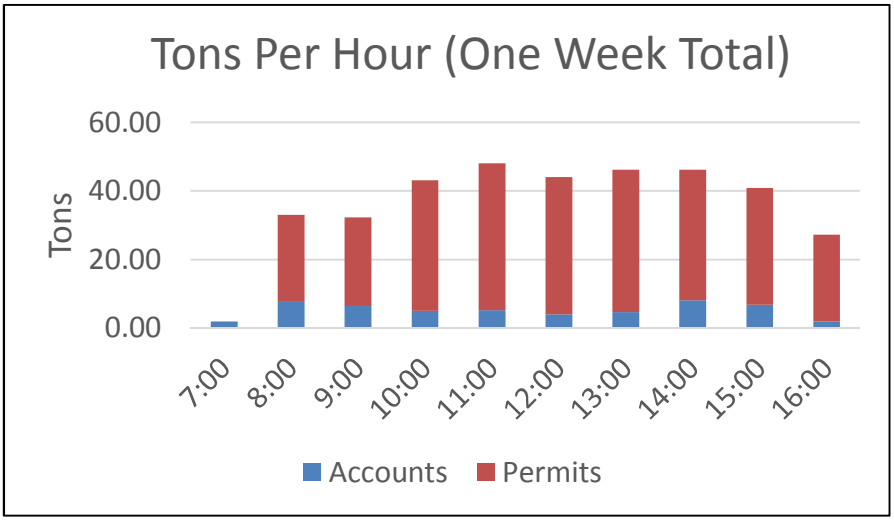


Figure 5

Revenue

The City of Helena Transfer Station has 4 main sources of revenue/expenditures:

- MSW – Residential
- MSW – Commercial
- Landfill Monitoring District
- Transfer Station

The distribution of revenue is shown in Figures 6.

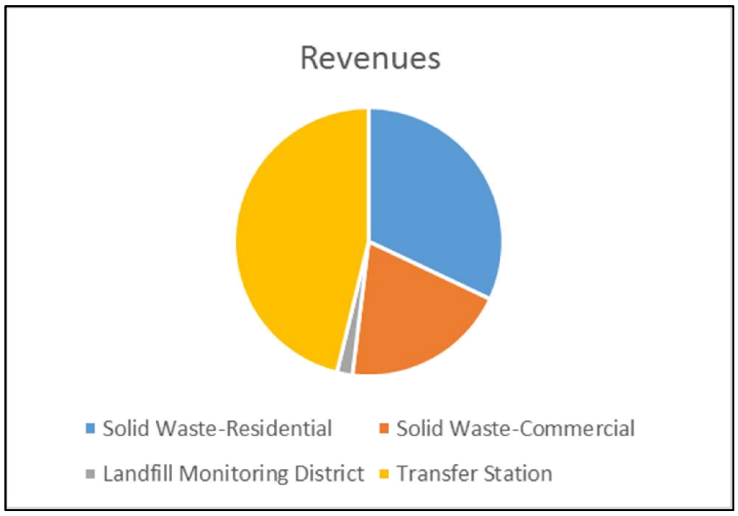


Figure 6

The revenue from the Transfer Station is shown in Figure 7. The main source of revenue is from Residential and Scratch gravel tipping fees.

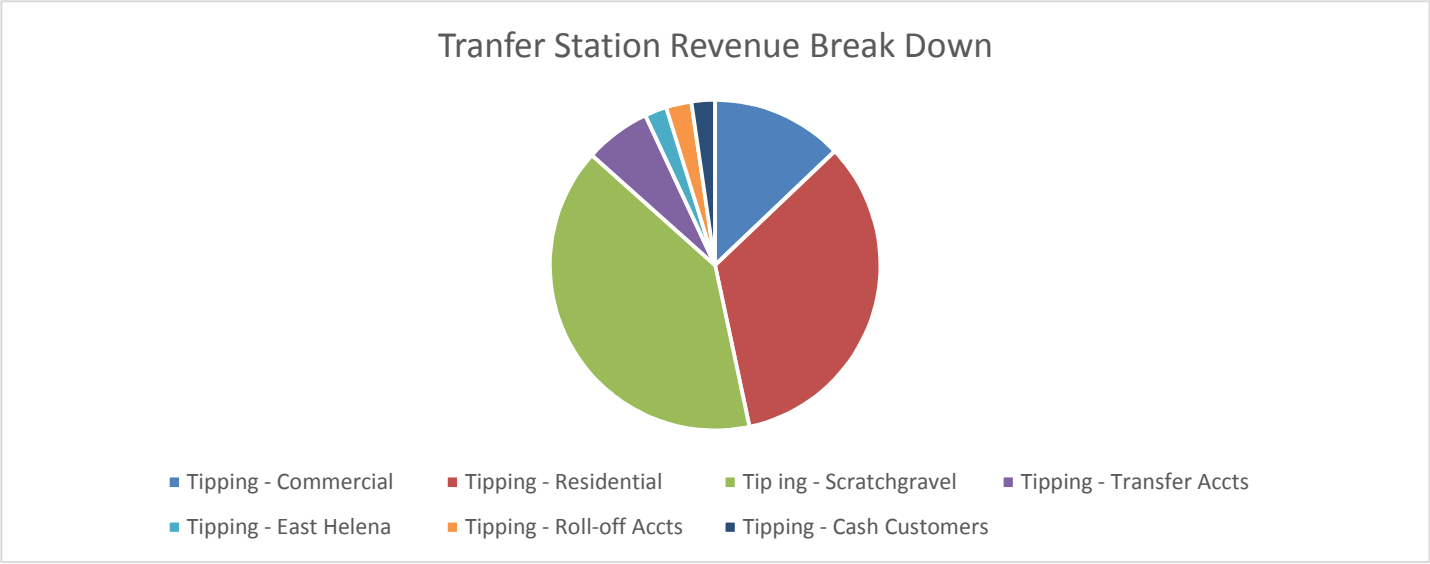


Figure 7

Direct Haul to Landfill

The current system is as follows. The collection fleet is stored at the City Shop and every day they do the appropriate collection routes. They deposit the loads at the TS and then return to the city shop. We conducted a study to determine the operational cost savings that would be incurred if the fleet was stored at the TS. We also added a third scenario; the

cost if the collection fleet directly hauled to the Landfill. The model is based on owning and operating costs associated with the Collection Fleet, Transfer Trucks, Transfer Trailers, and all heavy machinery related to running the TS.

The results of the study:

Total Operation Cost for One Week	
Current System	$7,859.79
Store Fleet at TS	$7,492.29
Direct Haul to LF	**$5,202.98**

This finding is in line with our experience with siting/assessing Transfer Stations over the past 25 years. Generally speaking, a Transfer Station makes sense when the cost of direct hauling (with trash trucks) exceeds the capital and operating cost of the Transfer Station (including land, design, construction, etc.). As a simple rule of thumb, we've found that if annual ton-miles is less than 1million, direct haul is most economical. To calculate annual ton-miles, multiply annual (waste) tonnage x round trip miles (from city center to Landfill). For the City of Helena, in 2013, the Transfer Station shipped 36,450 tons of waste to the Landfill. The round trip distance from the Transfer Station to the Landfill is 23.8 miles. Thus, the annual ton-miles for 2013 was 867,510 ton-miles.

$$36{,}450\ tons\ \times 23.8\ miles\ = 867{,}510\ ton\ miles$$

Also, during last year's (November 6-7, 2013) DEQ-sponsored course on Transfer Station Design and Safety (taught by Neal Bolton), we reviewed the 1million ton-mile rule of thumb. At that time, Barry Damschen (original designer of the Helena Transfer Station) affirmed that the primary reason for siting the Transfer Station was to reduce the traffic load to the Landfill – not to provide the least cost hauling option.

Finally, in a recent article, Daniel T. Duffy, P.E., PMP, a senior practitioner in waste facility design at GeoSyntec outlined the industry standard feasibility formula for TS construction (MSW Management, June 2014). According to Mr. Duffy,

Whether or not a Transfer Station makes financial sense can be determined by a simple formula:

BEM = FC ÷ (CHC – THC)

Where;

> *BEM = Breakeven mileage, the distance from the Transfer Station to the Landfill*
>
> *FC = Fixed capital costs of the construction of the Transfer Station, as determined by the Transfer Station's siting and design*
>
> *CHC = Collection truck hauling costs, total for all trucks bringing waste to the Transfer Station*
>
> *THC = Trailer hauling costs, total for all trucks shipping waste to the Landfill*

If the distance from the Landfill to the Transfer Station is less than the BEM, the construction and operation of a Transfer Station is not financially justified. And to take advantage of economies of scale, much greater distances should be served by larger Transfer Stations.

The results of this analysis on the City of Helena TS:

> *FC = $4,000,000.00 (bond payments over a 19 year period)*
>
> *CHC = $616,605.00 (O&O over a 19 year period)*

THC =$438,484.00 (O&O over a 19 year period)

BEM = 22 miles

Actual distance to LF from TS = 11.9 miles

11.9 < BEM

Therefor the construction and operation of the Transfer Station was never financially justified. This follows with the current situation where direct hauling is actually more financially beneficial than utilizing the TS.

There is some concern regarding the additional miles that would be added to the collection vehicles if direct hauling is implemented. And it is true that there would be additional miles in the route trucks. However, it is our opinion that the miles to/from the Landfill will be relatively easy miles (compared to the start/stop of the typical route). We also believe that the life of the route trucks will be minimally impacted by placing additional road miles on the drive-train …because most of the wear on the drive train and body occurs on the routes.

We also believe that from a safety standpoint, the road-miles to/from the Landfill will be the safest miles for the route trucks (as opposed to *on-route* miles).

Recommendations

We offer the following recommendations for the Transfer Station:

a. Do not allow loads of clean (uncontaminated) green waste to dump in the Transfer Station pit – where it will have to be processed, hauled, Landfill …and charged a tipping fee of $31.25/ton. Instead, required customers to place clean green waste in the green waste area, and charge a higher fee for inbound green waste that is mixed with trash …and thus must be placed in the pit.
b. Install a remote camera (with tilt, pan, zoom) to watch the green waste area. It is our understanding that the wheel loader currently travels from the Transfer Station pit …to the green waste pile every hour for the purpose of pushing loads into the pile …and removing any unwanted waste. Based on an estimated 12 minutes per trip, 7 trips per day, 7 days/week, and $100/hour, we estimate that the annual loader cost is $50,400 per year. A camera would likely cost less than $10,000, depending on location and availability of power. The gate attendant can also monitor the stacking of individual loads and then radio the loader operator when it's time to push.
c. During the time that route trucks continue dumping at the Transfer Station, we recommend additional slots be opened on the north side of the facility. Currently only slots are available for dumping …slots that fill up with 1 front-loader loads …or 2 side-loader loads. And once those slots fill up, the loader must push …or the next truck cannot unload. This puts a costly limitation on the loader …and requires it to essentially be on-call at all times. Opening up more slots will decrease the pressure on the loader to respond immediately to route truck arrivals.

d. We suggest all trucks with consolidated loads (i.e., route trucks) direct haul to the Landfill. We recognize that this will eliminate up to 75% of the tipping fee revenue collected by the Transfer Station, but will reduce the overall cost of the system. Instead of paying $70.75/ton at the Transfer Station, disposal costs will be reduced to $31.35/ton at the Landfill. We propose this also include Tri-County trucks also be instructed to direct haul to the Landfill. We recommend doing this in stages, we suggest starting with commercial trucks first and then expanding the program to residential.

e. We recommend the Transfer Station implement a minimum charge for all customers entering the facility. Currently, the minimum charge is $0.71 for 20 pounds of waste. This is unrealistic in terms of what is required to process a single load of trash. We recommend the minimum charge be started at $7.00/visit … and increased as necessary. Part of the goal is to provide a reasonable cost for weighing, transacting, handling, loading, transporting and disposing of the material. A survey of other Montana waste facilities indicates that $7.00/visit is near the average rate of facilities that have a minimum charge, although several facilities have a higher minimum fee. The other purpose for increasing the minimum fee is to discourage residents from using the Transfer Station on a too frequent basis.

Facility	Minimum Charge
City of Billings LF	$6.85
Cascade County LF	$9.00
Park County TS	$2.00
Missoula County LF	$16.50
Lake County TS	$5.00
West Yell/Hebgen Basin	$5.00
Gallatin County Logan LF	$5.00
City of Helena (City & County Permits)	*$0.71*

Figure 8

f. We suggest the Transfer Station establish a series of front-loader bins that can be used by customers with 3 bags of trash or less. The purpose is to provide additional unloading capacity for customers, without having to design/build more capital improvements at the Transfer Station (i.e., expansion of tipping floor).

g. Re-direct trailers beyond a certain size/capacity to haul direct to the Landfill. This may also apply to all vehicles that are slow to unload. This will eliminate crowding the Transfer Station's unloading slots with vehicles that are difficult to maneuver and/or may take too long to unload.

h. After the above listed changes, if additional unloading slots are required, we recommend the loader's shed be relocated to an area east or south of its current location. This would produce approximately 3

additional pit-level slots at the east end of the Transfer Station.

i. Reduce loader hours. By instructing route trucks, selected trailers and C&D loads to haul direct to the Landfill, and by eliminating some of the "lite-load" customers, the loader's annual hours are expected to drop. Additionally, instructing the loader operator to clean the GW area only when necessary (by installing a camera), the loader hours will be further reduced. Overall, we expect to see the annual loader usage decrease by approximately 70%.

j. Eliminate 7 days per week operation. We recommend closing two days per week. The most logical days of the week to close are Wednesday and Thursday, based on finding two concurrent days with relative low tonnage (See Figure 9).

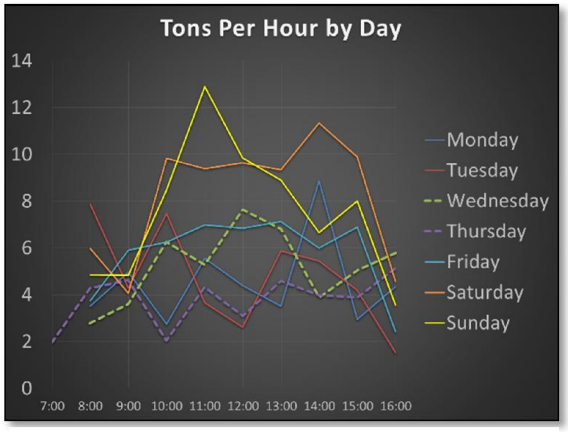


Figure 9

Immediate Savings:

- Avoid the Cost of expanding the Transfer Station to the east …savings undetermined

Annual Savings:

- We recommend direct hauling to the Landfill with all route trucks …saves $138,000/yr (See Appendix B)
- Raise minimum charge from $0.71 to $7 per load …savings undetermined
- Reduce hours/days of operation (decrease operational costs) …saves $100,000/yr
- Send green waste to a 3rd party to avoid loader, processing, hauling cost or install a camera to reduce the number of trips the loader must make to the green waste area. …saves $35,000/yr (first year)
  …saves $50,000/yr thereafter

Annual Savings: $288,000/yr

Commercial Collections

Currently, the City competes with a private hauler for commercial collections customers within the City of Helena. This is an important revenue stream for the City's waste operation, and so improving the efficiency of commercial collections is very important.

Eliminate 2 trucks working short days Monday – Friday. Instead, we recommend the existing commercial routes be re-organized so that a single truck works 5 full days per week, with the 2nd truck providing backup as needed 1-2 days per week.

We recommend the City conduct a review of commercial areas, to affirm that local businesses are not avoiding commercial service by using adjacent residential containers. During our review of the commercial operation, we observed some businesses that appeared to have no commercial service ….and coincidentally, there were several 300-gallon residential containers in the alley behind the businesses.

We recommend that the commercial collections manager be allowed more flexibility in terms of bidding for new commercial accounts, including not having to stay within a published range of service rates. This would also include reviewing the actual cost of operation to add a new customer, based on: a truck already being in the area, the truck not being full, shorter haul distance to the Landfill based on customer location, etc.

We recommend:

1. Conduct a billing and service audit of all commercial front-loader accounts. This is a pay for service. Accurate billing and service requirements are critical components for analyzing and assessing commercial route productivity.

2. Drivers and trucks should be assigned to the same route every day. This allows for better productivity analysis. It also holds the driver accountable for customer service as well as the mechanical operation of the truck. When drivers switch routes frequently it's difficult, if not impossible, to hold them accountable for anything that happens on the route. The same problem exists with the truck. If a driver is not assigned the same truck every day, there is no way to hold a driver accountable for the maintenance of the truck. The exception to this is relief drivers, who are assigned different route to cover for vacations and other days off by the regular drivers.

3. The Saturday route should be eliminated. Only 4 customers have six-times a week service that require a Saturday pick up. These customers can be accommodated by giving them an extra bin that would only be collected on Monday or Friday depending on their needs. The remaining customers, that have less than six times a week service, can be spread out over the five days and collected by the Monday through Friday routes.

4. Eliminating the Saturday route (86 lifts) would add about 9 lifts per day to each route Monday through Friday,

increasing the average lifts per route from 63 to 72. This is still below the industry average of 125 to 150.

5. There is only enough work for one fully productive route. However, the one route would be at full capacity with no room for expansion. An alternative is to adjust routing so a second truck only goes out 1 or 2 times a week. This would increase the first route's productivity in line with industry standards and allow the second or part-time route to be productive on the days it goes out. This also indicates that there is room for expansion within the current system …and that obtaining additional commercial accounts would make the overall system even more efficient.

6. Direct haul to the Landfill to obtain a lower tipping fee – this is addressed in detail in the Transfer Station section.

In addition the City should review the commercial pricing model and consider making adjustments to allow the Solid Waste Division staff flexibility to price service on a customer-by-customer basis. This could increase customer count and route density. Both are important factors to building productive routes.

Annual Savings:

- We recommend direct hauling to the Landfill with all route trucks …saves $138,000/yr (*Based on City supplied data, O&O costs, and transportation model ..savings are already presented in the Transfer Station section)
- Focus on using 1 primary truck, with overflow handled by a 2nd truck …and reduce hours/days of operation. This will optimize truck use, and may decrease the required driver hours by approximately 0.5 FTE. The savings are estimated. …saves approx. $35,000/yr

Annual Savings: $35,000/yr

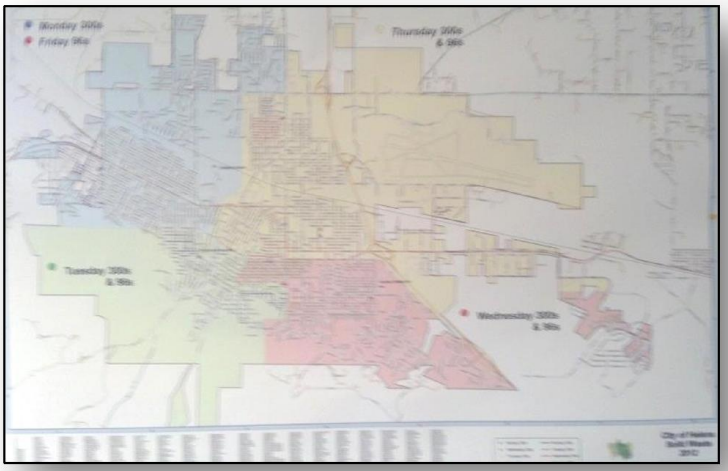
Residential Collections

The division operates 3 residential routes Tuesday through Friday and one route on Sunday and Monday. Drivers make about 687 lifts a day. The driver who works on Sunday and Monday collects half the route on Sunday and the other half of the route on Monday. The drivers work 4 to 7 hours a day on the route, depending on the day of the week. When drivers complete their route they are assigned duties such as tramp truck, roll-off truck, cart delivery and repair, landscape and building maintenance at the Transfer Station facility, and other duties that may arise from time to time.

Residential accounts are not assigned a route number in the customer database. The 300-gallon cans located in the alleys are not assigned an address or a route number. In addition, drivers and trucks are not assigned to the same route every day. Drivers rotate residential and commercial routes and trucks. Moving drivers and trucks from route to route makes analyzing productivity difficult.

Based on the available information, residential productivity is low by 20 to 25 percent. A report[1] prepared for the Solid Waste Association of North America (SWANA) states that automated routes can make about 950 to 1,000 households or lifts per day. Considering the city's topography and the severe winter conditions, a single-person automated route can be expected to make 850 to 890 lifts per day. If one route is eliminated and the remaining 2 routes work 5 days a week, Monday through Friday, each driver would make about 894 lifts per day up from 687 lifts. This is more in line with industry standards. This level of productivity would require each driver to make 3 to 4 trips a day to the tipping site. Eliminating one route would save the city approximately $200,000 annually (based on industry-standard costs). During severe weather conditions a third route could be added if the new productivity standard can't be maintained. This, however, would reduce the annual savings from eliminating one route.

We recognize that direct hauling to the Landfill will increase driver time per route, so this must be considered when adjusting routes.



The division uses 2-axle, 22 cubic yard trucks for garbage collection. If the division used larger capacity 3-axle 32 cubic yard trucks, productivity can be increased further because fewer trips to the tipping site are needed, thus increasing on-route time.

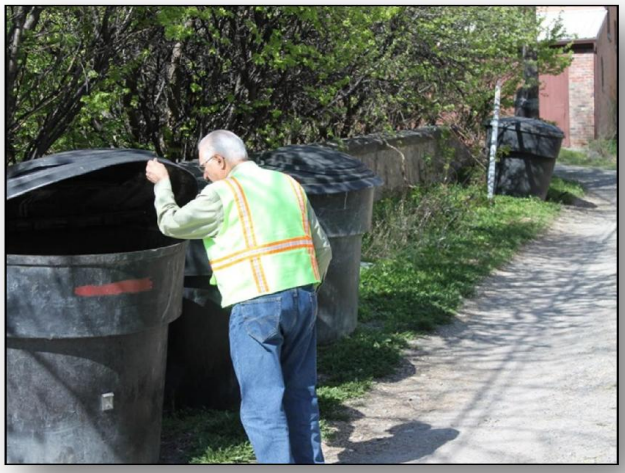
Large capacity trucks were discussed with the staff during the on-site visit. They were hesitant to use them

[1] The Benchmarking of Residential Solid Waste Collection Services: FY 2008 Report, Prepared for SWANA Applied Research Foundation Collection Group Subscribers and Project Sponsors, page 31.

because of the icy conditions during the winter. We discussed this concern with the AutoCar salesperson in the Midwest. (The City of Helena uses AutoCar truck chassis). The salesperson stated that large capacity trucks are used in Minnesota, which has similar winter weather conditions to Helena, however Minnesota has different topography. The Division staff should investigate the use of larger trucks. They would reduce truck trips and increase *on-route* time. Adjusting routes to allow the larger (3-axle) truck to handle the flatter sections and using the 2-axle trucks for the hill routes would reduce overall costs.

Additional recommendations.

1. The Sunday route should be eliminated and the garbage collected on Monday. This can easily be accomplished by changing drivers' workdays.
2. Drivers and trucks should be assigned to the same route every day. This allows for better productivity analysis. It also holds the driver accountable for customer service as well as the mechanical operation of the truck. When drivers switch routes frequently it's difficult, if not impossible, to hold them accountable for anything that happens on the route. The same problem exists with the truck. If a driver is not assigned the same truck every day, there is no way to hold a driver accountable for the maintenance of the truck. The exception to this is relief drivers, who are assigned different route to cover for vacations and other days off by the regular drivers.
3. The division should assign a route number to each residential account. This will be the start of determining the size of the route and the productivity of the driver.
4. The division should undertake a project to identify the location of each 300-gallon can. This can be accomplished by listing the GPS coordinates for each can, assigning it an address, and a route number.
5. We also recommend the division conduct a can-capacity audit. This could be combined with item 4 (above) and could be conducted by a summer intern. During our site review, we identified a number of situations where existing cans were being underutilized. Specifically, we found many 300-gallon cans that were far below 50% …and a number that were below 25%. Conversely, we understand that some cans are regularly over-filled. This further justifies the need to assess can placement and usage and re-balance the system.



6. Once route numbers are assigned to each cart and can the division can generate a RAMS-Pro report detailing the number of stops and the volume collected by route. This will provide a baseline for route productivity improvements
7. We recommend that the division devote certain days to Household Hazardous Waste collection. This is considered common practice for municipalities of this size.
8. The division uses Alpine Technology Corporation's RAMS-Pro Software to manage their customer database. RAMS-Pro is a powerful application for managing solid waste collection operations. The application integrates customer information for billing and routing and provides an array of reports to help manage the operation.

The Division should engage Alpine Technology to conduct a systems utilization audit. This type of audit identifies areas where users may not be taking full advantage of their system.

Annual Savings:

- Eliminate one route …saves $200,000/yr
- Use larger capacity 3-axle 32 cubic yard trucks …savings undetermined
- Route number designation and productivity tracking …savings undetermined

Annual Savings: $200,000/yr

Recycling

City and County residents are currently provided with a number of options for recycling. These include (for City residents) a Bluebag program, commercial bins for cardboard, and subscription-based curbside recycling. All City and County residents can utilize recycling containers located strategically within the City of Helena, various recycling bins at the Transfer Station. These are in addition to other recycling options offered by other entities such as Tri-County Disposal, Pacific Recycling, Helena Recycling and SAVE.

We offer the following recommendations for the recycling effort:

a) The recycling program should be funded through its own enterprise fund/ funding to be provided directly from solid waste assessments for both City and County residents.

b) Eliminate the Blue Bag program. This program is currently receiving a low level of participation (5.3%). This, along with the high unit cost of operating the system, translates into a current operating cost of $800/ton to $1000/ton (per City Report "ESTIMATED OVERALL COST FOR BLUE BAG PROGRAM, 3/19/14).

c) Eliminate the separated plastic program. Because this is a labor intensive procedure, the current process costs an estimated $1,000/ton (per City estimate).

d) Where practical, expand the capabilities of the voluntary drop-off recycling effort utilizing containers at various locations across Helena. This system appears to be effective.

e) We recommend the City/County (i.e., combined entity) seek a public/private arrangement for providing a subscription-based curbside recycling system. Helena Recycling's current program is working, John Hilton is motivated and has a clear, business-based perspective of what will work. We recommend the City/County work through a Statement of Qualifications type arrangement to select a contractor who understands the local culture and can help develop a workable and cost-effective recycling program.

f) Following the recommendations to direct haul (with commercial trucks), re-direct large trailer and slow unloaders to the Landfill, and increase the minimum charge, we anticipate the traffic flow at the Transfer Station will decrease. And, if/when the City teams with a private company to offer subscription-based curbside collection of recyclables, we recommend a more detailed look at how the space at the Transfer Station can be utilized to provide more cost-effective support for recycling. This may include installation of a baler, construction of covered space for sorting, baling and storing recyclables. The ultimate goal would be to find cost-effective ways to increase recycling by consolidating certain types of

recyclables and shipping them directly to market rather than working through a middle-man that may not offer the best rates or may create a system bottleneck (i.e., Pacific Recycling currently has limited availability for baling certain commodities).

Financial

The current system is working, but it is – in some ways – inefficient. For example, County residents pay an annual solid waste assessment. Then if/when they bring waste into the Transfer Station, a transaction is created that bills the County for the disposed waste at a rate of $70.75/ton. Currently this transaction could be as little as $0.71. Then the City consolidates inbound trash into a transfer truck load and transports it to the Landfill. The County then bills the City $31.25/ton.

We recognize that some re-distribution of money will be required if our recommendations are implemented. For example, when route trucks direct haul to the Landfill, they will essentially be billed at the rate of $31.25/ton (the Landfill's fee), rather than at $70.75/ton (the Transfer Station's fee). So, while this will reduce the overall cost of operating the system, it will significantly decrease the revenue going to the Transfer Station division.

Residence with curbside pickup have an additional advantage. Tonnage picked up curb side is not counted towards the 3000 lbs./year allotted per permit.

One of the most obvious results of reducing the revenue of the Transfer Station may be an inability to continue funding the recycling program through the Transfer Station division's budget. To eliminate this problem, we also recommend recycling be funded directly through the solid waste assessments for both City and County residents. Establishing a separate funding source for recycling would make managing the recycling system's budget simpler and more transparent. Currently, the recycling program receives unpaid (and untracked) support from the Transfer Station crew. One example of this is the staff oversight currently provided for the plastics recycling program at the Transfer Station.

Regardless of the policy adopted for recycling – or the level of effort it receives, we feel strongly that the financial cost should be transparent and all-inclusive so that residents understand the financial reality of recycling.

Survey Summary

The county issued a survey to city and county residence to collect data on public opinion for a variety of issues (See appendix F). This was an important part of this study – since the goal is to provide service that City and County residents want. The results are summarized below:

24,787 residents were asked to respond, 1,040 responded for a response rate of 4.2%.

- A majority of the survey participants were from scratch gravel residence outside of the Helena city limits
- A majority of the survey participants utilize the solid waste collection system as their main disposal system
- Survey participants are satisfied with the current system
- Survey participants do not want to haul to the Landfill directly
- Survey participants don't care if they can pay their garbage bill online, but those who do care would like the option
- There is no predictable pattern for the time frame that people take garbage to the Helena TS

- The public is very satisfied with the Helena TS
- The public feels the Transfer Stations needs to be open on Sundays
- A majority of the households recycle
- Those that do not recycle feel that it is not worth the effort
- The house holds that do recycle take their recyclables to city drop off points or to the Helena TS
- The house holds that do recycle, recycle most materials
- The public is not satisfied with the recycling options in Helena and Lewis & Clark County
- The public feels that materials should be recycled even if it cost more to recycle than it does to dispose of the material in an environmentally safe manner
- The public is unsure if it wants to pay for recycling

But the real-world results do not reflect a similar level of commitment to recycling. Take for example the Bluebag program. Of the 9,000 City residents who were offered to participate in the Bluebag program at no additional charge 480 signed up and at this point only 153 are actually participating.

Subsequently, it appears that the demographic of the person most likely to recycle is also most likely to want recycling. But the overall results of the survey do not clearly align with what's actually happening.

Implementation

We've made a number of recommendations for change – most of which are interactive. Some of our recommendations are essentially low-hanging fruit, and will be fairly easy to implement by simple policy and/or management changes. Others will require more time and more effort. So, in order to help the City and County move forward efficiently and effectively, we've put together a draft implementation schedule. Please note: The steps are listed in logical order, but do not include specific dates. We recommend the various recommendations be adopted a step at a time, working out the logistics and proving it out before moving to the next series of changes. Please see **Appendix G – Implementation Plan** for a detailed implementation form.

1. Establish a means of bringing the City and County together so they can make decisions based on improving the overall system.
2. Implement a regular cross-check for all required safety procedures, things like: Lock-out/Tag-out, Pre-Trip (Walk-around) Inspections, PPE, etc.

City

1. Re-brand the Transfer Station to reflect its increased role as a recycling facility.
2. Increase the minimum charge for Transfer Station customers to at least $7.00 per visit.
3. Look for opportunities to expand the existing voluntary recycling program.
4. Eliminate the Blue Bag and separated plastics recycling programs.
5. Begin development of a Request for Qualifications to create a public/private partnership for a subscription-based curbside recycling program.
6. Conduct a container/weight audit of the residential routes to determine key characteristics of each route.
7. Contract with a 3rd party to process/remove green waste from the Transfer Station. If some green waste is needed at the Landfill for mulch, segregate inbound loads and stockpile material that does not require processing (i.e., leaves, grass and other fines) so it can be placed on the Landfill slopes for minimum cost.
8. Direct haul to the Landfill on a trial basis while monitoring performance, cost, driver workload/hours, etc.
9. Reduce machine hours at the Transfer Station based on reduced workload resulting from direct haul and higher minimum tipping fee.
10. Adjust commercial routes to allow full workdays for one truck Monday-Friday, using 2nd truck for backup as needed.
11. As the recycling programs prove out (i.e., are shown to be working), work toward creating a recycling facility at the Transfer Station that meets the needs of the system. We anticipate this will include a baler and enclosed area to process/store recyclables. Prove out the system on the street first, determine quantities of recycled material being collected then begin creating the facility at the Transfer Station.

County

1. Modify Landfill tipping fee schedule to begin charging for all inbound waste material, including tires and green waste.
2. Eliminate stockpiled tires at the Landfill.
3. Reduce machine hours at the Landfill.
4. Defer purchase of new compactor at Landfill.
5. Obtain new teeth for the compactor and replace with Landfill staff – as time allows.
6. Eliminate the compost operation at the Landfill.

7. Re-structure the equipment replacement policy to allow for rebuilding individual components such as engine, transmission and undercarriage, …up to the point of doing a complete rebuild – even a certified rebuild. The used machines at the Landfill (i.e., compactor) retain a significant amount of unused value.

Appendix

Appendix A - Compost Analysis Model (Next Page)

Lewis & Clark Co. Solid Waste Landfill
Model to Analyze Compost Operations

11/17/13

Facts/Parameters	Planning Estimates				2012		2013	
Wood waste	1,600	Tons/YR	7840	YDS/YR	1917	Tons	903	Tons
Green Waste	920	Tons/YR						
Tons of sewage biosolids sludge	2,260	Tons/YR	2938	YDS/YR	1851	Tons	2086	Tons
Fuel consumption gal per year	1465	YR			240.9	Gal	245.7	Gal
Estimated cost of fuel	$4.00	Gallon			$963.48	YR	$982.75	YR
Wood waste Yards per Ton	4.9	YDS/Ton						
Biosolids Yards per Ton	1.3	YDS/Ton						
Operator cost per hour including benefits	$30.00	HR			120	YR	151	YR
Equipment Maintenance 624JD	$10.00	HR			$1,000	YR	$1,020	YR

City of Helena
Contract Amount - Ueland Western Reclamation Inc.

Note: Contract ended Sept. 2011				
Shredded wood waste management	$10	Wet Ton	$16,000	YR
Raw Green Waste Management	$10	Wet Ton	$9,200	YR
Biosolids Management -1,000 ton minimum	$10	Wet Ton	$22,600	YR
City paying $18/ton to grind, $700 mobilization			$45,360.00	
Total			**$93,160**	YR

Lewis & Clark County Landfill
Equipment & Cost

					2012	2013
Air Blower, Gast Model R4110-2	$800				$ 811	
PVC Pipe & Fittings	$1,000				$1,074	
Compost Testing	$2,100	YR	$350	ea		
Electricity	$350	YR			$100	$0.00
O2 Tester	$2,000					
*note: use existing water pump and hose	NC					
Ground Waster Monitoring	$3,000	YR				
Compost Thermometer	$200				$199	
Total	**$9,450**				$ 2,185	$0.00

Compost Operating Costs	Planning Estimate				2012		2013	
Fuel								
Fuel Gallons/Hour 624JD Loader	2.4	Gallons/HR			240.0	Gal/YR	244.8	Gal/YR
624JD Equipment Hours/YR	650	HRS/YR			100	HRS	102	HRS
624 JD Fuel/YR	$1,083.33	YR			$960.00	YR	$979.20	YR
Operator								
Equipment Operations 650 hrs plus 650 hrs	1,300	HRS/YR			120	HRS/YR	151	HRS/YR
$30 per hour including benefits	$39,000	YR			$3,600	YR	$4,530	YR
Equipment Maintenance								
624 JD Maintenance/HR	$ 10	HR						
624 JD Maintenance/YR	$ 6,500	YR			$2,400	YR	$2,448	YR
Compost equipment maintenance/YR	$ 1,890				$0.00		$0.00	
Total operating costs	**$ 53,923**	**YR**			**$9,145**	YR	**$7,957**	YR
Operating Minus Labor	**$ 14,923**				**$5,545**	**YR**	**$3,427**	**YR**

COMPOST FEEDSTOCK BREAKOUT

Carbon to Nitrogen Ratio	30:1							
Moisture Content	50%							
Recipe								
Wood Chips	2	CY	4,520	CY				
Grass/green waste	1	CY	2,260	CY				
Biosolids	1	CY	2,260	CY				
Total			9,040	CY			**11/13/2013**	
Compost Produced (reduces product by 50%)			**4,520**	**CY/YR**			**2,519**	**CYDS**
Tons @ 1300/lbs/yd			2,938	Tons/YR			1,637	Tons
Cost to Produce/Ton W/Labor			$18.35	Ton			**$10.45**	**Ton**
Cost to Produce/ton W/O Labor			$3.30	Ton			$5.48	Ton
Cost to produce/CY			$11.93	CY			**$6.79**	**CY**

COMPOST SALES OPTIONS

					2013	
Value of unscreened compost at $7/YD	$ 31,640	YR			$17,633	
Note: Purchas of a used Trommel (to screen for sale) would increase value to $15/YD	$ 75,000	YR				
Wood chips not utilized (Excess)	3,320	CY/YR			367.29	CY
Possible Wood Chip Value (Sales to Biologic Compost)/CY	$ 6.00	CY				
Possible Wood Chip Value (Sales to Biologic Compost)/YR	$19,920	YR			$2,204	YR
Cost to chip wood waste	$15	CY	$ 18.00	ton	$18.00	ton

Appendix B - Direct Haul Analysis Model

	City Shop	3000 E Lyndale Ave			
	TS	1601 N Benton Ave	Miles		
	Monday Centroid	1905 Henderson St	13	0.216666667	0.65
	Tuesday Centroid	107 E 6th ave	15	0.25	0.75
	Wed Centroid	301 N Fee St	12	0.2	0.6
	Thusday Centroid	1421 Poplar St	11	0.183333333	0.55
	Friday Centroid	1905 Henderson St	13	0.216666667	0.65

City Shop	TS	LF
0	3.7	7.7
3.7	0	8.5
7.7	8.5	0
4.5	1.4	8.7
3.2	0.9	8.7
1.9	2.6	8.8
2	1.9	7.1
4.5	1.4	8.7

Side Loader Cost($/h)	$50.00
Front Loader Cost($/h)	$55.00
Wheel Loader Cost($/h)	$47.11
Crane Cost($/h)	$32.50
Skid Loader Cost($/h)	$42.39
Transfer Truck Cost($/h)	$41.27
Transfer Trailer Cost($/h)	$29.00

Current System-City Shop-TS-LF			Option1-TS-TS-LF			Option 2-TS-LF		
Monday			**Monday**			**Monday**		
Trips Per Day	4.5		Trips Per Day	4.5		Trips Per Day	4.5	
Side Loader Time(h)	3.8615		Side Loader Tin	3.3615		Side Loader Time(h	6.2865	
Side Loader Cost($/h)	$50.00	$193.08	Side Loader Co	$50.00	$168.08	Side Loader Cost($/	$50.00	$314.33
Trips Per Day	4		Trips Per Day	4		Trips Per Day	4	
Front Loader Time(h)	6.9		Front Loader Ti	6.4		Front Loader Time(l	9	
Front Loader Cost($/h)	$55.00	$379.50	Front Loader C	$55.00	$352.00	Front Loader Cost($	$55.00	$495.00
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tin	0.39		Skid Loader Time(h)	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	4.60		TT per day	4.60		TT per day	4.60	
Transfer Truck Time(h)	4.6		Transfer Truck	4.6		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$189.84	Transfer Truck	$41.27	$189.84	Transfer Truck Cost	$41.27	$0.00
TT per day	4.60		TT per day	4.60		TT per day	4.60	
Tranfer Trailer Time(h)	4.6		Tranfer Trailer	4.6		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$133.40	Transfer Traile	$29.00	$133.40	Transfer Trailer Cos	$29.00	$0.00
Tuesday		**$1,136.05**	**Tuesday**		**$1,083.55**	**Tuesday**		**$809.33**
Trips Per Day	7.4		Trips Per Day	7.4		Trips Per Day	7.4	
Side Loader Time(h)	6.0278		Side Loader Tin	5.5278		Side Loader Time(h	11.0778	
Side Loader Cost($/h)	$50.00	$301.39	Side Loader Co	$50.00	$276.39	Side Loader Cost($/	$50.00	$553.89
Trips Per Day	3		Trips Per Day	3		Trips Per Day	3	
Front Loader Time(h)	5.3		Front Loader Ti	4.8		Front Loader Time(l	7.05	
Front Loader Cost($/h)	$55.00	$291.50	Front Loader C	$55.00	$264.00	Front Loader Cost($	$55.00	$387.75
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tin	0.39		Skid Loader Time(h)	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	6.00		TT per day	6.00		TT per day	0.00	
Transfer Truck Time(h)	6		Transfer Truck	6		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$247.62	Transfer Truck	$41.27	$247.62	Transfer Truck Cost	$41.27	$0.00
TT per day	6.00		TT per day	6.00		TT per day	0.00	
Tranfer Trailer Time(h)	6		Tranfer Trailer	6		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$174.00	Transfer Traile	$29.00	$174.00	Transfer Trailer Cos	$29.00	$0.00
Wed		**$1,254.75**	**Wed**		**$1,202.25**	**Wed**		**$941.64**

Trips Per Day	8.8		Trips Per Day	8.8		Trips Per Day	8.8	
Side Loader Time(h)	7.0736		Side Loader Tin	6.5736		Side Loader Time(h	11.8536	
Side Loader Cost($/h)	$50.00	$353.68	Side Loader Co	$50.00	$328.68	Side Loader Cost($/	$50.00	$592.68
Trips Per Day	2		Trips Per Day	2		Trips Per Day	2	
Front Loader Time(h)	3.7		Front Loader Ti	3.2		Front Loader Time(l	4.4	
Front Loader Cost($/h)	$55.00	$203.50	Front Loader C	$55.00	$176.00	Front Loader Cost($	$55.00	$242.00
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tim	0.39		Skid Loader Time(h	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	4.75		TT per day	4.75		TT per day	4.75	
Transfer Truck Time(h)	4.75		Transfer Truck	4.75		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$196.03	Transfer Truck	$41.27	$196.03	Transfer Truck Cost	$41.27	$0.00
TT per day	4.75		TT per day	4.75		TT per day	4.75	
Tranfer Trailer Time(h)	4.75		Tranfer Trailer	4.75		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$137.75	Transfer Traile	$29.00	$137.75	Transfer Trailer Cos	$29.00	$0.00
Thursday		**$1,131.20**	**Thursday**		**$1,078.70**	**Thursday**		**$834.68**
Trips Per Day	8.75		Trips Per Day	8.75		Trips Per Day	8.75	
Side Loader Time(h)	7.03625		Side Loader Tin	6.53625		Side Loader Time(h	11.3488	
Side Loader Cost($/h)	$50.00	$351.81	Side Loader Co	$50.00	$326.81	Side Loader Cost($/	$50.00	$567.44
Trips Per Day	4		Trips Per Day	4		Trips Per Day	4	
Front Loader Time(h)	6.9		Front Loader Ti	6.4		Front Loader Time(l	8.6	
Front Loader Cost($/h)	$55.00	$379.50	Front Loader C	$55.00	$352.00	Front Loader Cost($	$55.00	$473.00
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tim	0.39		Skid Loader Time(h	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	5.00		TT per day	5.00		TT per day	5.00	
Transfer Truck Time(h)	5		Transfer Truck	5		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$206.35	Transfer Truck	$41.27	$206.35	Transfer Truck Cost	$41.27	$0.00
TT per day	5.00		TT per day	5.00		TT per day	5.00	
Tranfer Trailer Time(h)	5		Tranfer Trailer	5		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$145.00	Transfer Traile	$29.00	$145.00	Transfer Trailer Cos	$29.00	$0.00
Friday		**$1,322.90**	**Friday**		**$1,270.40**	**Friday**		**$1,040.44**
Trips Per Day	4.5		Trips Per Day	4.5		Trips Per Day	4.5	
Side Loader Time(h)	3.8615		Side Loader Tin	3.3615		Side Loader Time(h	6.2865	
Side Loader Cost($/h)	$50.00	$193.08	Side Loader Co	$50.00	$168.08	Side Loader Cost($/	$50.00	$314.33
Trips Per Day	4		Trips Per Day	4		Trips Per Day	4	
Front Loader Time(h)	6.9		Front Loader Ti	6.4		Front Loader Time(l	9	
Front Loader Cost($/h)	$55.00	$379.50	Front Loader C	$55.00	$352.00	Front Loader Cost($	$55.00	$495.00
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tim	0.39		Skid Loader Time(h	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	6.00		TT per day	6.00		TT per day	6.00	
Transfer Truck Time(h)	6		Transfer Truck	6		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$247.62	Transfer Truck	$41.27	$247.62	Transfer Truck Cost	$41.27	$0.00
TT per day	4.60		TT per day	4.60		TT per day	4.60	
Tranfer Trailer Time(h)	6		Tranfer Trailer	6		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$174.00	Transfer Traile	$29.00	$174.00	Transfer Trailer Cos	$29.00	$0.00
Saturday		**$1,234.43**	**Saturday**		**$1,181.93**	**Saturday**		**$809.33**
Trips Per Day	0		Trips Per Day	0		Trips Per Day	0	
Side Loader Time(h)	0.5		Side Loader Tin	0		Side Loader Time(h	0	
Side Loader Cost($/h)	$50.00	$25.00	Side Loader Co	$50.00	$0.00	Side Loader Cost($/	$50.00	$0.00
Trips Per Day	2		Trips Per Day	2		Trips Per Day	2	
Front Loader Time(h)	3.7		Front Loader Ti	3.2		Front Loader Time(l	4.5	
Front Loader Cost($/h)	$55.00	$203.50	Front Loader C	$55.00	$176.00	Front Loader Cost($	$55.00	$247.50
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tim	0.39		Skid Loader Time(h	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	2.50		TT per day	2.50		TT per day	2.50	
Transfer Truck Time(h)	2.5		Transfer Truck	2.5		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$103.18	Transfer Truck	$41.27	$103.18	Transfer Truck Cost	$41.27	$0.00
TT per day	2.50		TT per day	2.50		TT per day	2.50	
Tranfer Trailer Time(h)	2.5		Tranfer Trailer	2.5		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$72.50	Transfer Traile	$29.00	$72.50	Transfer Trailer Cos	$29.00	$0.00
Sunday		**$644.41**	**Sunday**		**$591.91**	**Sunday**		**$247.50**

Trips Per Day	4.5		Trips Per Day	4.5		Trips Per Day	4.5	
Side Loader Time(h)	3.8615		Side Loader Tin	3.3615		Side Loader Time(h	3.3615	
Side Loader Cost($/h)	$50.00	$193.08	Side Loader Co	$50.00	$168.08	Side Loader Cost($/	$50.00	$168.08
Trips Per Day	4		Trips Per Day	4		Trips Per Day	4	
Front Loader Time(h)	6.9		Front Loader Ti	6.4		Front Loader Time(	6.4	
Front Loader Cost($/h)	$55.00	$379.50	Front Loader C	$55.00	$352.00	Front Loader Cost($	$55.00	$352.00
Wheeler Loader Time(h)	2.81		Wheeler Loade	2.81		Wheeler Loader Tin	0	
Wheeler Loader Cost($/h)	$47.11	$132.38	Wheeler Loade	$47.11	$132.38	Wheeler Loader Co	$47.11	$0.00
Crane Time(h)	2.81		Crane Time(h)	2.81		Crane Time(h)	0	
Crane Cost($/h)	$32.50	$91.33	Crane Cost($/h	$32.50	$91.33	Crane Cost($/h)	$32.50	$0.00
Skid Loader Time(h)	0.39		Skid Loader Tim	0.39		Skid Loader Time(h	0	
Skid Loader Cost($/h)	$42.39	$16.53	Skid Loader Co	$42.39	$16.53	Skid Loader Cost($/	$42.39	$0.00
TT per day	4.60		TT per day	4.60		TT per day	4.60	
Transfer Truck Time(h)	4.6		Transfer Truck	4.6		Transfer Truck Time	0	
Transfer Truck Cost($/h)	$41.27	$189.84	Transfer Truck	$41.27	$189.84	Transfer Truck Cost	$41.27	$0.00
TT per day	4.60		TT per day	4.60		TT per day	4.60	
Tranfer Trailer Time(h)	4.6		Tranfer Trailer	4.6		Tranfer Trailer Time	0	
Transfer Trailer Cost($/h)	$29.00	$133.40	Transfer Trailer	$29.00	$133.40	Transfer Trailer Cos	$29.00	$0.00
		$1,136.05			**$1,083.55**			**$520.08**
		Current			**City Shop**			**Direct Haul**
		$7,859.79			$7,492.29			$5,202.98
						Savings		**$2,656.81**

One week period: **$2656.81** in savings.

Appendix C - City of Helena Collection Statistical Analysis Results

Average net weight load by truck number:

Residential		Commercial	
Truck#	Tons	Truck#	Tons
#212	5.36	221	6.08
#213	5.21	222	5.89
#214	5.13	223	5.92
#215	5.27		
#240	4.49		
#241	4.76		
#242	4.72		
#243	4.61		

Average number of loads by day of week by truck number:

Truck Number		Average Number of Trips Per Day
#212	Monday	2.50
#212	Tuesday	2.47
#212	Wednesday	2.50
#212	Thursday	3.00
#212	Friday	3.10
#213	Monday	2.00
#213	Tuesday	2.92
#213	Wednesday	2.76
#213	Thursday	2.36
#213	Friday	1.89
#214	Sunday	3.00
#214	Monday	2.00
#214	Tuesday	2.27
#214	Wednesday	2.91
#214	Thursday	2.22
#214	Friday	2.32

#215	Sunday	3.59
#215	Monday	3.17
#215	Tuesday	2.33
#215	Wednesday	2.08
#215	Thursday	2.86
#215	Friday	2.14
#240	Sunday	3.58
#240	Monday	3.22
#240	Tuesday	2.13
#240	Wednesday	2.14
#240	Thursday	2.77
#240	Friday	2.33
#241	Monday	3.00
#241	Tuesday	2.40
#241	Wednesday	2.65
#241	Thursday	3.10
#241	Friday	2.91
#242	Tuesday	2.82
#242	Wednesday	2.70
#242	Thursday	2.39
#242	Friday	1.36
#243	Sunday	4.00
#243	Monday	2.50
#243	Tuesday	2.22
#243	Wednesday	2.43
#243	Thursday	2.57
#243	Friday	2.00
#221	Monday	1.91
#221	Tuesday	1.43
#221	Wednesday	1.16
#221	Thursday	1.89
#221	Friday	1.57
#221	Saturday	2.00
#222	Monday	1.84
#222	Tuesday	1.35

#222	Wednesday	1.00
#222	Thursday	1.96
#222	Friday	1.74
#222	Saturday	2.04
#223	Monday	1.90
#223	Tuesday	2.07
#223	Wednesday	1.12
#223	Thursday	1.98
#223	Friday	2.02

Average Time and Weight of Last Load of Day by Truck By Day of Week

Truck Number		Day of week	Average Time of Last Load	Average Weight of Last Load
#221	2	Monday	10:30:49 AM	7.29
#221	3	Tuesday	10:49:46 AM	5.97
#221	4	Wednesday	11:05:06 AM	6.09
#221	5	Thursday	10:57:30 AM	5.65
#221	6	Friday	10:59:46 AM	5.70
#221	7	Saturday	10:41:10 AM	5.94
#222	2	Monday	11:07:31 AM	5.91
#222	3	Tuesday	10:40:00 AM	5.43
#222	4	Wednesday	10:45:09 AM	6.20
#222	5	Thursday	10:40:42 AM	5.71
#222	6	Friday	10:43:33 AM	6.34
#222	7	Saturday	10:20:23 AM	6.45
#223	2	Monday	10:49:41 AM	5.58
#223	3	Tuesday	10:40:56 AM	6.14
#223	4	Wednesday	10:59:09 AM	6.00
#223	5	Thursday	11:10:20 AM	5.83
#223	6	Friday	10:34:09 AM	6.03
#212	2.00	Monday	10:47:00 AM	4.36
#212	3.00	Tuesday	11:46:57 AM	4.48
#212	4.00	Wednesday	12:04:41 PM	3.94
#212	5.00	Thursday	12:02:57 PM	4.12
#212	6.00	Friday	1:09:33 PM	4.67

#213	2.00	Monday	10:40:12 AM	4.33
#213	3.00	Tuesday	12:24:07 PM	3.68
#213	4.00	Wednesday	12:58:41 PM	3.28
#213	5.00	Thursday	12:07:22 PM	4.00
#213	6.00	Friday	12:27:33 PM	4.24
#214	1.00	Sunday	1:20:30 PM	3.66
#214	2.00	Monday	12:14:00 PM	3.47
#214	3.00	Tuesday	12:35:22 PM	4.55
#214	4.00	Wednesday	1:20:29 PM	4.10
#214	5.00	Thursday	12:01:40 PM	3.86
#214	6.00	Friday	1:01:11 PM	4.15
#215	1.00	Sunday	12:53:41 PM	4.16
#215	2.00	Monday	12:21:47 PM	3.95
#215	3.00	Tuesday	1:00:51 PM	3.69
#215	4.00	Wednesday	12:23:42 PM	4.12
#215	5.00	Thursday	12:58:25 PM	4.02
#215	6.00	Friday	12:28:34 PM	4.07
#240	1.00	Sunday	1:17:16 PM	3.39
#240	2.00	Monday	12:14:33 PM	3.14
#240	3.00	Tuesday	1:03:52 PM	3.79
#240	4.00	Wednesday	12:46:17 PM	4.58
#240	5.00	Thursday	1:14:19 PM	2.79
#240	6.00	Friday	12:57:10 PM	2.99
#241	2.00	Monday	11:33:22 AM	2.62
#241	3.00	Tuesday	12:20:12 PM	3.96
#241	4.00	Wednesday	1:08:51 PM	3.74
#241	5.00	Thursday	12:43:57 PM	3.25
#241	6.00	Friday	1:14:27 PM	3.05
#242	3.00	Tuesday	12:27:14 PM	4.05
#242	4.00	Wednesday	1:11:45 PM	3.45
#242	5.00	Thursday	11:55:39 AM	3.52
#242	6.00	Friday	12:17:57 PM	4.10
#243	1.00	Sunday	1:30:30 PM	3.19
#243	2.00	Monday	11:20:00 AM	4.47
#243	3.00	Tuesday	12:49:07 PM	4.46

#243	4.00	Wednesday	12:22:09 PM	3.37
#243	5.00	Thursday	12:24:43 PM	3.69
#243	6.00	Friday	12:53:03 PM	3.15

Appendix D - Owning & Operating Cost Summary

				Cost/Hr	Cost/Hr
				Wheel_Loader Unit #204	Skip_Loader Unit #217
				WA-380	1845C
	Planned Replacement Date:			11/22/2018	3/26/2018
	Planned Service Life (Years):			9.994444444	24.98611111
	Average Annual Usage, To Date:			1305.116762	134.1904762
	Total Ownership Usage (Hours / Miles):			13043.91697	3352.898148
OWNING & OPERATING COSTS					
1	a. Delivered Price (w/ Attachments):			$204,600.00	$17,680.00
2	Less Residual Value @ Replacement			$79,794.00	$9,900.80
3	a. Value to be recovered through work			$117,606.00	$4,579.20
3	a. Value to be recovered through work (hourly):			$9.02	$1.37
4	Interest Costs			$0.03	$0.02
5	Insurance Costs			$0.01	$0.01
6	Property Tax			$0.01	$0.01
7	Total Hourly Owning Cost			$9.07	$1.40
OPERATING COSTS					
8	Fuel Cost (per hour, per mile)			$3.34	$9.18
9	Lube Oils, Filters, Grease (per hour, per mile)			$1.24	$0.00
10	a. Tires :Replacement Cost (per hour, per mile)			$1.80	$1.07
	b. Undercarriage (per hour)			$0.00	$0.00
11	Repair Reserve (per hour, per mile)			$4.95	$0.00
12	Special Items (per hour, per mile)			$0.65	$0.50
13	Lease Cost			$0.00	$0.00
14	Sales Tax Added to Lease Cost			$0.00	$0.00
15	Total Operating Costs			$11.98	$10.75
16	Total Owning + Operating			$21.04	$12.15
17	Operators Wage/hr			$26.07	$26.07
18	Total Owning & Operating Cost:			$47.11	$38.22

				Cost/Hr	Cost/Hr
				Semi_Tractor	Semi_Tractor

				Unit #227	Unit #228
				3 Axle Tractor	3 Axle Tractor
	Planned Replacement Date:			5/9/2022	1/10/2019
	Planned Service Life (Years):			19.98611111	19.98611111
	Average Annual Usage, To Date:			1000.205752	881.6581446
	Total Ownership Usage (Hours / Miles):			19990.22329	17620.91764
OWNING & OPERATING COSTS					
1	a. Delivered Price (w/ Attachments):			$66,822.00	$76,599.00
2	Less Residual Value @ Replacement			$9,355.08	$7,659.90
3	a. Value to be recovered through work			$50,266.92	$61,739.10
3	a. Value to be recovered through work (hourly):			$2.51	$3.50
4	Interest Costs			$0.01	$0.02
5	Insurance Costs			$0.00	$0.00
6	Property Tax			$0.00	$0.00
7	Total Hourly Owning Cost			$2.53	$3.53
OPERATING COSTS					
8	Fuel Cost (per hour, per mile)			$36.74	$36.74
9	Lube Oils, Filters, Grease (per hour, per mile)			$1.06	$1.06
10	a. Tires :Replacement Cost (per hour, per mile)			$0.09	$0.09
	b. Undercarriage (per hour)			$0.00	$0.00
11	Repair Reserve (per hour, per mile)			$1.20	$1.20
12	Special Items (per hour, per mile)			$0.16	$0.16
13	Lease Cost			$0.00	$0.00
14	Sales Tax Added to Lease Cost			$0.00	$0.00
15	Total Operating Costs			$39.25	$39.25
16	Total Owning + Operating			$41.78	$42.78
17	Operators Wage/hr			$26.07	$13.50
18	Total Owning & Operating Cost:			$67.85	$56.28

				Cost/Hr	Cost/Hr
				Semi_Tractor Unit #230	Trailer Unit #233
				3 Axle Tractor	Live Floor
	Planned Replacement Date:			6/7/2029	8/30/2017
	Planned Service Life (Years):			19.98611111	7.997222222
	Average Annual Usage, To Date:			1057.721226	0.218181818

	Total Ownership Usage (Hours / Miles):			21139.73395	1.744848485
OWNING & OPERATING COSTS					
1	a. Delivered Price (w/ Attachments):			$114,330.00	$68,967.00
2	Less Residual Value @ Replacement			$19,436.10	$19,310.76
3	a. Value to be recovered through work			$87,693.90	$46,456.24
3	a. Value to be recovered through work (hourly):			$4.15	$26,624.80
4	Interest Costs			$0.02	$67.82
5	Insurance Costs			$0.01	$16.96
6	Property Tax			$0.01	$16.96
7	Total Hourly Owning Cost			$4.18	$26,726.54
OPERATING COSTS					
8	Fuel Cost (per hour, per mile)			$36.74	$0.00
9	Lube Oils, Filters, Grease (per hour, per mile)			$1.06	$1.06
10	a. Tires :Replacement Cost (per hour, per mile)			$0.09	$0.04
	b. Undercarriage (per hour)			$0.00	$0.00
11	Repair Reserve (per hour, per mile)			$1.20	$2.00
12	Special Items (per hour, per mile)			$0.16	$0.10
13	Lease Cost			$0.00	$0.00
14	Sales Tax Added to Lease Cost			$0.00	$0.00
15	Total Operating Costs			$39.25	$3.20
16	Total Owning + Operating			$43.43	$26,729.74
17	Operators Wage/hr			$13.50	$0.00
18	Total Owning & Operating Cost:			$56.93	$26,729.74

				Cost/Hr	Cost/Hr
				Trailer Unit #234	Trailer Unit #235
				Live Floor	Live Floor
	Planned Replacement Date:			1/30/2022	4/29/2018
	Planned Service Life (Years):			7.997222222	7.994444444
	Average Annual Usage, To Date:			6	0.255319149
	Total Ownership Usage (Hours / Miles):			47.98333333	2.041134752
OWNING & OPERATING COSTS					
1	a. Delivered Price (w/			$87,000.00	$75,317.00

	Attachments):				
2	Less Residual Value @ Replacement			$19,140.00	$19,582.42
3	a. Value to be recovered through work			$64,660.00	$52,534.58
3	a. Value to be recovered through work (hourly):			$1,347.55	$25,737.93
4	Interest Costs			$3.14	$63.56
5	Insurance Costs			$0.79	$15.89
6	Property Tax			$0.79	$15.89
7	Total Hourly Owning Cost			$1,352.27	$25,833.27
OPERATING COSTS					
8	Fuel Cost (per hour, per mile)			$0.00	$0.00
9	Lube Oils, Filters, Grease (per hour, per mile)			$1.06	$1.06
10	a. Tires :Replacement Cost (per hour, per mile)			$0.04	$0.04
	b. Undercarriage (per hour)			$0.00	$0.00
11	Repair Reserve (per hour, per mile)			$2.00	$2.00
12	Special Items (per hour, per mile)			$0.10	$0.10
13	Lease Cost			$0.00	$0.00
14	Sales Tax Added to Lease Cost			$0.00	$0.00
15	Total Operating Costs			$3.20	$3.20
16	Total Owning + Operating			$1,355.47	$25,836.47
17	Operators Wage/hr			$0.00	$0.00
18	Total Owning & Operating Cost:			$1,355.47	$25,836.47

Appendix E - Cell Construction

In regard to cell construction, we recommend the Landfill crew begin building daily cells in horizontal lifts. This process – commonly referred to as a pancake operation – improves overall efficiency while increasing compaction and reducing soil use.

This is explained in detail on the follow pages.

Additionally, regardless of the cell-construction method used, we recommend the Landfill crew perform pre-fill stripping of soil. Before placement of waste on top of previously-placed waste, we strongly recommend all available soil be removed. The information box shown here explains/shows the process

Pre-Fill Stripping of Soil

Typically, daily cells are constructed like building blocks. They're stacked side-by-side as the operation moves back and forth across the landfill.

In many cases, as these daily cells are constructed they are covered with a considerable thickness of soil …from 6 inches up to 18 inches or more. This is to provide a driving surface for the waste vehicles.

Unfortunately, if this thick layer of soil is left intact, it will take up a significant amount of landfill airspace. In most cases, it is best to remove this layer of soil first thing in the morning, temporarily stockpiling it in one or more windrows.

Stripping off all available soil before placing each day's cell saves soil and airspace. It also helps prevent leachate from migrating laterally.

At the end of the day, this "stripped" soil is pushed back onto the finished cell as cover. And, even though it may contain a slight amount of trash (and therefore may not be suitable for "finished" daily cover), it works quite well as a "first pass," helping to fill the voids in the surface of the cell.

Build Pancake Cells

Selecting the best overall kind of cell construction can be a complex task. Many of the major factors are inter-related. For example, in order to minimize the use of intermediate cover soil (on each lift of trash), a very thick lift would be preferable. However, a thick lift, when combined with uphill pushing results in the dozers having to work much harder. Similarly, a steep working face will minimize the amount of ADC required, but will also slow the compactors, thus resulting in decreased density. In the following sections, we'll present the preferred method of cell construction.

We recommend the overall method of cell construction be changed to a “pancake” system.

Our first issue is related purely to geometry, and the fact that a small daily cell will require a higher percentage of cover soil than a large cell. As cell size increases, the surface area increases as a squared function (i.e., length x width), whereas the volume increases as a cubed function (i.e., length x width x depth).

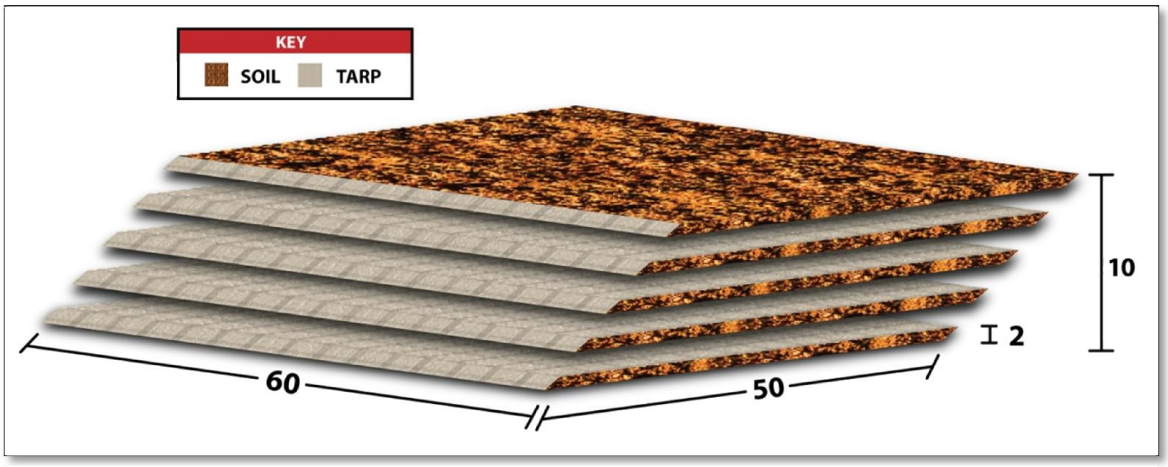


Figure A1

So, in order to take maximum advantage of this economy of scale, we propose the Landfill begin constructing what are, in essence, multi-day cells. Thus, instead of building and covering daily cells, we would instead construct one layer (pancake) cell each day, placing cover soil only when the stacked layers reach the grade of the adjacent stacks. Of course this must be done only with full regulatory approval.

The crew would cover the top and the front face of the daily cells with tarps, and the side of the cells with dragged tarps, ash or soil. This will require the purchase of additional tarps/spools for the Tarp-O-Matic.

When the stack of pancakes is completed, the advancing face retains the tarp cover.

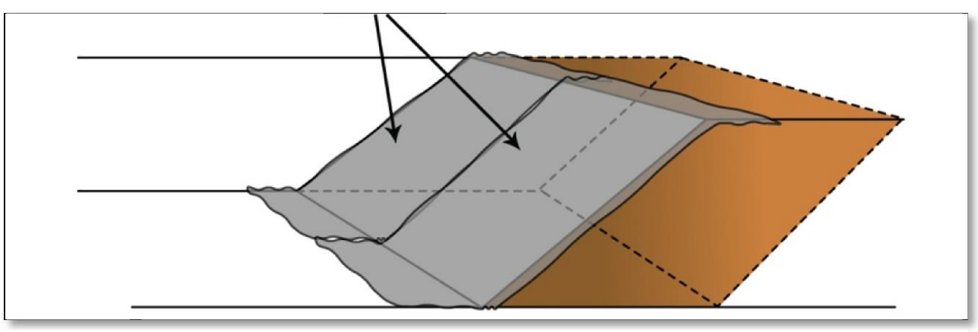


Figure A2

At the beginning of the next stack, previously-placed soil would be stripped for the next footprint. The stripped soil will be stockpiled at the side of the cell for re-use.

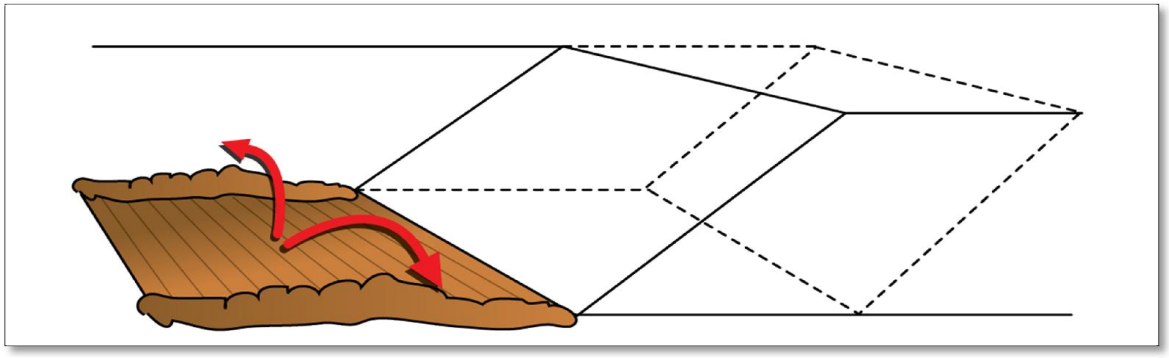


Figure A3

Waste would be spread horizontally across the stripped area and compacted. We estimate each day's pancake will be approximately 0.5 ' deep, 58' wide and 180' long.

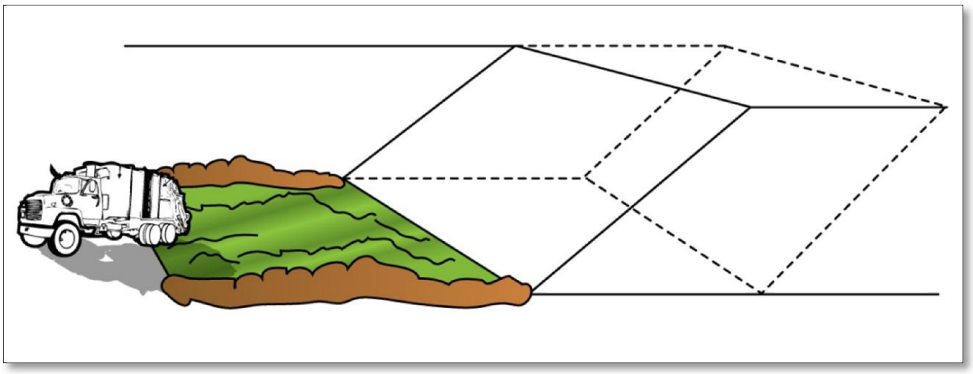


Figure A4

At the end of the day, the waste is covered with a tarp. Only the side edge receives cover soil.

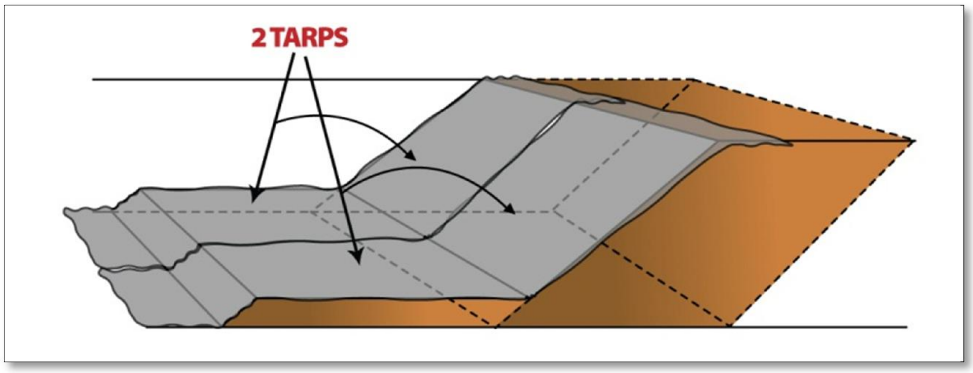


Figure A5

Each day the tarp is removed and more waste is placed. Once the stack reaches grade, the entire process is repeated.

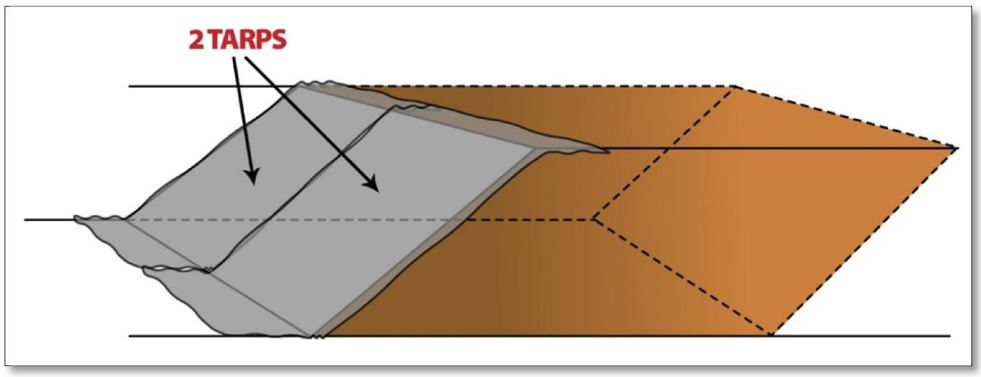


Figure A6

An example of this tarp placement system is shown here (See Figure A7).

When completed, once the stack of pancakes reaches grade, the top is covered with soil, and the face remains covered with a tarp. The following day, the next stack would begin.

Please note, the completion of the stack does not have to occur on any specific day …or on any set time of day. It is simply completed when the stack reaches grade – and if it doesn't reach grade or isn't ready to receive cover soil by the end of the day it is simply re-tarped.

By changing the way waste cells are constructed, and by minimizing the quantity of soil used for daily cover, we believe the Landfill can extend its life and save a significant quantity of soil.

Figure A7

We recommend the pancake cells be constructed to uniform dimensions when possible. Based on our analyses, that dimension is as follows:

The dimension s3 is the tipping edge where the trash will be deposited (Shown as the green area in the figure below).

This geometry is based on a 21 day cell.

	Dimensions						
	s1	**s2**	**s3**	**h**	**x**	**SA(yd^2)**	**V (yd^3)**
Yards	19	7	60	3	0.42 rad	3290	3490
Feet	**58**	**22**	**180**	**9**	**24°**		
	Cover Ratio:						
	4.69						

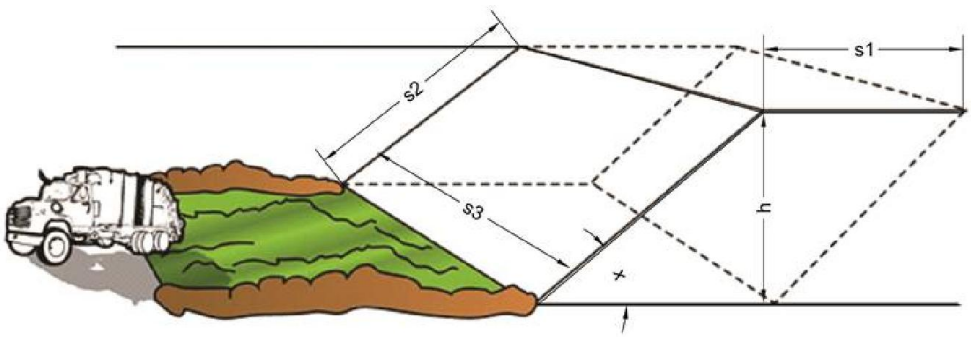


Figure A8

Tarps:

Tarps Needed:	**5**
Size:	**40 ft. x 100 ft.**
Spools:	**3**

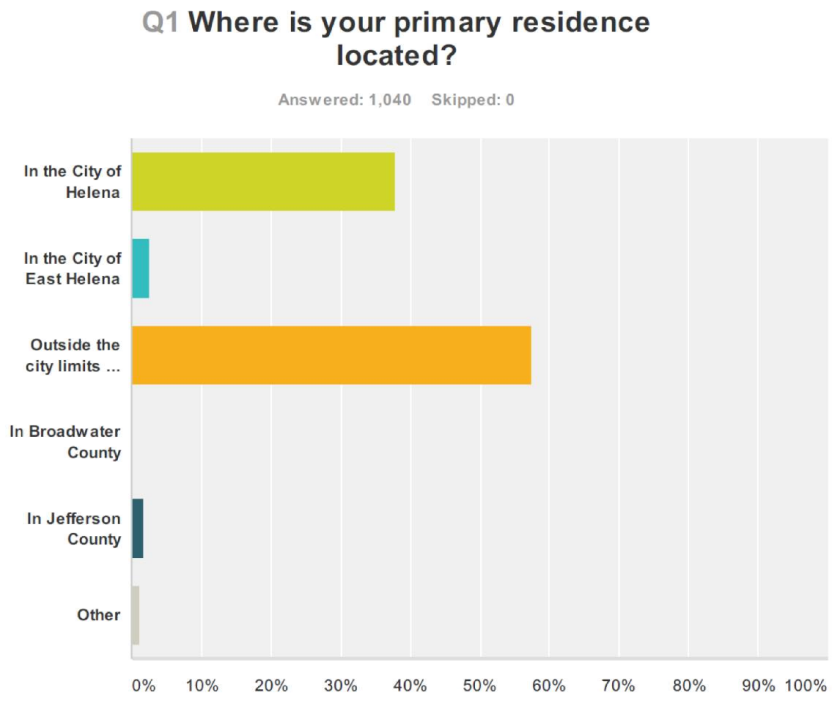
Different size tarps could be used to effectively cover the recommended cell geometry however we recommend four 40 ft. x 100ft. tarps for simplicity.

Two 40ft. x 100ft. tarps can be wrapped around one spool.

It is general practice to buy 1-2 additional tarps for special circumstances.

Appendix F – Survey Summary

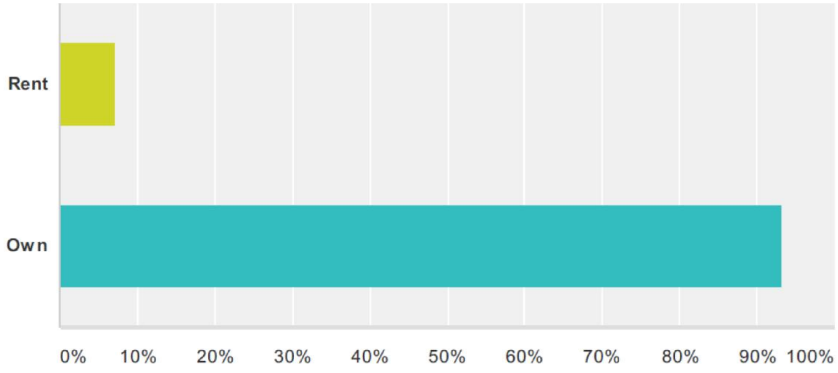
A survey was given to all permit holders. Out of 24,787 permit holders, 1,040 responded for a response rate of 4.2%



Answer Choices	Responses	
In the City of Helena	37.88%	394
In the City of East Helena	2.60%	27
Outside the city limits but within Lewis and Clark County	57.40%	597
In Broadwater County	0.29%	3
In Jefferson County	1.63%	17
Other	0.96%	10
Total Respondents: 1,040		

Q2 Do you rent or own your home?

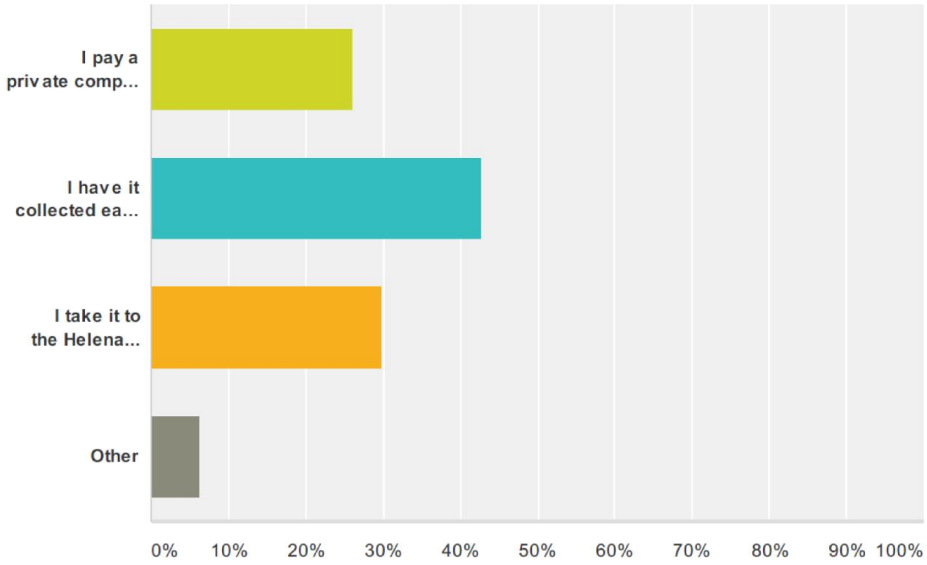
Answered: 1,032 Skipped: 8



Answer Choices	Responses	
Rent	7.17%	74
Own	93.12%	961
Total Respondents: 1,032		

Q3 How do you most often dispose of your garbage?

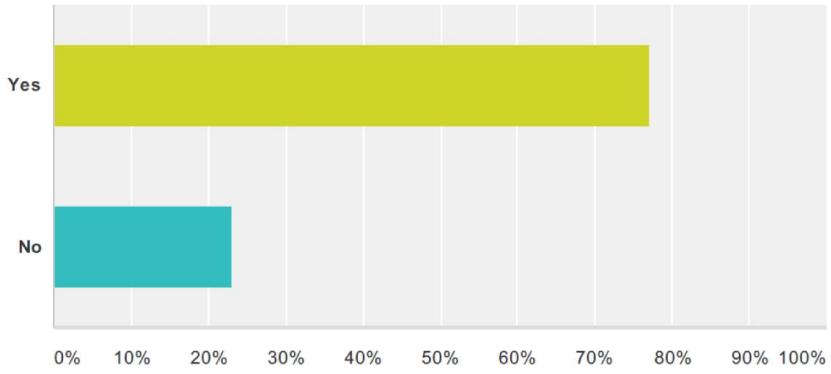
Answered: 1,021 Skipped: 19



Answer Choices	Responses	
I pay a private company to haul it away.	26.15%	267
I have it collected each week by the City Solid Waste Division.	42.80%	437
I take it to the Helena Transfer Station.	29.87%	305
Other	6.27%	64
Total Respondents: 1,021		

Q4 Are you satisfied with your garbage disposal options?

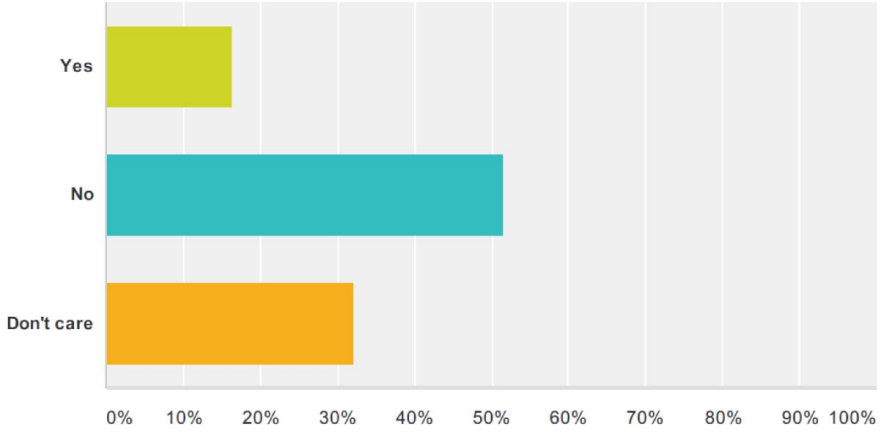
Answered: 1,015 Skipped: 25



Answer Choices	Responses	
Yes	76.95%	781
No	23.05%	234
Total		1,015

Q5 Would you like to be able to haul your garbage directly to the Lewis and Clark Landfill at 4075 Deal Lane in the East Helena Valley?

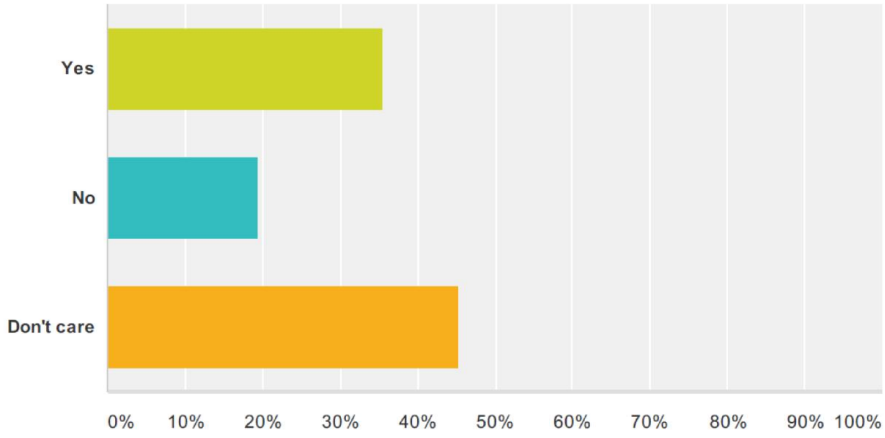
Answered: 1,014 Skipped: 26



Answer Choices	Responses	
Yes	16.37%	166
No	51.48%	522
Don't care	32.15%	326
Total		1,014

Q7 Would you like to be able to pay your garbage disposal bill online?

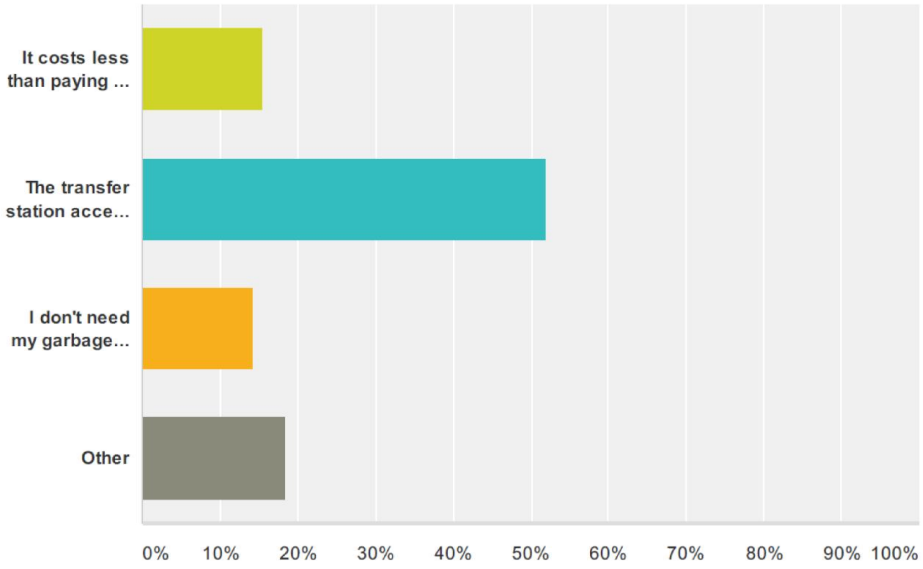
Answered: 1,000 Skipped: 40



Answer Choices	Responses	
Yes	35.40%	354
No	19.40%	194
Don't care	45.20%	452
Total		1,000

Q8 If you take your garbage to the Helena Transfer Station, what is your primary reason?

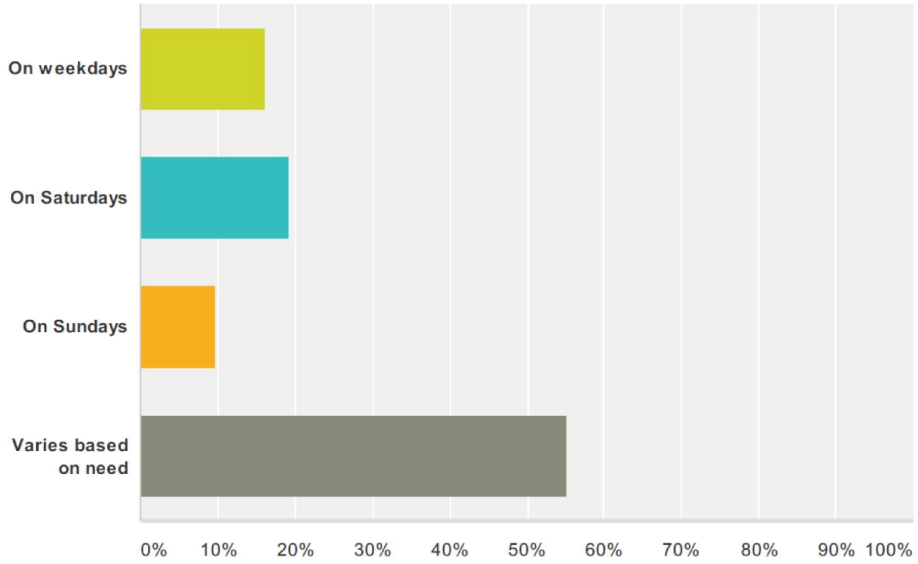
Answered: 716 Skipped: 324



Answer Choices	Responses	
It costs less than paying for garbage collection.	15.50%	111
The transfer station accepts types of garbage that are not collected curbside.	51.96%	372
I don't need my garbage picked up every week.	14.11%	101
Other	18.44%	132
Total		716

Q9 If you take your garbage to the Helena Transfer Station, when do you usually go?

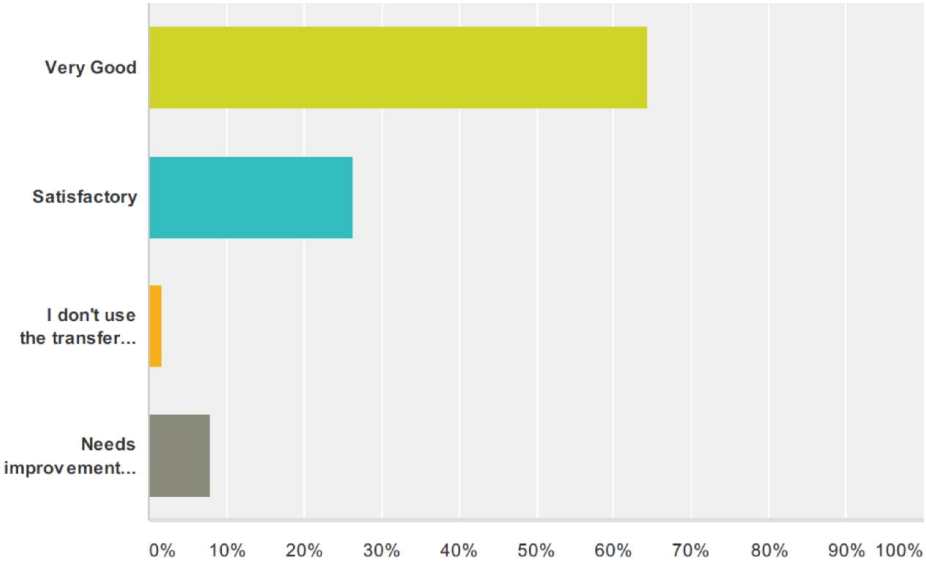
Answered: 732 Skipped: 308



Answer Choices	Responses	
On weekdays	16.12%	118
On Saturdays	19.26%	141
On Sundays	9.56%	70
Varies based on need	55.05%	403
Total		732

Q10 How would you describe your experiences with the Helena Transfer Station?

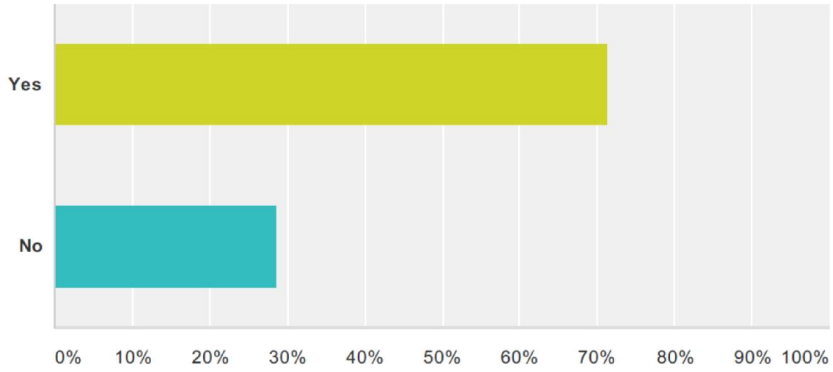
Answered: 763 Skipped: 277



Answer Choices	Responses	
Very Good	64.22%	490
Satisfactory	26.21%	200
I don't use the transfer station	1.57%	12
Needs improvement (please specify)	7.99%	61
Total		763

Q11 The Helena Transfer Station is currently open 7 days a week. Do you believe it needs to be open on Sundays?

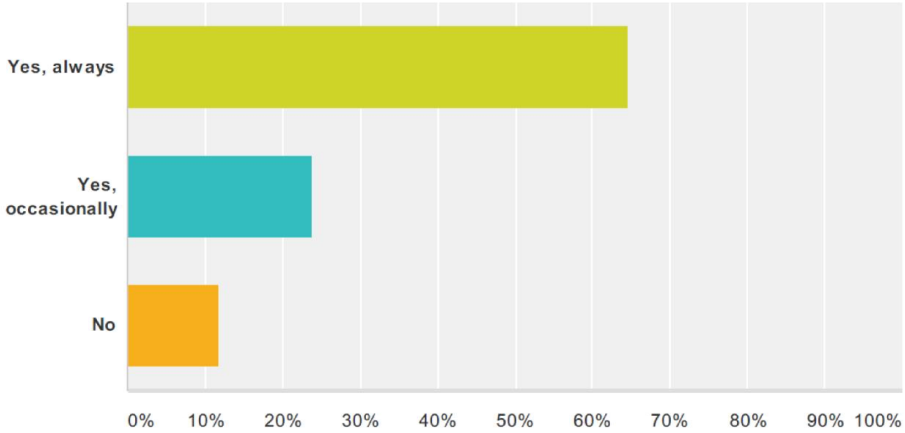
Answered: 761 Skipped: 279



Answer Choices	Responses	
Yes	71.35%	543
No	28.65%	218
Total		761

Q12 Does your household recycle?

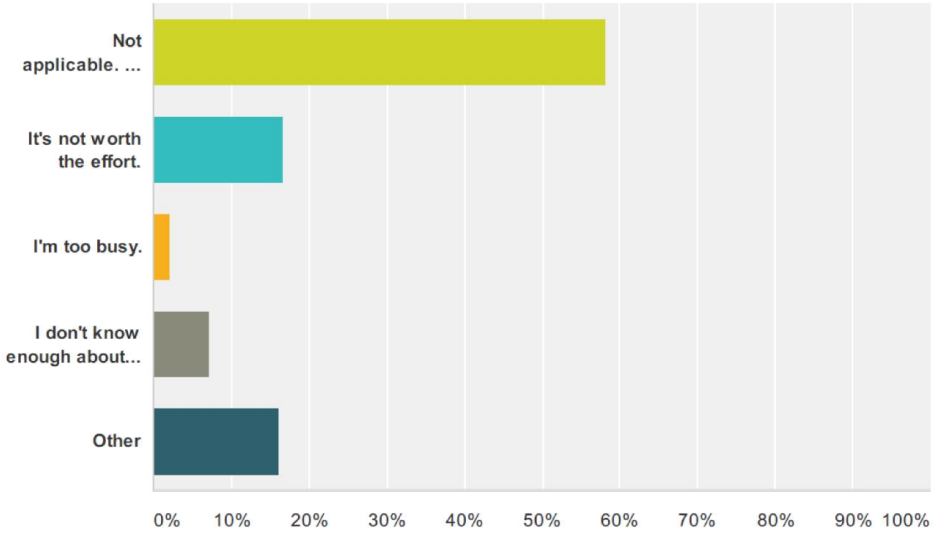
Answered: 1,007 Skipped: 33



Answer Choices	Responses	
Yes, always	64.55%	650
Yes, occasionally	23.73%	239
No	11.72%	118
Total		1,007

Q13 If your household doesn't recycle, why not? (Check all that apply.)

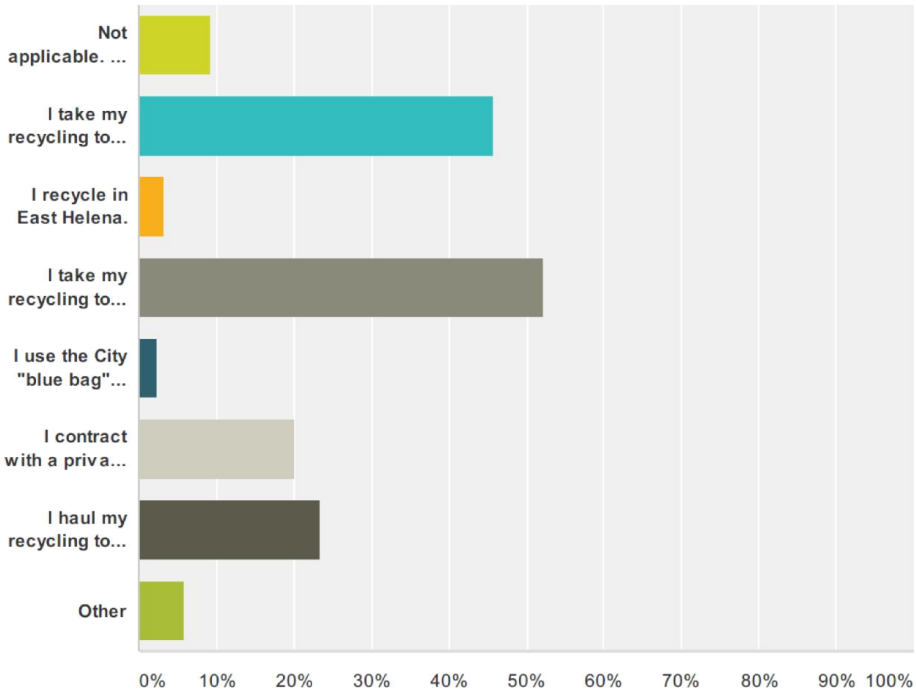
Answered: 600 Skipped: 440



Answer Choices	Responses	
Not applicable. I do recycle.	58.17%	349
It's not worth the effort.	16.67%	100
I'm too busy.	2.00%	12
I don't know enough about recycling.	7.00%	42
Other	16.17%	97
Total		600

Q14 If your household does recycle, how do you most often do so? (Check all that apply.)

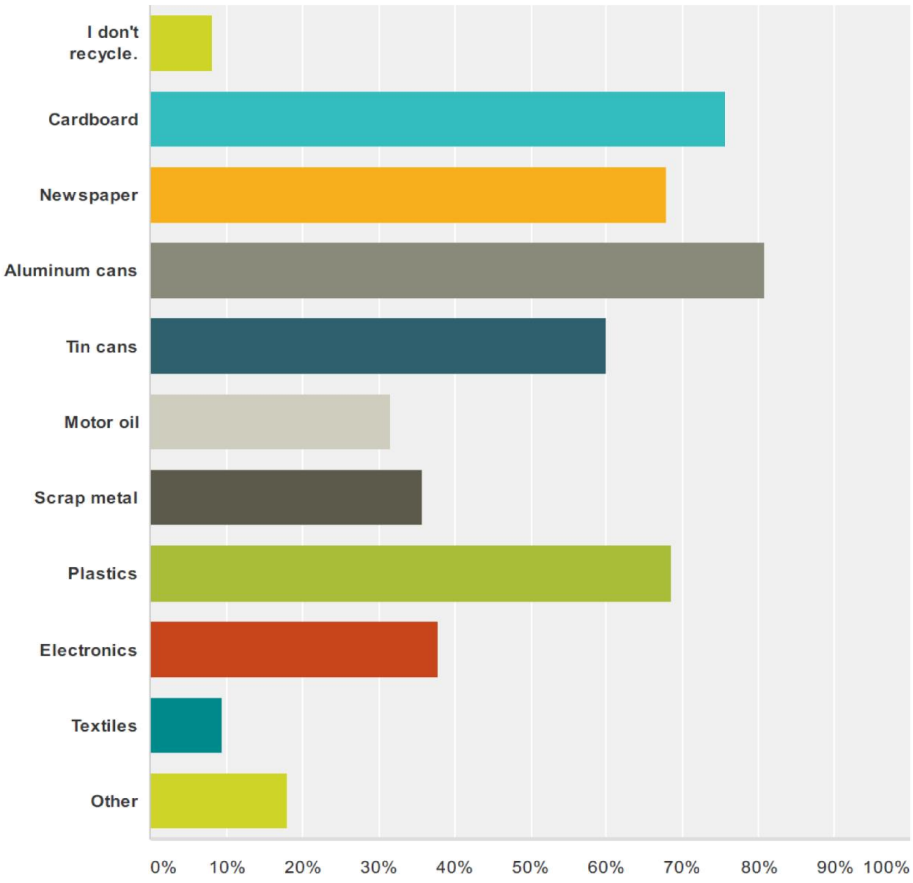
Answered: 978 Skipped: 62



Answer Choices	Responses	
Not applicable. I do not recycle.	9.20%	90
I take my recycling to drop-off sites in the City of Helena.	45.71%	447
I recycle in East Helena.	3.07%	30
I take my recycling to the Helena Transfer Station.	52.25%	511
I use the City "blue bag" system.	2.35%	23
I contract with a private recycling firm.	19.94%	195
I haul my recycling to Pacific Steel and Recycling.	23.31%	228
Other	5.83%	57
Total Respondents: 978		

Q15 What materials does your household recycle? (Check all that apply.)

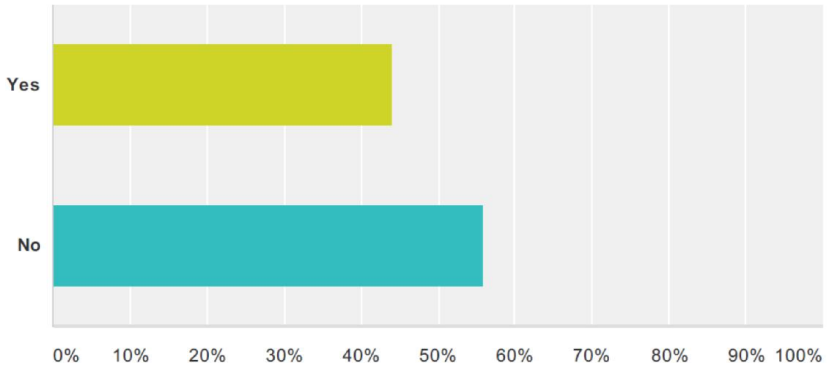
Answered: 985 Skipped: 55



Answer Choices	Responses	
I don't recycle.	8.12%	80
Cardboard	75.53%	744
Newspaper	67.92%	669
Aluminum cans	80.71%	795
Tin cans	59.90%	590
Motor oil	31.57%	311
Scrap metal	35.74%	352
Plastics	68.43%	674
Electronics	37.77%	372
Textiles	9.34%	92
Other	17.87%	176
Total Respondents: 985		

Q16 Are you satisfied with recycling options in Helena and Lewis and Clark County?

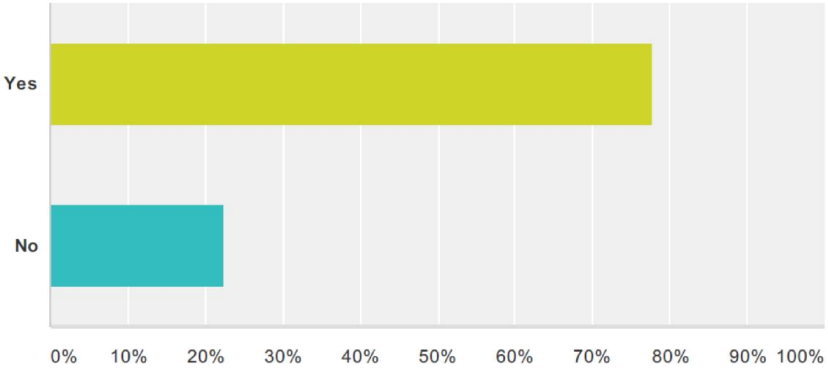
Answered: 983 Skipped: 57



Answer Choices	Responses	
Yes	44.15%	434
No	55.85%	549
Total		983

Q17 Do you believe materials should be recycled even if it costs more to recycle than it does to dispose of the material in an environmentally safe landfill?

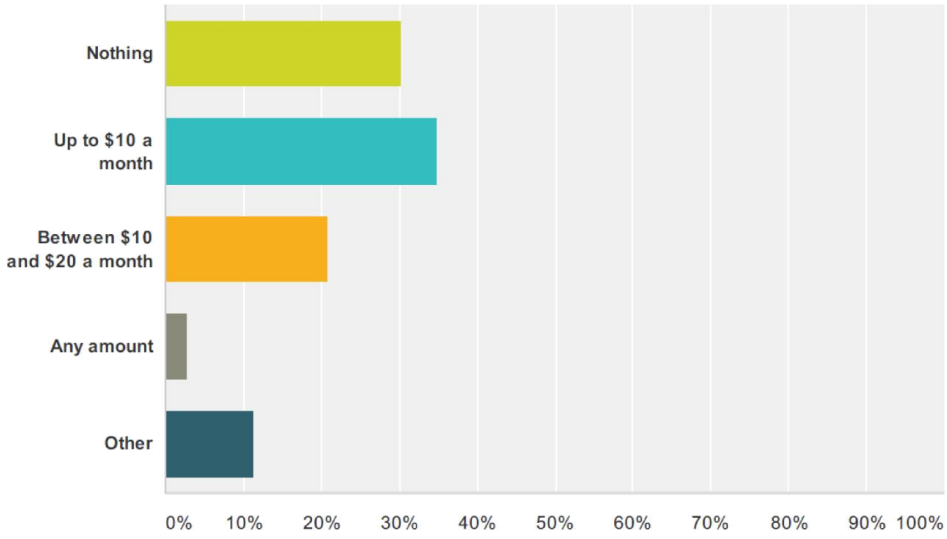
Answered: 977 Skipped: 63



Answer Choices	Responses	
Yes	77.69%	759
No	22.31%	218
Total		977

Q18 How much are you willing to pay to be able to recycle?

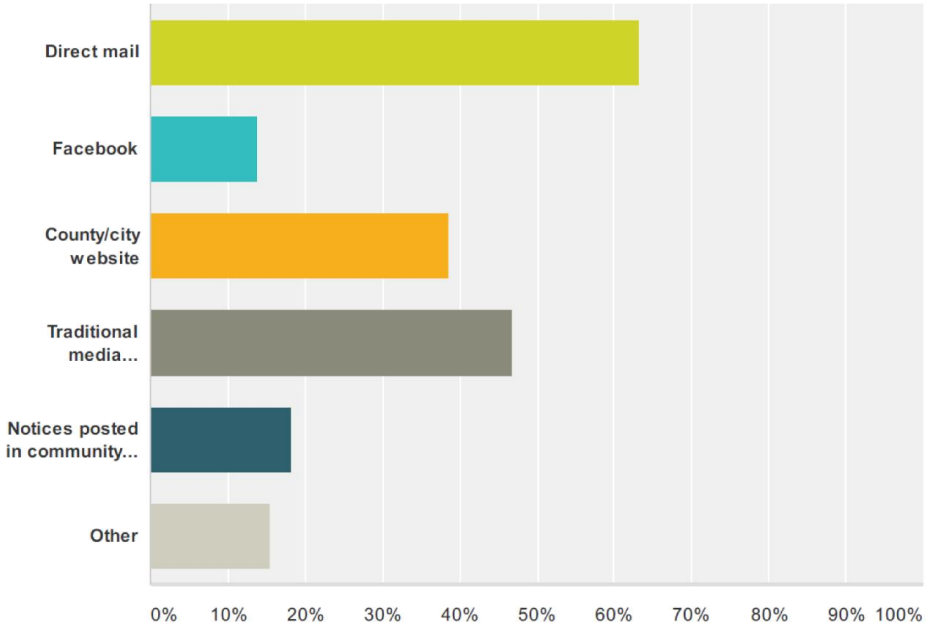
Answered: 991 Skipped: 49



Answer Choices	Responses	
Nothing	30.37%	301
Up to $10 a month	34.81%	345
Between $10 and $20 a month	20.79%	206
Any amount	2.72%	27
Other	11.30%	112
Total		**991**

Q19 How would you prefer to receive information about garbage disposal and recycling programs from the City of Helena and Lewis and Clark County? (Check all that apply.)

Answered: 988 Skipped: 52



Answer Choices	Responses	
Direct mail	63.16%	624
Facebook	13.77%	136
County/city website	38.66%	382
Traditional media (newspaper, radio, TV)	46.76%	462
Notices posted in community gathering places (grocery stores, libraries, etc.)	18.22%	180
Other	15.38%	152
Total Respondents: 988		

Appendix G – Implementation Plan

Recommendations: Implementation Plan					
	Overall System	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
M1	Merge City and County solid waste services into a single entity	X			
M2	Implement a Household Hazardous Waste Collections Program	x			
M3	Combine shop operations	X			
	Landfill	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
L1	Reduce compactor hours.		X		
L2	Eliminate compost operations or charge a tipping fee.		X		
L3	Do not purchase new compactor.		X		
L4	Extend duration of tarp placement.		X		
L5	Eliminate (if eliminate compost) or share wheel loader.		X		
L6	Eliminate weekend operations.		X		
L7	Modify litter control system.		X		
L8	Determine marginal or fixed costs for setting tipping fees.		X		
L9	Use airspace as a resource - actively seek out-of-county waste.	X			
L10	Either combine shop operations with Transfer Station or eliminate position.	X			
L11	Charge a tipping fee for tire recycling.		X		
	Transfer Station	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
T1	Consolidate loads and direct haul to Landfill.		X		
	* Implement in stages, start with larger commercial trucks.				
	** Evaluate in stages, by route, type of account, truck.				
T2	Implement minimum charge ($7.00 per visit recommended.)	X			
T3	Add convenience site using front loader bins for 3 bags or less.		X		
T4	Re-direct large trucks and trailers to Landfill.		X		
T5	Relocate loader garage.		X		
T6	Green waste management - increase tipping area to make more room for customers.		X		
T7	Construction & demolition loads hauled directly Landfill.		X		
T8	Eliminate 7 days per week operations (close Wed. & Thurs.)	X			
T9	Have large loads of green waste hauled directly to the Landfill.		X		

T10	Install remote camera in waste green waste area.		X		
T11	If additional unloading space is needed, open additional slots on north side for packer trucks.		X		
T12	Reduce loader hours.		X		
	Scratch Gravel Solid Waste District	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
SG1	Have the City pick-up the waste from Marysville (note: would require PSC authority.)		X		
	Commercial Collections	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
CC1	Eliminate 2 trucks working short days. Instead use 1 truck, 5 days/week.		X		
CC2	Conduct review of commercial areas. Some may not be paying for services.		X		
CC3	Allow City SW Manger to bid on commercial accounts on cost of service basis.	X			
CC4	Eliminate Sunday route, collect on Monday.		X		
CC5	Assign drivers and trucks to the same route every day.		X		
CC6	Assign a route number to each commercial account.		X		
CC7	Determine the size of each route and the productivity of the driver.		X		
	Residential Collections	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
RC1	Eliminate Saturday and Sunday collections.		X		
RC2	Rework routes to assure that each truck is efficient.		X		
RC3	Direct haul waste to the Landfill.		X		
RC4	Use larger capacity 3-axel 32 CY trucks to increase efficiency (Only use smaller 2-axel trucks on hill routes.)		X		
RC5	Determine the size of each route and the productivity of the driver.		X		
RC6	Conduct a can capacity audit - assess can placement and usage.		X		
RC7	Once route numbers are assigned to each can, generate a RAMS-pro report detailing the number of stops and the volume collected by route. This will provide a baseline for route productivity improvements.		X		
RC8	Engage Alpine Technology (Rams Pro) to conduct a system utilization audit to identify areas were users may not be taking full advantage of their system.		X		

	Recycling	**Policy Change**	**Operational Change**	**Implemented**	**Notes**
R1	Independent funding and budget for recycling.	X			
R2	Expand drop-off recycling effort.		X		
R3	Eliminate blue bag recycling program because of lack of commitment and expense.	X			
R4	Eliminate separated plastic recycling.	X			
R5	Seek a public/private subscription based recycling system through a Statement of Qualification or RFP arrangement.	X			
R6	A detailed look at how the space at the Transfer Station can be utilized to provide more cost-effective support for recycling. This may include installation of a baler, construction of covered space for sorting, baling and storing recyclables. He ultimate goal would be to find cost-effect ways to increase recycling by consolidating certain types of recyclables and shipping them directly to market rather than working through a middle-man.		X		