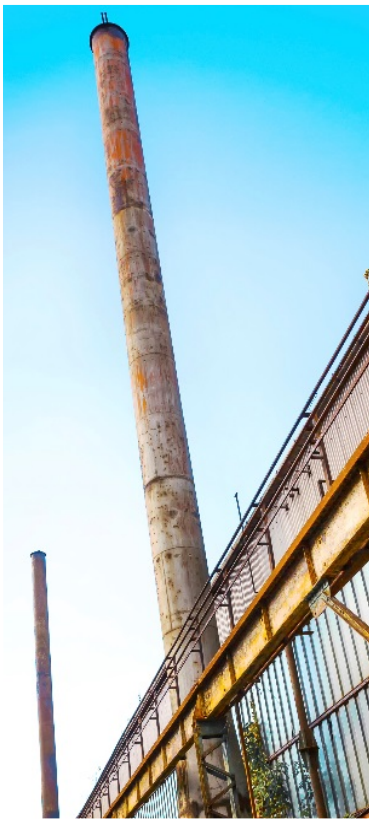
Regional Solid Waste Management Plan

Town of Okotoks

Attn: Paul Lyons, Okotoks

Date: January 8, 2019



Executive Summary

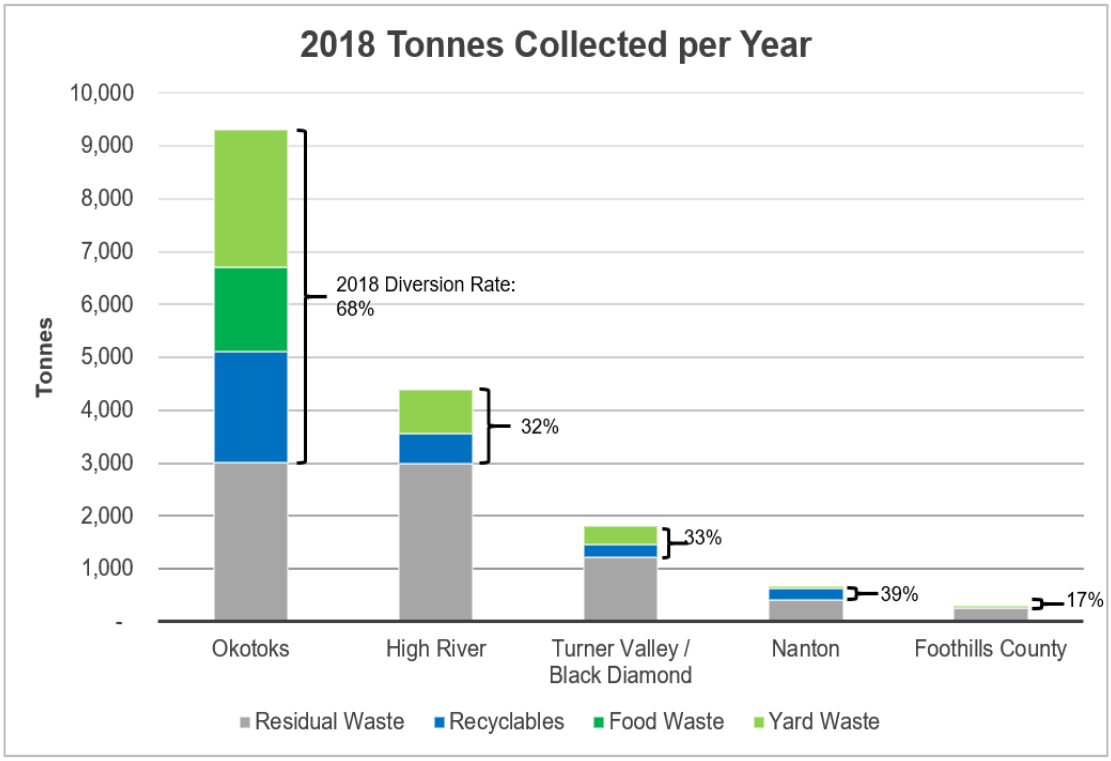
GHD Limited (GHD) was retained by the Towns of Okotoks, High River, Turner Valley, Black Diamond and Nanton and Foothills County (the Region or Partners) to develop a Regional Solid Waste Management Plan (RSWMP). The need for a regional plan was identified by the Town of Okotoks as a key step in improving local services and maximizing the life and value of the Foothills Regional Landfill and Resource Recovery Centre (LRRC), which is a resource shared by all members of the FRSC.

The primary drivers of the RSWMP was a desire to find opportunities for:

- Increased efficiency and associated cost savings
- Increasing the diversion rate for municipally-managed residential waste
- Optimize the useful life of the landfill

Each of the members of the Region provides curbside garbage collection service. The Towns of Okotoks and Nanton also provide curbside collection of recycling and the Town of Okotoks additionally provides curbside collection of organics. There are four recycling drop-off centres operated by Turner Valley/Black Diamond, High River, Okotoks, and Nanton. Residents can also drop off yard waste at some recycling centers or directly at the LRRC. Households in High River, Turner Valley and Black Diamond have the option of subscribing to private curbside recycling programs for a premium rate.

The current collection of municipally-managed waste is illustrated in the Figure below. The regional diversion rate for municipally-managed waste (i.e. excluding commercial, multi-family sources and the households in Foothills County not enrolled in curbside collection) is estimated to be 52 percent. The regional diversion rate is driven by the high diversion rate in the Town of Okotoks.



Waste generated in multi-family dwellings, commercial enterprises, and construction and demolition projects is collected by private haulers. The municipalities have less direct control over this waste.

The RSWMP assesses the current state of waste management in the Region as well as a number of options for regional collection and waste processing, culminating in 13 recommendations to improve the current solid waste management system, a 5-year plan for implementation, and a longer term outlook for waste management planning in the Region. The recommendations and implementation plan are the results of detailed assessment of current level of service, costs, and collection quantities as well as modelled projections of waste generation and collection under various level of service options. The appendices of the RSWMP describe the detailed assessments that were undertaken, while the main report itself summarizes the results and focuses in on the 13 recommendations and implementation plan.

The recommendations are summarized below, with full discussion of each provided in the body of the RSWMP and appendices:

Regionalized Collection

1. Regionalize curbside residual waste collection, utilizing existing assets and resources.
2. Implement regionalized curbside organic waste collection, contracting out the collection service.
3. Maintain existing recycling centre operations, align and optimize existing recycling drop-off facilities.

Regional Processing

4. Investigate potential partnerships to support the development of a regional organics processing facility.

Tools to Increase Public Participation and Diversion

5. Develop and implement a regional communication strategy.
6. Implement pay as you throw policies based on black residual waste cart size.
7. Implement and enforce material bans for curbside collected carts.
8. Review and update internal procurement policies and practices
9. Complete waste audits across the region every 3-5 years.

Landfill Management

10. Limit the amount of non-MSW accepted at the LRRC until landfill lifecycle analysis is completed and long-term tipping fee structure is developed that maximizes landfill value.
11. Require any new proposed services or operations at the LRRC to undergo a social, environmental and economic assessment prior to implementation.

Governance & Implementation

12. Regionalize the ownership of collection assets and services under the Region and hire qualified staff to manage the service.
13. Determine which Partners will cooperate in a regional waste management system and develop a detailed Implementation Plan.

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Glossary

Anaerobic Digestion	A method of processing organic waste in the absence of oxygen. This method produces biogas, which can be captured and utilized to generate electricity, heat, or renewable natural gas.
Compost	The stable product of composting. Compost, also called humus, is a soil conditioner and in some instances is used as a fertilizer.
Composting	The biological decomposition of organic materials by bacteria, fungi, and other organisms into a soil-like product. The waste must be exposed to air, either via turning or by forcing air through pipes that pass through the material.
Compostable	Material that can be successfully decomposed by composting, typically plant and animal matter such as food waste and yard waste.
Construction & Demolition Waste	Waste generated by construction, renovation and demolition of buildings, such as bricks, concrete, drywall, lumber, miscellaneous metal parts and sheets, packaging materials, etc.
Contaminated Soil	Soil that is contaminated with gasoline, kerosene, jet fuel, diesel fuel, or any combination of them, or soil that is contaminated with metals or other deleterious substances.
Diversion	The process of directing waste materials to processes such as recycling or organics processing instead of being landfilled.
Diversion Rate	The proportion of waste material diverted for recycling, organics processing, or reuse, and away from landfilling.
Generation	The total quantity of materials discarded that require management as solid waste, including garbage, recycling, food waste and yard waste.
Household Hazardous Waste	Products used in residences, such as paints and some cleaning compounds that are toxic to living organisms and/or the environment.
Inert Waste	Solid waste that, when disposed of in a landfill, is not expected to produce substances that may cause an adverse effect. Inert waste includes demolition debris, concrete, asphalt, glass, ceramic materials, scrap metal and dry timber or wood that has not been chemically treated.
Landfill	A waste management facility at which waste is disposed of by burying it.

Material Recovery Facility	A facility for separating commingled recyclables by manual or mechanical means. Separated recyclables are baled and marketed.
Municipal Solid Waste	Recyclable and compostable materials, as well as garbage from homes, businesses, institutions, and construction and demolition sites.
Organic Waste/Organics	Kitchen scraps, food waste, leaf and yard waste.
Organics Processing Facility	A facility that processes organic waste into useful end-products. This is primarily separated into two main technology types: composting, which produces compost, and anaerobic digestion, which produces biogas.
Recyclable	Items that can be processed into feedstock for new products. Common examples are paper, glass, aluminum, corrugated cardboard, and plastic containers.
Tonnes	Metric tonnes.
Waste Management Facility	A facility for the collection, storage, treatment or disposal of waste.
Waste Management Hierarchy	A model of waste management pathways according to their environmental benefits. Also referred to as the 5Rs. The waste management hierarchy gives priority to practices that minimize environmental impacts. The steps in the waste management hierarchy are (in order from most to least preferred): reduce, reuse, recycle, recover, residuals management.

Acronyms

AD	Anaerobic digestion
C&D waste	Waste materials generated at construction, renovation and demolition projects
CO_2	Carbon dioxide
EPR	Extended Producer Responsibility
FRSC	Foothills Regional Services Commission
GHG	Greenhouse gas
HH	Household
HHW	Household hazardous waste
ICI	Industrial, commercial and institutional (does not include heavy industry
kg	Kilogram
LRRC	Foothills Regional Landfill and Resource Recovery Centre
L&YW	Leaf and yard waste
MRF	Material recovery facility
MSW	Municipal solid waste
OCC	Old corrugated cardboard
OPF	Organics Processing Facility
PAYT	Pay-as-you-throw
RSWMP	Solid Waste Management Plan
SSO	Source-separated organics (kitchen scraps, food waste)
TAG	Technical Advisory Group

1. Introduction

This Regional Solid Waste Management Plan (RSWMP) is the product of an initiative by the Towns of Okotoks, Black Diamond, High River, Nanton, and Turner Valley, and Foothills County (together, the Region or Partners). These Partners are members of the Foothills Regional Services Commission (FRSC), and jointly own the Foothills Regional Landfill and Resource Recovery Centre (LRRC). The need for a regional plan was identified by the Town of Okotoks as a key step in maximizing the life and shared value of the LRRC.

The development of the RSWMP began in early 2019, and involved regular meetings with a Technical Advisory Group (TAG) comprised of staff from each of Partners. The TAG was asked to provide input data, review preliminary analysis, contribute to the development of a set of shared regional objectives, and comment on options for regionalization. Input from the TAG informed the development of the draft RSWMP.

1.1 Drivers

The primary driver of the RSWMP was a desire to find opportunities for:

- Increased efficiency and associated cost savings
- Increasing the diversion rate for municipally-managed residential waste
- Responsible landfill stewardship

At this time, the Town of Okotoks is the only member of the Region to use the waste management hierarchy (Figure 1.1) to guide its waste management planning and decisions. The waste management hierarchy was presented to the other members of the Region for consideration.

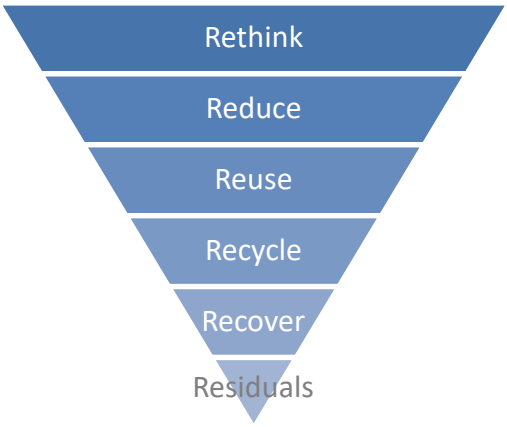

Figure 1.1 Waste Management Hierarchy

This RSWMP recognizes that the cost and effort of diverting waste from the landfill now will result in future benefits.

The RSWMP focuses on waste that is directly controlled by the Towns and County (i.e. waste generated by the single family residential sector and a small number of multi-family dwellings) and the actions that local governments can take to improve efficiency and diversion. Additional policy recommendations are included that address waste collected by private haulers (i.e. waste generated by multi-family dwellings and the commercial sector) and other wastes that are received at the LRRC (i.e. contaminated soil and other non-MSW materials).

1.2 Vision

The following vision was agreed on by members of the TAG:

> *The Region will provide a high level of waste management service at a reasonable cost that supports regional environmental objectives and the long-term sustainability of the system.*

This vision has not been formally adopted by the Region.

2. Background and Existing Solid Waste Management Systems

2.1 Plan Area

The area covered by the RSWMP is shown in Figure 2.1. Foothills County surrounds the Towns of Black Diamond, High River, Okotoks and Turner Valley, and shares a border with the City of Calgary. The Town of Nanton is located south of Foothills County. The local governments cover a combined area of approximately 3,600 km^2.

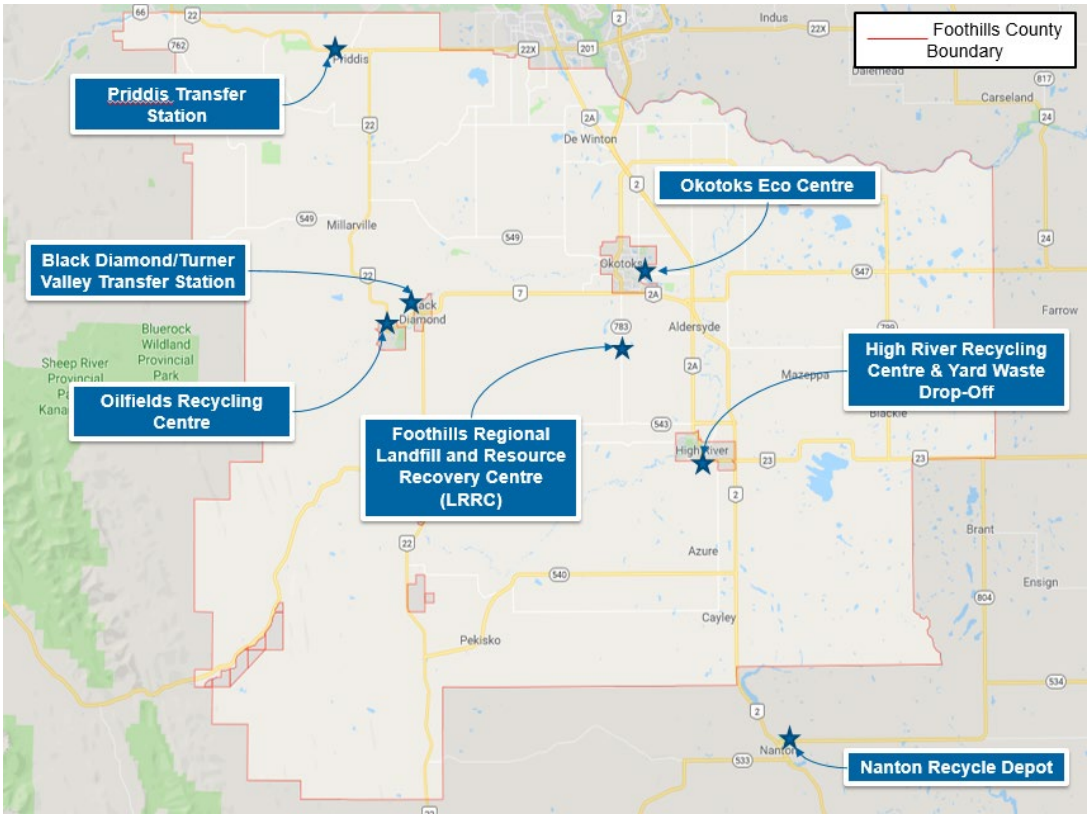

Figure 2.1 Location and Extent of Study Area and Key Municipal Facilities

2.2 Population

The total population in 2017 was approximately 73,000 people. Nanton, Turner Valley and Black Diamond each have populations in the range of 2-3,000, High River has a population of nearly 15,000, Foothills County has a population of nearly 23,000, and Okotoks is approaching a population of 30,000 (representing 40 percent of the population). Foothills County includes some more densely populated areas such as the hamlets of Aldersyde, Blackie, Cayley and Priddis, as well as extensive areas with a low population density. Populations of each local government are provided in Table 2.1, with a calculated average annual growth rate from 2011 to 2016.

The distribution of the population influences the structure of the municipal solid waste (MSW) management system in the study area. Levels of service vary significantly between local governments, with the highest level of service provided in the Town of Okotoks and the least service provided to residents of the rural areas of Foothills County. The study area can be described as having three distinct waste sheds: the Towns of Okotoks and High River with their larger populations, higher levels of economic activity and resulting higher rates of waste generation; the smaller towns and hamlets, with their relatively dense populations and moderate economic activity, and the rest of the area with a rural population, less economic activity and consequently lower rate of garbage generation.

Table 2.1 Population

Partner	2011	2016	Average Annual Growth Rate 2011 to 2016 [1]
Nanton	1,977	1,965	-0.12%
Turner Valley	2,167	2,249	0.75%
Black Diamond	2,274	2,552	2.33%
High River	12,920	13,420	0.76%
Foothills County	21,248	21,258	0.01%
Okotoks	24,470	28,833	3.34%
TOTAL	**64,422**	**72,620**	**2.53%**

Notes:

1 2011 and 2016 population data is from Statistics Canada Census data

The rate of growth has slowed in recent years, and past growth rates are not expected to continue in the near future. In addition, a large fraction of the growth in Okotoks has occurred in multi-family dwellings that are not serviced by the Town.

2.3 Waste Generation

The composition of the waste generated by residents of single family dwellings is an important factor when estimating the potential impact of new collection programs and policies. GHD used waste composition data from the single-family residential sector in the Town of Okotoks to estimate the residential waste composition across all of the Partners. The composition of waste generated in Okotoks was determined by combining data from the three stream curbside collection program, the Eco Centre, yard waste delivered to the LRRC, and residual waste (garbage) self-hauled to the LRRC. The results of the Waste Composition Study for the Town of Okotoks (Tetra Tech, 2018) also contributed to GHD's understanding of contamination levels in the curbside residual waste and recycling streams. As there is no available data on the proportion of food waste and yard waste collected in the curbside organics program, GHD applied the average food waste capture rate from three organic waste collection programs that collect food-waste only (BC Government, 2012a, 2012b, 2012c) to estimate the portion of green cart material that is attributable to food waste, and assumed the remainder of the material collected in Okotoks' green cart program is yard waste.

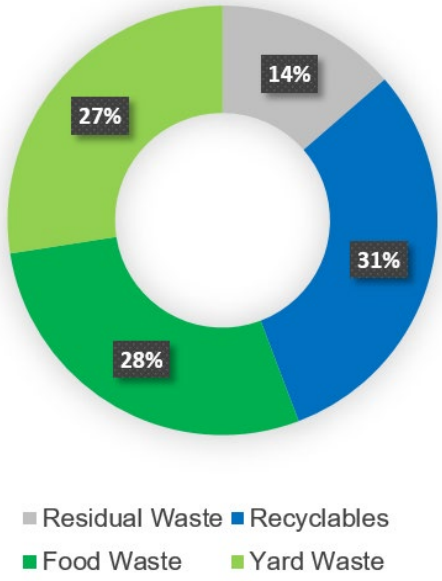

Figure 2.2 Composition of Residential Waste Generated in the FRSC

The resulting waste generation composition is shown in Figure 2.2. Note that the waste composition indicates a maximum diversion potential of 86 percent. Typical high-performing diversion systems may capture approximately 75-80 percent of the divertible material; if this capture rate was achieved, the Partners could realize a diversion rate of nearly 70 percent. The waste composition is used throughout the assessment of the existing solid waste management systems.

2.4 Existing Solid Waste Management Systems and Assets

A preliminary step in developing the RSWMP involved reviewing and analyzing baseline data. Data was requested from the member municipalities; where requested data was not provided, GHD generated estimates using available data. Data for each member municipality is presented individually and summarized in a regional overview.

The existing waste management systems in the Region are summarized below, in the order of the waste management hierarchy.

2.4.1 Rethink, Reduce and Reuse

The Town of Okotoks offers education programs that address topics related to waste reduction. Field trip opportunities and in-school educational presentations are available. The Town also hosts waste reduction events such as repair cafes and clothing exchanges.

2.4.2 Recycle

Recycling programs in Region include both traditional blue box recyclable materials (i.e. plastics, metals, papers, etc.), organic waste (food and yard waste) and other recyclables such as paint, tires, electronics and household hazardous waste. The following sections describe the services provided and quantities diverted.

2.4.2.1 Blue Box and Other Recyclables

Recyclables can be collected directly from residents and/or at recycling centres (depots). Curbside collection services typically capture a larger fraction of the recyclables in the waste stream than depots, because the collection service is more convenient for residents. All residents of the Partners have access to recycling depots that accept paper and packaging materials, as well as a variety of materials covered by the Alberta Recycling Management Authority (ARMA)[1]. Residents of Nanton and Okotoks are also provided with curbside collection of paper and packaging materials. The curbside collection is provided by a private operator hired by each town. Residents of High River, Turner Valley, and Black Diamond have private options for curbside recycling collection available to them. In High River, approximately 450 households are subscribed to a private service.

Across the Partners, residents who receive municipal collection service generated approximately 7,100 tonnes of recyclable material in 2018[2]. Of the total generated, only 3,150 tonnes (44 percent) was collected as recycling; the remainder was collected with residual waste and landfilled. Figure 2.3 illustrates how the total quantity generated was managed. 1,500 tonnes were collected by the recycling centres in Turner Valley, Okotoks, Nanton and High River, 1,500 tonnes were collected through Okotoks' curbside collection program[3], and 150 tonnes were collected via Nanton's curbside collection program[4].

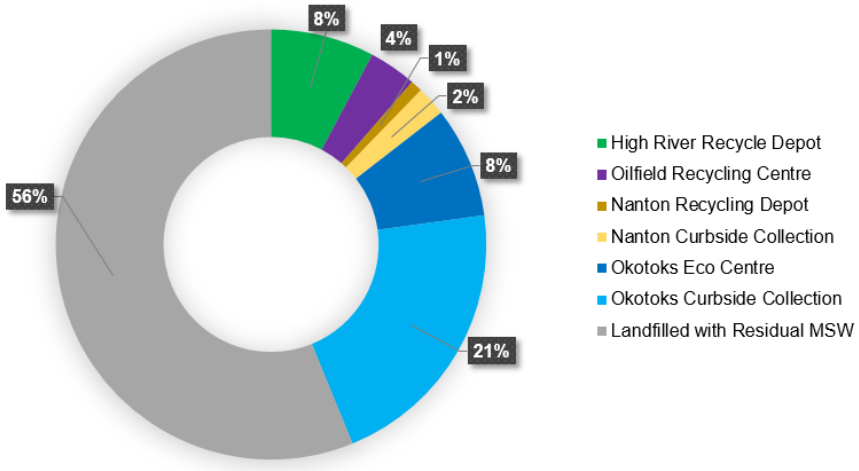

Figure 2.3 Where Generated Recyclables among the Partners Go (2018 Data)

[1] ARMA is a provincial not-for-profit association responsible for managing electronics, paint, tires and used oil.

[2] Excluding multi-family and ICI customers not involved in collection programs, and the large portion of Foothills County's residential population not included in curbside collection.

[3] Non-recyclable quantities collected in the blue carts were derived from the Waste Composition Study for the Town of Okotoks (Tetra Tech, 2018). These amounts were subtracted out of total quantity of recycling collected.

[4] Nanton recycling collection quantities are based on the quantity collected per household in Okotoks, since actual data from Nanton was unavailable.

Table 2.2 below summarizes the recycling services provided to residents in each Partner.

Table 2.2 Summary of Residential Recycling Services

Local Government	Residential Services	Tonnes Collected (2018)
Nanton	• Weekly, automated collection of single stream recycling (contracted service) • Recycling depot open 4 days/week; accessible to residents and businesses	62 – Depot (estimated) 155 – Curbside (estimated)
Turner Valley	• Oilfields Recycling Centre • Open 5 days/week; accessible to residents and businesses • Optional private collection service	255
Black Diamond	• Oilfields Recycling Centre shared with Turner Valley • Optional private collection service	Included above
High River	• High River Recycling & Yard Waste Centre • Open 7 days/week; accessible to residents only (no commercial loads allowed) • Optional private collection service	557
Foothills County	• Financial support to Okotoks Eco Centre, Oilfields Recycling Centre • Recycling at Priddis Transfer Station	Included in others
Okotoks	• Weekly, automated collection of single stream recycling (contracted service) • Optional subscription for MF homes • Okotoks Eco Centre (depot) open 5 days/week; accessible to residents and businesses	622 – Eco Centre 1,703 – Curbside

2.4.2.2 Organic Waste

Organic waste includes two streams: yard waste (grass clippings, weeds, leaves, branches, etc.) and food waste (kitchen scraps). All residents have access to yard waste diversion programs through local recycling depots and/or self-haul to the LRRC. All yard waste collected through the depots is delivered to the LRRC for composting. The composting operation at the LRRC produces Class A Compost that is sold for $25 per tonne.

Residents of Okotoks are also provided with a weekly organics collection service from the fall to spring, which drops to bi-weekly in winter months, which collects both food waste and yard waste. The service is provided by a contractor who is hired by the Town. Organic waste collected through the curbside collection program is processed at a private facility. The Okotoks Eco Centre also accepts yard waste.

Across the Partners, residents who are receive municipal collection service generated approximately 9,200 tonnes of organic waste in 2018. The overall diversion rate for the organic waste stream was nearly 60 percent. Approximately 44 percent of residential food waste and 83 percent of yard waste was diverted from disposal. 3,700 tonnes of organic waste was landfilled. Yard waste data is from the LRRC, while curbside collection data is from the Town of Okotoks.

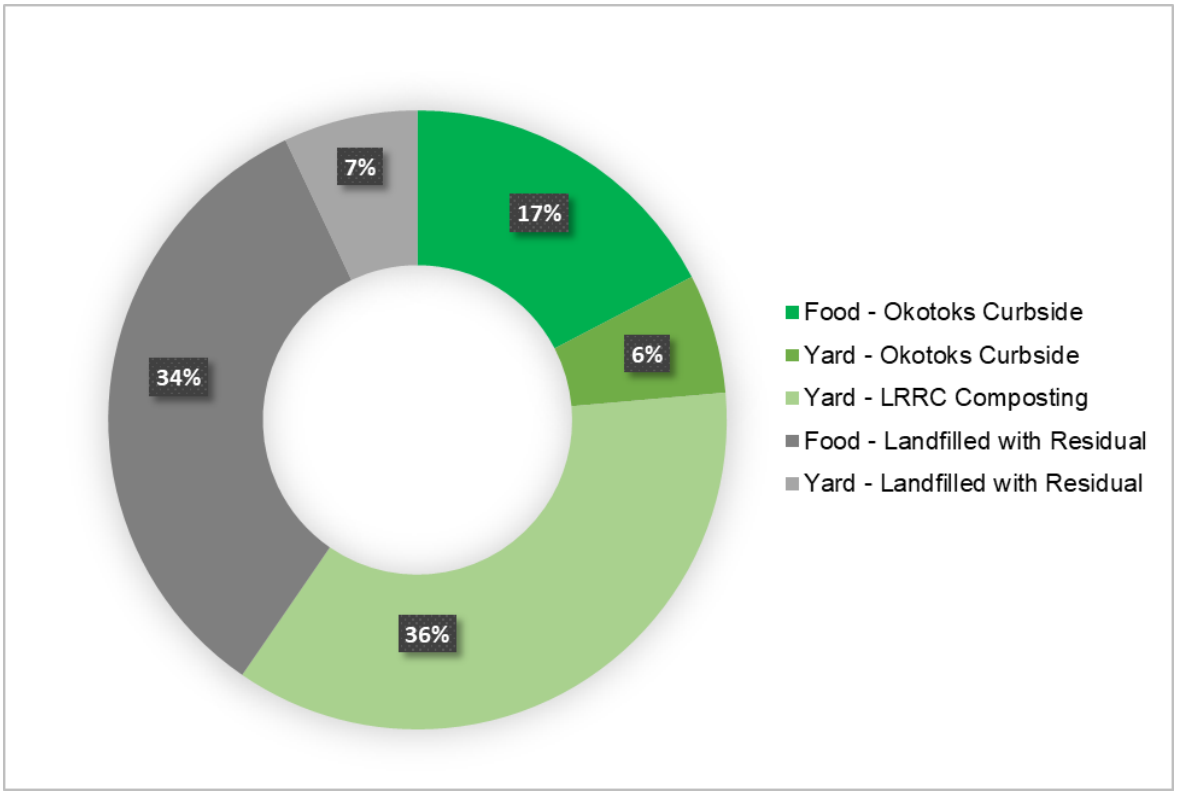

Figure 2.4 Organic Waste Collection in the Region in 2018

Table 2.3 below summarizes the services provided.

Table 2.3 Summary of Residential Organic Waste Services

Local Government	Residential Services	Tonnage Collected and Self-hauled (2018, LRRC and Okotoks data)
Nanton	• Yard waste can be brought to the recycling depot or LRRC	33
Turner Valley	• Yard waste can be brought to the LRRC	69
Black Diamond	• Yard waste can be brought to the LRRC	272
High River	• Yard waste can be brought to the recycling depot or LRRC	843
Foothills County	• Yard waste can be brought to the LRRC	1,200
Okotoks	• Weekly, automated collection of mixed food and yard waste (contracted service) • Seasonal supplementary yard waste collection • Yard waste and food waste can be brought to the Eco Centre • Yard waste can be brought to the LRRC	2,198 (curbside yard and food waste) 2,040 (self-haul yard waste)

2.4.3 Recover

The “Recover” level of the waste management hierarchy includes forms of thermal energy recovery, such as mass burn incineration, and emerging technologies such as gasification. None of the Partners use energy recovery facilities at this time.

2.4.4 Residual

Residual waste management includes collection, transfer and disposal of material that is not (or cannot be) diverted.

2.4.4.1 Curbside Collection and Transfer Stations

Residents of the towns who live in single family dwellings (and some smaller/ground-oriented multi-family dwellings) receive collection services through their local government. Some towns own and operate collection vehicles, and other towns hire a contractor to provide the service. Most residents of Foothills County do not receive curbside collection service, and instead must self-haul their waste to a transfer station or the LRRC or contract privately for waste collection. All residents have the ability to self-haul their waste to the LRRC.

Table 2.4 Residential Garbage Collection Services

Local Government	Residential Services	Tonnage from Municipal Collection Programs	
		2017	2018
Nanton	• Contracted service, 1 day/week • Weekly service • Automated	377	404
Turner Valley	• Vehicle shared with Black Diamond (used 1.25 days/week) • Weekly service	643	601
Black Diamond	• Vehicle shared with Turner Valley (used 2 days/week) • Weekly service	623	608
High River	• One vehicle operated 3 days/week; second vehicle operated 4 days/week • Includes single family and multi-family homes with ground level access • Weekly service	3,058	2,998
Foothills County	• Contracted service, 1 day/week • Contracted service provided to 404 households only, out of nearly 10,000 households • Operates two transfer stations	257 (estimated)	260 (estimated)
Okotoks	• Two vehicles operated 4 days/week • Weekly service • Predominantly single family homes	2,996	3,014

2.4.4.2 Disposal

All residual waste collected by municipal crews or municipal contractors is sent to the LRRC. The LRRC operates under Approval No. 47447-02-00 (Approval) issued by Alberta Environment and Parks (AEP) on August 28, 2014. While the approval does not specify conditions related to the origin of the waste accepted at the LRRC, the 2016 operations plan states that loads originating from outside the Region should be rejected; this is not strictly adhered to. The LRRC is designed for a total airspace of 7,285,350 m^3. According to the LRRC's 2017 Annual Report, 1,148,770 m^3 had been consumed (16 percent) as of the end of 2017, resulting in remaining airspace of 6,136,580 m^3.

In addition to waste from the municipal collection programs, the LRRC accepts waste from commercial haulers, contractors, and residents who self-haul their waste. The landfill records the source and material type of each in-bound load.

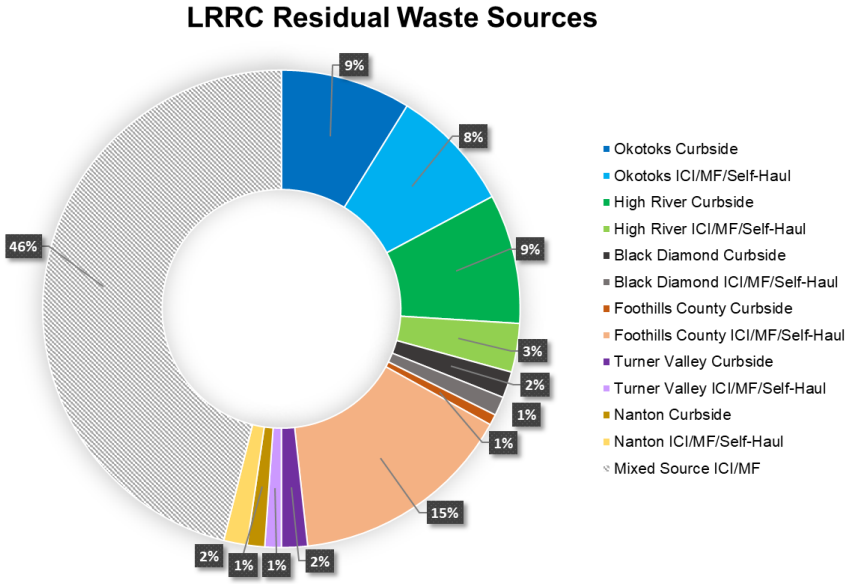

Figure 2.5 Sources of MSW Collected at the LRRC

In 2018, 34,170 tonnes of municipal solid waste (MSW) were received at the LRRC. The LRRC classifies incoming MSW by the source. Material coded as originating in a Partner municipality includes waste collected by municipal programs as well as some multi-family (MF), institutional, commercial and industrial (ICI), and self-hauled waste. Each Partner provided data on the quantity collected through its municipal curbside collection program[5]. This data is presented in Figure 2.5, identified as "Curbside", while the "ICI/MF/Self-Haul" data for each Partner is the difference between the tonnage recorded by the LRRC for each Partner and the "Curbside" data provided by the Partners. The remaining MSW was identified as mixed source ICI/MF by the LRRC, containing load of material from multiple Partners and thus not coded directly to a Partner.

A summary of the MSW received at the LRRC is provided in Table 2.5.

[5] The exception is Foothills County, for which the collected tonnages were estimated based on households included in the program and the average tonnes per household from the Partners with similar services (Turner Valley, Black Diamond, and High River).

Table 2.5 Annual Quantities of Waste Landfilled and Diverted at the LRRC

	2014	2015	2016	2017	2018
	Tonnes	*Tonnes*	*Tonnes*	*Tonnes*	*Tonnes*
MSW from Partners[1]	43,207	30,564	21,594	22,392	18,415
Mixed Source MSW	7,411	13,518	15,927	11,561	15,755
Other landfilled waste (ICI and C&D)[3]	23,849	5,800	4,083	3,972	992
C&D material Diverted[4]	5,868	11,138	2,526	2,594	4,022
Recyclables[5]	330	389	560	4,992	4,926
Compostable material[6]	3,730	4,079	4,212	3,013	3,346
LRRC Diversion Rate	**12%**	**24%**	**15%**	**22%**	**26%**

Notes:

1 *Includes MSW collected from Partner curbside collection programs as well as MF, ICI, and self-hauled material directly from a Partner.*

2 *Determined as total MSW recorded at LRRC minus the MSW from Partners. Includes mixed-source MF and ICI loads, not directly attributable to one Partner.*

3 *Includes material reported as landfilled by the LRRC in the following categories: hard to handle, animal products, mixed C&D, mixed asphalt, mixed flood garbage, special handling, and C&C grind.*

4 *Includes material reported as diverted by the LRRC in the following categories: wood, clean wood, clean drywall, concrete, asphalt, clean shingles, diverted C&D, clean mixed C&D, sandstone, gypsum, asbestos, drill cuttings, and industrial.*

5 *Includes such recyclables as metals, white goods, batteries, salvaged material, tires, ewaste, propane tanks, HHW, among others.*

6 *Includes composted materials such as grass, yard waste, sod, bulk compost.*

The diversion rate at the LRRC more than doubled from 2014 to 2018, primarily as a result of a decrease in the quantity of material landfilled as the impact of the 2013 floods has passed.

2.5 Costs in the Existing Systems

The solid waste management systems are funded by a combination of user fees, revenue from the sale of recyclables, and general revenue (rate stabilization funds, taxes, utility rates, etc.). The sections below provide a summary of system costs per household per month.

2.5.1 Collection, Processing and Disposal Costs

Financial data for 2018 was provided by the Partners. The data was analyzed to produce cost per tonne, cost per capita, and cost per household numbers to identify programs or systems that could be targeted for increased efficiency. Full comparisons of costs are presented in Appendix A, while the key insights are discussed in this section. Note that financial data for Turner Valley and Black Diamond were combined, due to the interrelationships between their programs. Data for recycling systems costs was not available for Nanton, and although costs were available for Foothills County the recycling tonnages are not separated out at the existing recycling depots; therefore there are no recycling costs analyzed for those two Partners. The current system costs per household per month by waste stream are presented in Figure 2.6 below, while detailed cost results are presented in Appendix A.

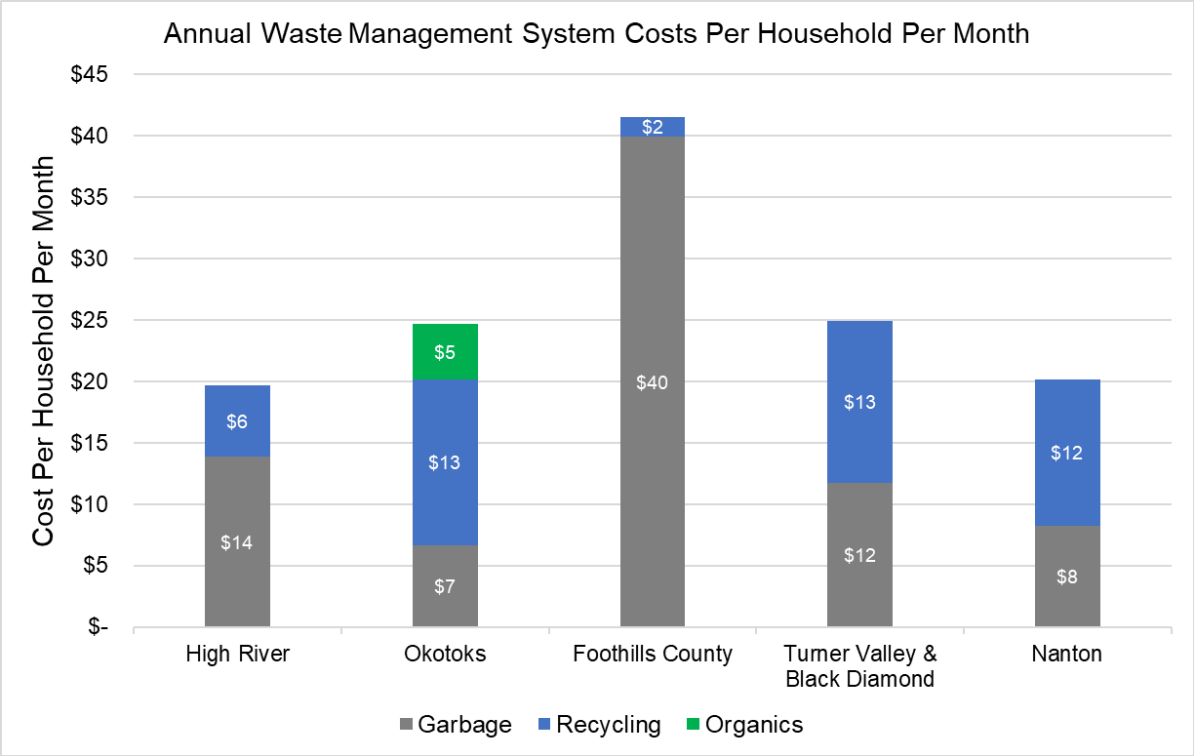

Figure 2.6 Current Waste Management System Costs per Household per Month
(Annual expenses paid by each municipality on a cost per household per month basis, not the monthly fee paid by residents)

The following insights were drawn from the data presented in Appendix A:

- Excluding Foothills County, the average total system costs across the Partners is $22.40 per household per month. Okotoks' system is only slightly higher than this average, despite offering additional service compared to the other Partners. This highlights the cost efficiencies that can be realized from operating multiple curbside collection streams.
- Excluding Foothills County, the average residual waste system costs per household per month is $10.13. Nanton and Okotoks, who offer additional curbside collection streams, have below-average costs while High River and Turner Valley/Black Diamond, who only offer curbside collection of residual waste, have above-average costs.
- On a gross cost per tonne and cost per household basis, the residual waste management system in Foothills County is the least efficient among the Partners. This is due to the low quantity of waste managed, the low quantity and density of households involved in curbside waste collection, and high costs relative to the waste management systems in the more densely populated towns. If the households involved in curbside waste collection in Foothills County were to join a regionalized system with the other Partners, it is expected that significant cost savings could be realized.
- Turner Valley and Black Diamond together have the most efficient residual waste management system at the lowest cost per tonne. This is potentially due to the partnership between the two towns, where assets and resources are shared to deliver the curbside collection program.

- Okotoks and Nanton offer similar levels of recycling services and have similar recycling program costs per household per month and lower residual waste management costs per household per month when compared to High River, Turner Valley and Black Diamond. The lower residual waste system costs are due to the reduced tonnage for the residual waste stream, as well as overall system efficiencies.
- The most efficient recycling system on a cost per tonne basis is Okotoks. This is expected because of Okotoks' curbside recycling collection program, which collects a larger quantity of recyclables than recycling depots. High River and Turner Valley/Black Diamond have similar costs per tonne, which aligns with their similar level of service – both operate a recycling centre for drop-off of materials.
- Okotoks' curbside organics collection program has a cost per tonne approximately equal to the cost per tonne for residual waste management, despite the processing fees being considerably higher for organic material than the tipping fees for residual waste. This is likely due to the sharing of overhead costs with the other streams and the current collection contract.

2.5.2 Residential Charges

Each Partner engages in rate stabilization efforts to provide residents with a relatively stable cost each year. In all cases, the rate charged to residential households is less than the total system costs presented in Appendix A. Revenues from recyclables, taxes, and rate stabilization funds are used to achieve rate stabilization.

Table 2.7 below summarizes the current (2019) cost to residential households per month for the default level of service. Many of the Partners offer larger cart sizes for a higher rate.

Table 2.6 Waste Management System Residential Charges

Partner	Charge Includes	Charge per Household per Month
Okotoks	Collection & disposal of 120 L garbage, 240 L recycling, 120 L organics Okotoks Eco Centre	$ 22.08
High River	Collection & disposal of 240 L garbage High River Recycling Centre	$ 13.85
Black Diamond	Collection & disposal of 240 L garbage Access to Oilfields Recycling Centre	$ 14.89
Turner Valley	Collection & disposal of 240 L garbage Oilfields Recycling Centre	$ 20.00
Nanton	Collection & disposal of 240 L garbage and 240 L recycling (Depot charge unreported)	$ 14.00
Foothills County	Collection & disposal of 340 L garbage (404 households only) Access to recycling depots (all households)	$ 21.00

2.5.3 LRRC Tipping Fees

Tipping fees are in effect at the LRRC. The Partners receive a preferential rate, which reflects their investment in the facility. The current rate charged to the Partners is $69/tonne. Rates charged for self-haulers and private haulers vary by material type and are listed in Table 2.8.

Table 2.7 2019 LRRC Tipping Fees

Landfilled Waste	
Minimum Charge – Up To 100 Kg	$ 10.00
General Household and Commercial Waste	$ 102.00
Animal Carcasses	$ 159.00
Hard to Handle	$ 159.00
Demolition Waste	$ 150.00
Asbestos Waste – Small bagged asbestos	$ 175.00
Large Asbestos – Large bins with liners	$ 350.00
Asbestos – Minimum Charge	$ 350.00
Recyclable Materials - No Charge	
Batteries	$ 0.00
Grass, Leaves & Sod	$ 0.00
Electronic Waste	$ 0.00
Tires	$ 0.00
Paint	$ 0.00
Oil – Less than 40 L	$ 0.00
Household Hazardous Waste – Small Residential Volumes	$ 0.00
Propane Tanks	$ 0.00
Grain Bags	$ 0.00
Recyclable Materials - Charged	
Wood	$ 70.00
Clean Wood – Unpainted and Untreated	$ 50.00
Drywall – Unpainted, No Wood, Metal , or Plastic	$ 70.00
Asphalt Shingles	$ 90.00
Concrete	$ 50.00
Asphalt	$ 70.00
Yard Waste & Branches	$ 70.00
Metal	$ 75.00
Cardboard and mixed paper	$ 70.00
Fluorescent Bulbs – Commercial Volumes	$ 2.00/kg
Manure and bedding	$ 90.00
Soil Materials for Disposal	
Mixed Soil – Clay, Gravel, Black Dirt	$ 25.00

Landfilled Waste	
Cover Soil With Debris	$ 25.00
Clean Topsoil or Loam (must be approved as topsoil by staff to be free)	$ 0.00
Street Sweepings	$ 62.00
Surcharges in Addition to Tipping Fees	
Fridges/Freezers/White Goods Freon Removal	$ 20.00
Automotive Propane Tanks	$ 25.00
Household Hazardous Waste – Large Residential Volumes	$ 50.00
Household Hazardous Waste – Commercially Generated Volumes	$ 100.00
205 L Drums of Unlabeled Chemicals	$ 450.00
Untarped or Unsecured Load	$ 10.00
Equipment Assistance per half hour	$ 75.00
Prepaid Voucher Booklet -10 vouchers	$ 75.00

2.6 Service Level and User Fee Comparisons to Similar Regions

The waste management programs offered by the Partners were assessed against similar municipalities and regions in Alberta. A detailed assessment is provided in Appendix B. In general, the rates charged by the Partners were found to align with the rates charged by similar municipalities and counties, although some smaller and medium sized municipalities were found to provide a higher level of service (e.g. separate collection of organic waste).

Table 2.8 Service Level and User Fee Comparison Summary

Partner(s)	Compared to	Findings
Nanton, Turner Valley, Black Diamond	Hanna, Magrath, Tofield, Vulcan	• Similar garbage & recycling services • Hanna and Tofield offer more services for organic waste • All towns in range of $5 to $14 /HH/month
High River	Lacombe, Cold Lake	• Lacombe recently suspended its curbside recycling program • Cold Lake collects recycling biweekly for $9/month; collects organics seasonally • High River has lowest cost to residents and lowest level of service
Foothills County	Grande Prairie, Red Deer, Sturgeon Counties	• Foothills County residential charges are approx. $10/HH/month higher than Grande Prairie County with comparable level of service

Partner(s)	Compared to	Findings
Okotoks	Cochrane, Chestermere, Spruce Grove	• Each municipality offers weekly, curbside, automated residual, recyclable, and organic waste collection • Okotoks cost is lowest but comparable, range is $22 to $25/HH/month

2.7 Waste Projections

An effective RSWMP needs to consider the future growth of waste management needs. GHD developed waste projections for the Partners to 2030 for this purpose, based on the number of single-family households that were estimated to be added to the municipal programs. The waste generation rate per household and waste composition were held steady. Detailed waste projections results are presented in Appendix C.

A summary of the projections is provided in Figure 2.7 below. The projections are based on continued operation of current collection programs and depots, with no increase in diversion rate as a result of enhanced service or education. GHD also projected the quantity of each stream if diversion programs were enhanced as part of the evaluation of options; those findings are presented in Section 3.

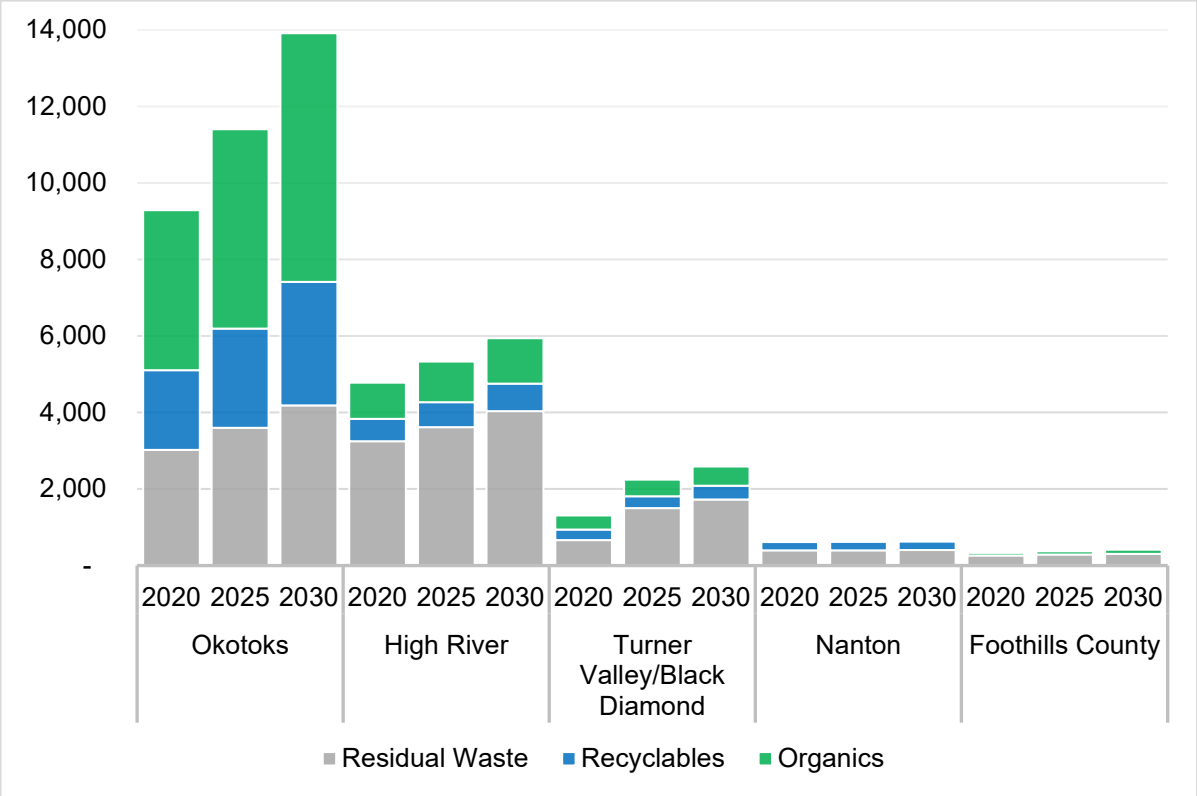

Figure 2.7 Status Quo Projections of Collected Tonnages

3. Assessment of Strategies and Actions

To address the drivers identified in Section 1, the following categories of actions were identified:

- Regionalized collection
- Regionalized processing
- Tools to increase public participation and diversion
- Landfill management
- Governance

The following sections present the analysis of options that was completed for each category.

3.1 Regionalized Collection

3.1.1 Analysis

Each Partner currently runs its own waste collection programs, with the exception of the garbage trucks shared by Turner Valley and Black Diamond. A regionalized collection system would require fewer collection assets (i.e. trucks, storage), resources required to run the program (i.e. administration, financing), and education and public outreach efforts. Increased efficiency can lead to cost savings. If collection is contracted out to a third-party, as is currently the case for Okotoks'

curbside recycling and organics programs, the municipalities involved may enter under the same contract, which can reduce overall costs and complexity.

Options for regionalizing the collection service were evaluated. The evaluation considered population growth, assets required, an increase in participation in new diversion programs over time, and other variables. The detailed analysis, considerations, assumptions, and results are presented in Appendix D. A summary of the key results from the evaluation is presented in Table 3.1. Note that costs of carts are not included in this summary table – the cost will increase by $0.80 per household per month per additional stream for municipalities that require additional carts.

All costs presented have been rounded to the nearest dollar to account for uncertainty in analysis and future costs. Thus, totals may not equal the sum of parts in this table, due to rounding. The tables in Appendix D provide detailed results.

Table 3.1 Summary of Key Results - Regionalization Options Analysis

	Option 1 Garbage Only		Option 2 Garbage and Recycling		Option 3 Garbage and Organics		Option 4 Garbage, Recycling and Organics	
	2020	2030	2020	2030	2020	2030	2020	2030
Regional Diversion Rate (municipally-managed MSW only)	52%	52%	58%	58%	56%	69%	62%	75%
Assets Required if Owned and Operated								
# Residual Waste Collection Trucks Needed incl. Spare	6	7	6	7	6	7	6	7
# Recyclable Waste Collection Trucks Needed incl. Spare	0	0	6	7	0	0	6	7
# Organic Waste Collection Trucks Needed incl. Spare	0	0	0	0	6	7	6	7
Total Trucks Owned	**6**	**7**	**12**	**14**	**12**	**14**	**18**	**21**
Cost Summary - Own and Operate All Streams ($/HH/month)								
Collection Cost	$7.00	$7.00	$14.00	$14.00	$14.00	$14.00	$20.00	$20.00
Disposal Cost	$3.00	$3.00	$5.00	$5.00	$4.00	$5.00	$6.00	$6.00
Recycling Centre/Depot	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
Total Cost ($/HH/month)	**$15.00**	**$15.00**	**$23.00**	**$23.00**	**$22.00**	**$23.00**	**$31.00**	**31.00**
Cost Summary - Own and Operate Residual Collection, Contract Out Recyclables/Organics								
Collection Cost ($/HH/month)	$7.00	$8.00	$12.00	$13.00	$12.00	$13.00	$16.00	$19.00
Disposal Cost ($/HH/month)	$3.00	$3.00	$5.00	$5.00	$4.00	$5.00	$6.00	$6.00
Recycling Centre/Depot	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00
Total Cost ($/HH/month)	**$15.00**	**$15.00**	**$21.00**	**$22.00**	**$20.00**	**$22.00**	**$26.00**	**$31.00**

The analysis shows that the average total cost for garbage collection across the Partners would be reduced under a regionalized service, because the number of trucks in operation (including spares) would drop from eight (plus 2-days per week of contracted services) to six (five in operation on a 4-day weekly collection schedule with one spare, and no additional contracted services) in 2020. By 2025, the number of trucks required increases to seven (plus a spare) and remains at that level until

after 2035. Regionalizing garbage collection services would not necessarily result in any increase to the regional diversion rate, although tools to increase public participation and diversion (described in Section 3.3) could be applied even if no additional diversion services were provided.

Comparing the cost results presented in Table 3.1 with the current system costs presented previously in Figure 2.6, the following conclusions can be drawn:

- Regionalizing residual waste collection results in a lower cost per household per month for residual waste management for High River and Turner valley/Black Diamond, and higher a higher cost for Okotoks and Nanton.
- Since disposal costs for residual waste are lower than processing costs for recyclables and organics, costs increase as diversion collection programs are initiated. Curbside organics management is slightly cheaper than curbside recyclables management due to lower processing costs for organics.
- If Option 4 is pursued, the expected increased in total system costs (using the data in Figure 2.6 as baseline, except for Foothills County where the charge of $21 per household per month is used) for each Partner is as follows:
  - Okotoks: 5.6 percent increase in total system costs, no change to level of service
  - High River: 32.4 percent increase, curbside recycling and organics collection added
  - Turner Valley/Black Diamond: 4.6 percent increase, curbside recycling and organics collection added
  - Nanton: 29.4 percent increase, curbside organics collection added
  - Foothills County select communities enrolled in collection: 24.3 percent increase, curbside recycling and organics collection added
- In 2020, cost savings of almost $2.00 per household per month per diversion stream can be realized if the collection service is contracted out. However, this benefit disappears overtime as the model conservatively estimates that contract costs will increase. Contract periods are short, typically 2-5 years, and costs are uncertain following the end of a contract. If the Region can attain consistently low costs for third-party collection, contracting out the collection services will be more cost effective in the long run than owning the service. Otherwise, owning and operating the service will become more cost effective overtime. The key benefits and drawbacks of contracting out the service are presented in Table 3.2 below, with a detailed discussion included in Appendix D.

Table 3.2 Summary of Key Benefits and Drawbacks to Owning vs. Contracting Out Collection Service

	Benefits	Drawbacks
Own and Operate Collection Service	• Future costs more predictable and constant over time, simplifies rate stabilization for residents • Residents generally experience better level of service when the municipality/region operates the service	• Capital investment required for trucks and storage, operators and staff need to be managed, trained in house • Higher costs • Unpredictable events, such as major equipment failures, pose a significant

	Benefits	Drawbacks
	• Control over service effectiveness, customer satisfaction, and accountability is maintained by the municipality	risk to the system as the risks must be
Contract Out Collection Service	• Greatly simplifies collection service for the municipalities, reducing the need to manage assets and resources in house • Lower costs • More stability for unpredictable events such as truck downtime or staff leaving the job, as the contractor manages these issues	• Contracts are generally short (3 years), creating uncertainty for future costs depending on future attainable contracts[6] • Once a collection service is contracted out, it is extremely costly and demanding to transition back into ownership and operation of the service • Limited control over level of service, addressing customer complaints, etc.

Operation of the existing recycling depots was maintained in all options, because the depots are vital for ensuring that hazardous material (electronics, flammables, propane tanks, etc.) is kept out of blue carts, increasing overall capture rate, and providing recycling options to multi-family residences not included in curbside collection. There are opportunities to harmonize service and to provide complimentary services (e.g. staggered hours of operation).

A decision about regionalizing the garbage collection system must be formalized in 2019, because of a truck purchase scheduled for 2020 in Turner Valley and Black Diamond.

3.1.2 Diversion Achievable Through Enhanced Curbside Collection Programs

Introducing additional waste management streams can have a significant impact on the regional diversion rate among the Partners. With current waste management systems, it is estimated that the regional diversion rate for waste under the control of municipal programs (i.e. excluding ICI, multi-family sources and the households in Foothills County not enrolled in curbside collection) is 52 percent. By 2030, if regionalized collection of both curbside recycling and curbside organics collection is rolled out across the Partners, the regional diversion rate could be as high as 75 percent, as illustrated in the Figure below. The Figure shows the breakdown of each waste stream and collection method depending on the diversion programs initiated.

[6] The City of Lacombe recently experienced this drawback firsthand, when their recycling collection program went out to RFP for contract renewal. Only one private collector responded with 66 percent higher costs and more stringent requirements for materials included. Lacombe decided to suspend its recycling program.

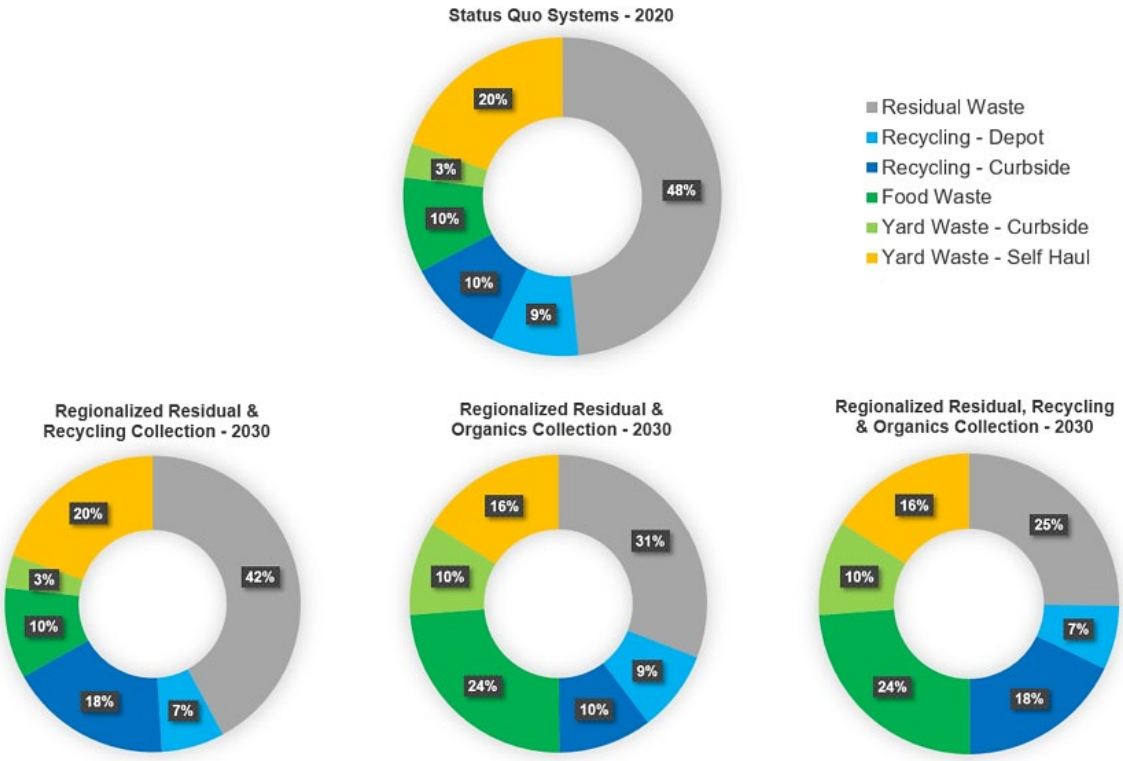

Figure 3.1 Collection Rates Depending on the Regional Waste Management Option Adopted by 2030

3.1.3 Conclusions

The analysis summarized above and detailed in Appendix D leads to the following recommendations and conclusions:

1. Residual waste collection should be regionalized as a first step, utilizing existing assets and resources. Existing staff and trucks can be shared with minimal disruptions to level of service and jobs. The regional collection service should be managed by either a regional entity or by a single municipality, where each Partner pays into the program depending on the number of households involved. This is the easiest way to optimize the current assets and resources across the Partners and reduce overall costs in the short term.

2. Regionalize an organics collection program next to increase the diversion rate and potentially generate value (compost or energy) from the organic material. A regional organics collection program will have a bigger impact on reducing the amount of waste sent to landfill than a regional recycling program, and the cost to process organic waste is lower than the cost of recycling. A regional organics collection program could be implemented a year or two following the implementation of regional residual waste collection, and the options for owning and operating or contracting out the service should be evaluated in the interim period.

3. The current market for recyclables warrants caution before launching a regional recycling program. Such a program could be implemented in a few years if market conditions become favourable. The existing recycling drop-off centres in the Region, could be optimized by:
(i) reviewing and aligning the materials collected in accordance with market conditions,

(ii) aligning sorting methods and material categories, (iii) developing consistent signage and combining public education efforts, (iv) combining material collected for brokering better deals from the market, and (v) staggering open days and hours to ensure a high level of service for residents in the Region.

The Region has requested that the analysis be conducted a second time for the case where High River does not partake in regionalization. This analysis, including impacts on tonnage and costs, is presented in Appendix G.

3.2 Regional Processing

3.2.1 Materials Recovery Facility

The potential for developing a local materials recovery facility (MRF) to process and market materials from curbside collection programs and depots has been of interest in the region since 2014. Separate studies were conducted in 2014 and 2017, and an updated analysis of the costs and benefits of developing a local MRF was undertaken as part of the development of the RSWMP. The detailed assessment and conclusions are presented in Appendix E.

The analysis determined that MRF development is not an optimal use of resources at this time, as there is sufficient capacity at private MRFs in the region and uncertain market conditions for recyclables. The cost per tonne to own and operate a MRF would be approximately two times higher than the cost per tonne charged by private MRFs (see Table E.2 in Appendix E). At this time, the Partners would be better served working together to negotiate favourable contract terms such as price, processing guarantees, and access agreements if regional curbside recycling collection is implemented.

However, future conditions may create a favourable atmosphere for the development of a regional MRF. These triggers are summarized in Table 3.3 below, and discussed in further detail in Appendix E. The status of these trigger should be re-evaluated every 3-5 years, as processing contracts come up for renewal.

Table 3.3 MRF Development Triggers

Trigger	Commentary
Closure, reduction in capacity or substantial increase in price at private MRFs in Calgary.	If the existing MRFs close or if their capacity becomes unavailable for materials from the Partners (e.g. as a result of a significant increase in ICI recycling in Calgary), the price for processing could increase.
Improvement of local markets for recyclables (i.e. expanded capacity of western Canadian factories that process post-consumer recyclables into new products).	Improved local markets for the materials sorted at the MRF would reduce the risk associated with operating the MRF. A contractual commitment from Alberta-area MRFs to supply materials to local mills and factories could stimulate the local market.
Mandatory recycling for all ICI establishments throughout the Region and ability to require all ICI recycling be	If ICI recycling becomes mandatory in all Partners, the quantity of recyclables needing processing will nearly double. Those materials could be accommodated by a second shift and no additional equipment would be required. This would reduce the overall cost per tonne. However, the recyclables from the ICI sector would not necessarily flow to a local MRF. It is generally difficult for

Trigger	Commentary
processed at the regional MRF.	municipalities to compete with the private sector for the higher value, easy to recover recyclable materials, such as clean, dry OCC. Municipal MRFs will often be left with the lower value, mixed streams that are more difficult and costly to recycle, and that have much lower revenue.
Changes to the materials collected in the blue box program	The materials accepted in the recyclables collection program could be adjusted to minimize the market risk. Both capital and operating costs could be reduced. There is a significant risk that the contamination level would increase, because it would be difficult to train residents to exclude materials that they are currently recycling (especially various types of plastics).

3.2.2 Organics Processing Facility

There appears to be an emerging need for an organics processing facility (OPF) in the Foothills Region. There is a regional shortage of well-run facilities and multiple facilities have recently been closed due to odour issues. As a result of the recent establishment of disposal bans on organic waste from the ICI sector at City of Calgary landfills, private and public composting facilities in southern Alberta are operating at or near capacity. When the Town of Okotoks begins requiring the ICI sector to segregate organic waste in 2020, the demand for facilities to accept the material will increase further.

An analysis of the need for a local OPF was undertaken as part of the development of the RSWMP. Detailed assessment and results are presented in Appendix F.

The analysis determined that there is a need for additional organics processing capacity and that the Partners may benefit from developing a regional facility, particularly in partnership with the private sector. The OPF could utilize composting, anaerobic digestion, or a combination of the two technologies to process organic waste and generate valuable end products.

As discussed in Appendix F, the decision on technology must consider the target feedstock. Processing ICI organic waste with municipally collected organics will require increased facility capacity and associated capital and operating costs, while also generating greater revenue from tipping fees and the generation of renewable natural gas (RNG) from anaerobic digestion. If the facility is to process only municipally-managed organic waste, the facility scale will not be large enough to justify anaerobic digestion and composting will likely be the only feasible technology option. Composting is associated with significantly lower capital and operating costs, as well as significantly lower revenues.

3.3 Tools for Increasing Public Participation and Diversion

A waste management program can fail to deliver the expected results if residents do not use it as designed. The effectiveness of recycling and organics collection programs, as well as the costs and revenues associated with processing the material, are dependent on the capture rates and contamination level of the material set out by each household. This section describes the tools that can be used to increase public participation and diversion. These tools will be most effective when applied to regionally harmonized programs and implemented at a regional scale.

3.3.1 Promotion & Education

A comprehensive communication strategy is recommended to support the behavioural changes required of residents and businesses as changes are made to the operation of the regional solid waste system. This is particularly true for the recommended changes for regional residual waste collection, implementation of organics collection, and changes to align the recycling depots. The development and implementation of a comprehensive communication strategy will help to coordinate and maximize the effectiveness of promotion and education campaigns.

Historically, local governments have focused on providing residents with the information they need to use a system properly. Over the past 20-years, research on social marketing has been applied to drive behaviour change in waste management. The key elements of social marketing for behavior change include the following (FutureProof, 2009; Shaw, Resick, & Van Rossum, 2014; Skumatz & Freeman, 2011, 2014):

- Understand and address barriers and motivators
- Reflect local values (are they economic, environmental and/or social?)
- Establish new norms
- Get people to make commitments
- Use regular (or well known) local people to promote recycling behaviors (these people are seen as trusted sources)
- Use face-to-face communication[7]
- Use prompts to remind people about the desired behavior, such as ads in local newspapers and on social media
- Customize messages to target specific audiences (e.g. younger audiences, renters and minorities)
- Use a variety of media, not just print sources, and capitalize on simple and effective marketing through social media such as Facebook, Instagram, and Twitter

Other important elements of public education and awareness include the use of consistent signage that primarily uses pictures or icons, rather than text. Seeing consistent, simple signage region-wide helps residents adopt new behaviours, which leads to reduced contamination and increased capture rates.

The RSWMP calls for the Partners to develop and implement a regional communication strategy that describes the methods and media for engaging with the public to increase public buy-in and participation for changes to the waste management system.

[7] Research done in the United States showed that door-to-door outreach increased recycling by more than double the non-door-to-door approaches and almost five times the increase from traditional outreach campaign methods. While much more costly to conduct per house (door-to-door is labor intensive), calculations showed the door-to-door social marketing campaign was considerably less expensive per ton than using mail and cart hangers. In addition, follow-up research showed the behaviour change lasted longer for the door-to-door outreach.

Development of the strategy is anticipated to cost approximately $15,000. Implementation costs will vary depending on the selected tactics and the amount of work undertaken by local staff or contracted out.

As this is a high priority item that will engage residents and businesses on all coming changes to the waste management system, the development of the communication strategy is recommended to begin in 2019. The communication strategy should be completed in 2020, and implementation should begin shortly thereafter.

3.3.2 Pay as You Throw

Research from the United States shows that on average, municipalities with pay as you throw (PAYT) systems generate nearly 45 percent less garbage per capita and recycle 62 percent more recycling than municipalities that do not (Crisan-Heavilin, 2018). Under a PAYT philosophy, diversion streams should be priced at a discount because recycling and organics diversion offer benefits, such as extended landfill life. Only garbage should be priced with a surcharge for larger collection carts.

PAYT is partially established in some Partners already, where residents can choose to pay a higher rate for larger garbage carts. Okotoks surveyed residents on their support for a model where rates are directly related to the household's chosen cart size (i.e. larger carts are associated with higher utility rates). Among households responding to the survey, this approach did not have a high level of public support (Town of Okotoks, 2019).

The RSWMP calls for all Partners to consider adjusting their rate structure to reflect PAYT principles, either independently or as part of a regionalized garbage collection program. Public education on the motivations behind increasing diversion should be conducted through the methods defined in the regional communication strategy.

3.3.3 Material Bans (With Enforcement)

Banning recyclable or compostable materials from the garbage stream can have a significant impact on the diversion rate, provided the bans are enforced. The most effective enforcement occurs at the point of collection, rather than at the point of disposal. A study in a major Ontario municipality found a potential increase in diversion of recyclables of up to 8 percent and a potential increase of 20-25 percent in organic waste when bans on these materials in the residual waste stream were enforced at the curb (CIF, 2019). Banning those materials from disposal increases participation and set-out rates in recycling and organics diversion programs.

With automated collection, enforcement is generally limited to curbside inspections of carts, as other approaches, such as requiring clear bags, are not feasible. The potential for every cart to be the target of a curbside inspection helps to ensure participation by everyone, though actual inspection measures would be limited by staff capacity and cost. To accompany enforcement, operators of a collection truck must be granted the right to not collect a cart in which banned material is visible (i.e. yard waste visible in a garbage cart, or non-organic material visible in an organic waste cart). This right to refuse collection must be included in the bylaw governing the collection service.

Enforcement must be accompanied by education; any carts that are not collected should be labelled with a sticker that explains why the material was left behind and what actions the resident needs to

take. An awareness campaign should precede any enforcement activities. Furthermore, material bans should only be implemented for materials that can be diverted through municipal services. For example, food waste should not be banned from disposal until a food waste collection service is provided.

The RSWMP calls for the Partners to revise their current garbage collection bylaws to expressly prohibit the placement of recyclable materials in the garbage stream, to allow collections staff to leave non-compliant carts, and to begin budgeting staff time for enforcement activities.

3.3.4 Procurement Policies & Practices

The Partners should review their internal procurement policies and practices to ensure alignment with the waste management hierarchy. The following practices should be implemented immediately as they require little effort and demonstrate leadership by example:

- Drinks and catering provided at Council meetings and other Town events should be served in reusable tableware (i.e. glasses and plates) and disposable water bottles should no longer be provided.
- Printer paper, paper towel and toilet paper purchased by the Partners should have post-consumer recycled content to support markets for paper recycling.
- All computers should be set to print double sided by default to reduce paper consumption.
- All Town offices should be equipped with recycling carts.

The success of these early endeavours can be shared as part of a communication strategy.

3.3.5 Waste Audits

Waste audits will provide the Partners with a more detailed understanding of the waste streams that should be targeted by reduction and diversion programs, and allow the Partners to track the effectiveness of their efforts. To date, Okotoks is the only Partner to have characterized its recycling and residual waste stream; the organic waste stream has not yet been officially characterized.

In order to measure the impact of any new program or policy, it is important to establish baseline conditions. Ideally the characterization would be conducted seasonally to account for variations in waste generation and composition, however this can be significantly more costly. It is important to conduct the characterization of each material stream in order to obtain a complete understanding of waste generation and capture rates.

The recommended approach is to conduct a baseline study for each Partner in 2020, with follow-up studies every 3-5 years, or after implementation of major system changes (e.g. after implementation of curbside collection of organic waste).

3.4 Landfill Management

A review of landfill operations was conducted that assessed the following at the LRRC:

- HHW management
- C&D waste management

- Financial assurance and post closure analysis
- Current landfill operations
- Potential impacts of new landfill operations and services
- Surface and groundwater management plans
- Ten year management plan
- Maximizing the value of the landfill airspace

3.4.1 Maximize Landfill Value through Limiting Acceptance of Non-MSW and Non-Regional Waste

The value of the landfill resides in the permitted airspace. Until the future value of airspace is established and tipping fees can be set accordingly, the acceptance of MSW from outside the Region and the acceptance of non-MSW in quantities that exceed the operational requirements of the LRRC should be limited. GHD understands that the large quantity of contaminated soils accepted in 2017 and 2018 were due to unique agreements with a hauler that benefitted the LRRC, and will not continue into the future. This is important as soils consume valuable airspace for lower tipping fees than MSW, consuming future value at a lower benefit. The LRRC should limit soil acceptance to what is required for operations on-site, while maximizing the use of the steel plates purchased previously for daily cover.

There are two financial considerations associated with accepting quantities of material that is non-Partner MSW:

- The value of the airspace may be higher in the future than it is currently, as other landfills reach capacity. The LRRC may be able to command higher tipping fees as supply of capacity at other landfills is depleted.
- The future capital cost of siting a new landfill can be delayed by not accepting soils, inert waste and divertible materials. If low-fee divertible and inert materials are kept out of the landfill, the current landfill will last longer, and the cost of siting, permitting, and developing a new landfill will be delayed farther into the future.

3.4.2 Thorough Assessments of Potential Impacts from New Landfill Services or Operations

To date, no major complaints associated with noise, air quality, or water quality impacts from the operation of the LRRC have been recorded. However, as additional services such as hydrovac waste acceptance are introduced, thorough assessments should be completed to evaluate potential environmental, social, and economic impacts. The results of those assessments should be shared with all Partners with ample time for questions and discussion prior to decisions being made to pursue or not pursue the change. The requirement to complete such an assessment mitigates risks and ensures responsible decisions.

3.5 Administration and Governance

There are six primary options to govern a regional service:

1. Regional Service Commission (RSC) Model: Alberta municipalities can collaborate on the delivery of services to their communities, including solid waste management services.
2. Cooperative Model: The Alberta Cooperatives Act allows for businesses/enterprises to be incorporated and jointly owned, as resources are pooled to meet common interests.
3. Inter-Municipal Agreement Model: Allows municipalities to enter into agreements as natural person powers are provided for municipalities to enter into contracts.
4. Municipal Controlled Corporation (MCC) Model: MCC's are for-profit corporations where the municipality (or municipalities) own more than 50 percent of votes in electing directors.
5. Part 9 Company Model: The Alberta Companies Act allows for incorporation of not-for-profit organizations that can engage in business activities, but profits cannot be paid out to the member organizations.
6. Society Model: Alberta Societies Act allows for the incorporation of not-for-profit organizations, for philanthropic, charitable, artistic, social, educational, etc. purposes. A society many not partake in trade or business activities.

For the purposes of waste collection services, the RSC and inter-municipal agreement models are considered the most appropriate. The other models each have additional requirements or burdens that do not align with the priorities for the delivery of a regionalized waste collection system.

An RSC could be used to deliver a regional collection service by increasing the mandate of the existing FRSC; this would require provincial approval, but would be simpler than establishing a new RSC solely for the purpose of waste collection services. A drawback of the RSC model is that commission board members must be selected from elected officials, who do not necessarily have the required background to make informed decisions. In order to overcome this obstacle to sound decision-making, the FRSC could hire additional staff to make operational and technical decisions. These could be dedicated staff, or the FRSC could contribute to the salaries of existing staff at a member municipality. This additional capacity would be required to ensure the FRSC could be accountable to the member municipalities and their evolving waste management needs.

An inter-municipal agreement model could be applied in one of two ways: The first is to enter into an agreement whereby the municipalities agree upon how and by whom the inter-municipal services will occur/be provided. Within this type of approach the individual members would continue to provide services under the conditions and provisions articulated in the agreement and would each own their own assets and employ their own staff. The second is to enter into an agreement that establishes an Authority along with a Board that oversees the delivery of the agreed upon services. The Board may hire their own personnel to deliver the service which can result in savings in labor costs due to economies of scale. Creation of a new Board under an inter-municipal agreement is not preferred, because it creates duplication with the FRSC.

Based on the evaluation of options presented here, transition of collection assets to the FRSC is recommended, contingent on the FRSC hiring staff or contractors to provide the knowledge and experience necessary to support sound decision-making. An inter-municipal agreement without a Board may be an appropriate as an interim measure to test the feasibility of shared delivery of collection services and/or if the FRSC is not able to hire qualified staff to manage a collection service.

4. Summary of Recommendations – Regional Solid Waste Management Plan

The previous sections presented and discussed the evaluation of a number of options for regional solid waste management among the Partners. This section summarizes the recommendations.

4.1 Regionalized Collection

Recommendation 1: Regionalize curbside residual waste collection, utilizing existing assets and resources

The regionalization of curbside residual waste collection is a logical and straightforward first step towards a regionalized waste management system among the Partners. Utilizing existing assets and resources, greater efficiencies will be found by collecting residual waste on a regional level rather than on individual municipal levels, due to economies of scale and the ability to optimize collection routes. This regionalization step is proposed to begin in 2020; governance options are provided in Recommendation 12. From the customer point of view, there will be minimal changes to waste collection (i.e. the day of collection may change as routes are optimized, but no other significant changes are expected).

Recommendation 2: Implement regionalized curbside organic waste collection, contracting out the collection service

Curbside collection of organic waste is a proven method for significantly increasing diversion from landfill and produces valuable end-products from the waste if the Region has a stake in the processing facility. Collection carts will need to be purchased for residents of Turner Valley, Black Diamond, High River, Nanton, and Foothills County. It is recommended that for the initial period of curbside organics collection, the Region should engage a contractor for the collection service, following the example of Okotoks. This will greatly reduce upfront capital costs and risks. Implementation should begin with securing organics processing capacity at an existing facility, until such time that a regional organics processing facility is developed (see Recommendation 4).

A curbside recyclables collection program is not recommended at this time due to high processing costs and market constraints. However, a recycling program should be assessed again in the future if the following triggers are present:

- Higher number of MRFs and recyclable processors in the area looking to purchase recyclables
- Improved technologies for sorting, cleaning, and generating valuable recycled materials from collect recyclables
- Improved international market for recyclable materials

Recommendation 3: Align and optimize existing recycling drop-off facilities

While the curbside collection of recyclables is not recommended at this time due to strict market conditions and expensive material recovery fees, the existing recycling depots in the Region should be optimized to provide customers across the Region with a high level of service. The recycling facilities are recommended to be optimized in the following ways:

a. Review and align the materials collected in accordance with market conditions, to ensure customers across the Region have equal ability to dispose of HHW, recyclables, and ARMA materials.

b. Align sorting methods and material categories to reduce confusion, increase capture rate, and reduce contamination.

c. Develop consistent signage and combine resources for public education efforts.

d. Stagger open days and hours to ensure a high level of service for residents in the Region.

e. Collaborate to sell material collected to obtain more favourable pricing.

f. Do not collect materials that are not marketable, for example film plastic.

4.2 Regional Processing

Recommendation 4: Investigate potential partnerships to support the development of a regional organics processing facility

There is a need for additional organics processing capacity in the Region, for both the residential and commercial sectors. The Partners may benefit from developing a regional facility, particularly in partnership with the private sector. Partnering with an interested and experienced organics processor to develop and construct a regional facility will benefit the Partners by:

a. Providing a low-tipping-fee facility for municipally-managed organic waste.

b. Attracting business from the commercial sector, which is currently faced with an organic waste disposal ban at City of Calgary landfills and a shortage of organics processing capacity.

c. Generating carbon emissions offsets through the diversion of organic material from the landfill.

d. Generating useful end-products such as renewable natural gas, which has a high market value but is only economic at large scales (i.e. the facility must accept commercial material to achieve the necessary scale).

e. Reducing capital and operating cost risk for the Partners due to partnership with the private sector.

The OPF could utilize composting, anaerobic digestion, or a combination of the two technologies to process organic waste and generate valuable end-products.

It is recommended that the Partners further investigate opportunities for partnering with the private sector to develop a regional organics processing facility in the coming years.

4.3 Tools to Increase Public Participation and Diversion

Recommendation 5: Develop and implement a regional communication strategy

A comprehensive communication strategy is recommended to support the behaviour changes required of residents and businesses as the transition to a regionally-managed system is implemented. This is particularly true for the recommended changes to curbside collection programs, recycling depot optimizations, and policy changes that aim to improve diversion. The development and implementation of a comprehensive regional communication strategy will help to

coordinate and maximize the effectiveness of promotion and education campaigns. This is a high priority item that should be initiated in the final quarter of 2019, and completed in 2020. The communication strategy will impact the implementation of each of the recommendations in the RSMWP.

Recommendation 6: Implement pay-as-you-throw policies

Pay-as-you-throw (PAYT) policies incentivize diversion by charging households that generate more waste more for collection and disposal than households that take steps to minimize and divert waste. It is recommended that PAYT policies be implemented across the Region at the same time as curbside residual waste collection is regionalized, with different household utility fees available for different sized residual waste collection carts.

Recommendation 7: Implement and enforce material bans

Residual waste collection bylaws should be revised to prohibit certain divertible materials from the black cart collection. This should include any materials that residents can easily divert through other means, primarily:

- HHW, electronics, paper products, packaging, and other recyclables that can be delivered to recycling centres.
- Yard and food waste once curbside organics collection is implemented.

Material bans should be enforced by granting collection staff the right to refuse to collect a cart that either has visible banned materials (i.e. yard waste sticking out of the cart, or large clean cardboard), or that has been inspected and found to contain banned material. Visual inspections should be completed on a small scale, with the potential for any cart to be visually inspected acting as a deterrent to households while minimizing costs and resources required. Collection staff should be provided with tags to place on carts that are not in compliance that explain clearly why the cart was not collected. Material bans must be addressed in the regional communication strategy to ensure residents are given adequate warning.

Recommendation 8: Review and update internal procurement policies and practices

As the Region implements diversion programs and policies across the Partners, it is critical that the Region lead by example. Internal procurement policies and practices for each municipal/regional council should be reviewed and updated to ensure alignment with the waste management hierarchy. Example actions include:

a. Using reusable cutlery and dishware for meetings.

b. Setting printers to print double-sided automatically to conserve paper.

c. Purchasing paper products that contain recycled content.

d. Making recycling carts available in all municipally-owned buildings, and, where reasonable, providing organics collection carts in all municipally-owned buildings.

Recommendation 9: Complete waste audits across the region every 3-5 years

Waste audits should be conducted every 3-5 years to assess the changing needs of the Region and the effectiveness of new programs. A baseline audit is recommended for 2020 for existing curbside

collection programs in each Partner, with a follow-up audit in 2023 to 2024 that provides a means of measuring the effectiveness of new programs. Audits are used to assess changes to waste management programs and provide guidance for future planning and assessments.

4.4 Landfill Management

Recommendation 10: Limit the amount of non-MSW materials accepted pending completion of detailed landfill airspace evaluation and landfill lifecycle assessment

The quantity of non-MSW material should be limited until the future value of airspace is clearly evaluated and tipping fees adjusted accordingly. While accepting significant quantities of soils generates revenue, the opportunity cost of consuming future higher-value airspace and of accelerating the need to site and permit a new landfill should be considered. It is recommended to limit these materials pending completion of a detailed landfill airspace assessment and landfill lifecycle analysis, such that only the quantities of soils required for the landfill operations be accepted. This will allow the LRRC and the Partners to make an informed decision regarding the relative priority of maximizing current revenue and preserving landfill space for the future.

Recommendation 11: Require any new proposed services or operations at the LRRC to undergo a social, environmental and economic line assessment and discussion with the Partners prior to implementation

All new proposed landfill operations or services should be subject to a triple-bottom-line evaluation prior to being implemented to ensure that the new service or operation:

a. Does not negatively impact the local environment and potential impacts are understood and addressed in a risk management plan.

b. Does not negatively impact residents and businesses in the Region and that potential impacts are addressed in a risk management plan.

c. Is a fiscally responsible undertaking that aligns with the long term goal of maximizing value from the landfill and minimizing long term liability.

4.5 Governance & Implementation

Recommendation 12: Regionalize the ownership of collection assets and services under the FRSC and hire qualified staff to manage the service

The recommendations in the RSWMP should be managed by one regional team. It is recommended that the current Regional Service Commission governance model be maintained, with the caveat that the FRSC must hire and empower a team of qualified and experienced waste management staff for the management of the regional services. A benefit would be to have dedicated staff working on the waste management system. An inter-municipal agreement could be signed in the interim until adequate resources have been obtained.

It is also recommended that an oversight committee be established to vet any reports and proposals prior to being voted upon by the FRSC board. The oversight committee should include one or two board members as well as technically qualified personnel and advisors. New proposals or reports that seek board approval would first be screened by the oversight committee, and the oversight

committee would then recommend the documents to the board for discussion and approval. This added step serves the purpose of ensuring that the board is receiving all necessary information, and that the information has been vetted, prior to voting.

Recommendation 13: Development of a Detailed Implementation Plan

Based on the feedback from various municipal councils to their respective administrations, GHD understands that there has been direction to develop an agreement and implementation plan within the next three months with member administrations that supports the prioritization and implementation of regional opportunities for solid waste as outlined in GHD's SWMP report for Foothills County, and Towns of Okotoks, High River, Black Diamond, Turner Valley and Nanton. GHD will work with the SWMP Project Manager, Town of Okotoks, to develop a frame work for this investigation as well as facilitate any additional data collection and modelling. The framework will first consider which municipalities are interested in participating in the proposed regional system as detailed in the recommendations above, followed by a determination of the level of service required based on the adoption of the recommendations above. From there, a number of governance and implementation steps will need to be discussed, as well as financial agreements between the collaborating Partners. GHD can facilitate this collaborative process through the provision of planning and technical support from GHD's experienced personnel, who have been instrumental in the advisory, planning, technology selection, and asset management support for regionalized waste management systems across North America and many international cities.

5. Costs and Implementation Plan

5.1 Costs Associated with the Recommendations

The costs in Table 5.1 represent new (additional) costs associated with implementing the recommendations of this RSWMP.

Table 5.1 Additional Costs of RSWMP Implementation

Recommendation	Capital/One-Time Cost	Capital Cost Year	Ongoing Operating Cost
Regionalized Collection			
1. Regionalize residual waste collection.	Turner Valley would see a cart cost of $80 each, or $0.80 per household per month, for purchasing black garbage carts to replace the current blue carts in use.	2020	Ongoing costs will decrease from the baseline for some municipalities and increase slightly for some municipalities.
2. Regional organics collection program.	$80 per cart, or $0.80 per household per month to cover cost.	2022	$9.00 per household per month (collection and disposal).
3. Align and optimize existing recycling facilities.	$20,000	2021	No additional costs anticipated; share current costs and optimize.

Recommendation	Capital/One-Time Cost	Capital Cost Year	Ongoing Operating Cost
Regional Processing			
4. Investigate partnerships for development of a regional organics processing facility.	Too early to estimate facility costs (depends on scale, technology and level of private sector partnership).		
Increase Public Participation and Diversion			
5. Develop and implement a regional communication and outreach strategy.	$50,000	2019-2020	$10,000
6. Adjust rate structures to reflect PAYT principles.	$10,000 in legal fees for bylaw changes	2020	No ongoing costs anticipated.
7. Material Bans (with Enforcement).	$10,000 in legal fees for bylaw changes	2021-2022	$10,000 for staff time
8. Procurement Policies and Practices.	$1000 for reusable tableware in all Partners	2021	Marginally higher ongoing costs anticipated due to purchase of recycled material.
9. Waste audits every 3-5 years, or after major system change.	$150,000	2020, 2024	No ongoing costs anticipated.
Landfill Management			
10. Limit acceptance of non-MSW, perform airspace evaluation.	$50,000 for detailed airspace evaluation and landfill lifecycle analysis.	2020	Loss in revenue in the short term expected.
11. Require triple-bottom-line analysis of proposed services and operations.	No capital cost anticipated	2020	Budget $10-20,000 for assessments.
Governance			
12. Interim inter-municipal agreement.	$10,000 in legal fees	2020	No ongoing costs anticipated.
12. Transition of collection assets to the FRSC.	No additional costs anticipated; redirect current individual system management costs to regional management team.	2022	No additional ongoing costs anticipated, redirect current individual system management costs to regional management team.

5.2 Implementation Plan

The implementation of the strategy is recommended to begin in 2019; all elements of the strategy are recommended to be in place by 2024. It is also important to develop an outlook for the longer-term, 10 to 20-years into the future, which should be re-evaluated as the recommendations are implemented.

The outlook is presented using a Three Horizons approach, where the first horizon represents the short-term plan (2019 to 2024), the second horizon represents the medium-term outlook (2025 to 2029), and the third horizon represents the long-term outlook (2030 to 2035). A high-level view of the implementation plan is visualized in Figure 5.1.

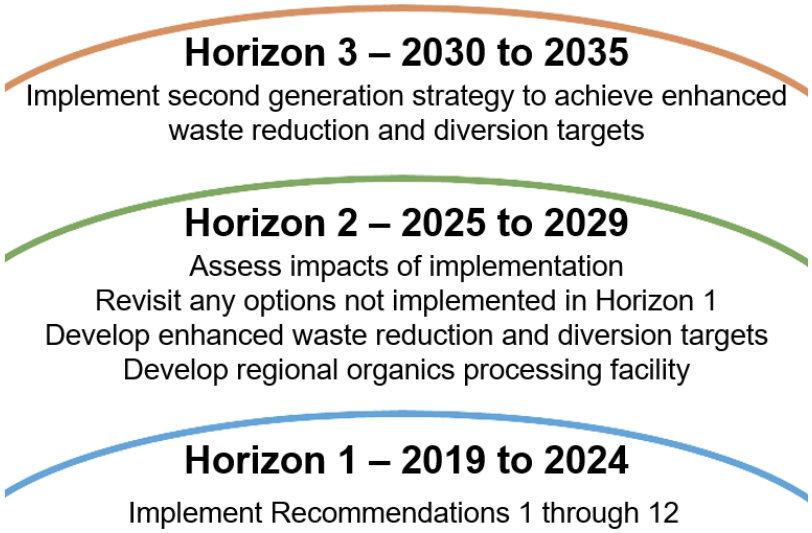

Figure 5.1 Three Horizons Implementation Plan

The detailed implementation plan is presented in Table 5.2.

Table 5.2 Detailed Implementation Plan

Year(s)	Implementation Plan
	First Horizon – 2019 to 2024

2019	• Begin implementing **Recommendation 4**: Develop organics processing capacity
	  ○ Engage in discussions with potential private partners
	  ○ Identify suitable sites
	• Begin implementing **Recommendation 5**: Develop a regional communication strategy
	• Begin implementing **Recommendation 12**: Assess and establish interim governance structure for regionalized collection services

2020	• Implement **Recommendation 1**: Regionalize residual waste collection utilizing existing assets and resources, following interim governance structure • Continue **Recommendation 4**: Investigate partnerships to support a regional organics processing capacity

Year(s)	Implementation Plan

	• Finalize **Recommendation 5**: Develop and implement regional communication strategy
	• Implement **Recommendation 6**: Adjust rate structures to reflect PAYT principles in all member municipalities
	  ○ Should be implemented alongside Recommendation 1
	• Begin implementing **Recommendation 7**: Material bans with enforcement
	  ○ Revise current garbage collection bylaws to prohibit select materials in the garbage stream and increase public engagement on the upcoming bans
	• Implement **Recommendation 9**: Complete waste audits every 3-5 years
	  ○ Complete baseline study in 2020
	• Implement **Recommendation 10**: Limit the acceptance of non-MSW at the LRRC
	  ○ Begin by implementing interim limits
	• Continue implementing **Recommendation 12**: Sign formal interim agreement for regional collection services and develop long-term governance structure for effective regional waste management

2021	• Prepare for implementation of **Recommendation 2**: Regionalized curbside organics collection, by identifying and securing organic waste processing capacity at existing facilities • Implement **Recommendation 3:** Align and optimize existing recycling facilities • Continue **Recommendation 4**: Move forward with potential partnerships for regional organics processing facility • Continue implementation of **Recommendation 7**: Begin enforcing material bans on select materials Implement **Recommendation 8:** Revise internal procurement policies and practices to reduce waste generated and support markets for recycled products • Continue implementing **Recommendation 10:** Complete third-party landfill lifecycle analysis and development of long-term tipping fee structure to maximize landfill value for the Partners • Finalize implementation of **Recommendation 12**: Establish long term governance structure for regionalized waste management services

2022	• Implement **Recommendation 2**: Regionalized curbside organics collection
	  ○ Roll out collection carts over the course of the year
	  ○ Utilize the communication strategy to engage the public and increase participation
	• Continue **Recommendation 4**: Develop a target timeline for facility development
	• Complete implementation of **Recommendation 7**: Enforce organic material bans in residual waste stream to encourage diversion through curbside organics collection
	• Implement policies arising from **Recommendation 11**

2023	• Continue **Recommendation 4**: Formalize private-sector agreements for organics processing facility
2024	• Finalize **Recommendation 4**: Transition from investigation of facility to design and implementation stage • Implement **Recommendation 9**: Perform Waste Audits Every 3-5 Years

Year(s)	Implementation Plan
Second Horizon – 2025 to 2029	

2025 – 2029	• Assess the effectiveness of Recommendations 1 through 12
	  ○ Engage the public in questionnaires on satisfaction with service and costs
	  ○ Evaluate collection and disposal operations and effectiveness, particularly considering recyclables marketability, contamination, and revenues
	  ○ Complete a Waste Audit in 2029, assess the differences and similarities with the two previous audits
	• Revisit possibility of curbside recycling collection and a regional material recovery facility
	• Develop waste reduction and diversion targets for next decade, considering external factors and costs
	• Move forward with developing a regional organics processing facility

Third Horizon – 2030 to 2039	
2030 – 2039	• Develop and pursue a strategy for achieving increased waste reduction and diversion in line with the targets developed

All of Which is Respectfully Submitted,

GHD

André Joseph, P.Eng.
Project Manager

Appendices

Appendix A
Existing System Costs

Appendix A Existing System Costs

Financial information was provided to GHD Limited (GHD) by each of the Partners for 2018. The financial data was then compared across the Partners on a cost per capita, cost per household, and cost per tonne of material collected and disposed basis. The following sections present the data and discuss the insights gathered.

Note that costs for Turner Valley and Black Diamond have been combined due to the existing interrelationships between the two systems. In all cases, the assessment looks exclusively at gross costs due to the incomparable nature of revenues (user fees, taxes, rate stabilization funds, recyclables sales, etc.) across the Partners.

1. Total System Costs and Revenues

Total revenues, expenses, and net income (or loss) for each waste stream are presented in Table A.1 below.

Table A.1 Total Revenues and Expenses

	Residual Waste	Recyclables	Organics
Revenues			
High River[1]	$ 633,364.54	$ 261,106.77	
Okotoks[2]	$ 960,000.00	$ 902,040.00	$ 502,000.00
Foothills County[3]	$ 128,094.00		
Turner Valley[4]	$ 185,500.00	$ 207,028.00	
Black Diamond[5]	$ 188,530.00		
Nanton[6]			
Expenses			
High River	$ 815,418.28	$ 343,648.58	
Okotoks	$ 693,800.00	$ 1,391,260.00	$ 474,300.00
Foothills County	$ 191,549.00	$ 189,381.00	
Turner Valley	$ 155,669.00	$ 176,029.00	
Black Diamond	$ 100,857.00		
Nanton	$ 128,394.00	$ 109,090.00	
Net Income (Loss)			
High River	$ (182,053.74)	$ (82,541.81)	
Okotoks	$ 266,200.00	$ (489,220.00)	$ 27,700.00
Foothills County	$ (63,455.00)	$ (189,381.00)	
Turner Valley	$ 29,831.00	$ 30,999.00	
Black Diamond	$ 87,673.00	$ 64,960.00	
Nanton			

Notes:
All data is from 2018 except where otherwise stated.
1 *High River data provided by High River staff to GHD.*
2 *Okotoks data provided by Okotoks staff to GHD.*
3 *Foothills County data provided by Foothills County to GHD. For recycling centre access, Foothills County pays approximately 1/3 the cost of running the Oilfields Recycling Centre to Turner Valley and 15% of the cost of running the Okotoks Eco Centre. Foothills County and High River are currently working on an agreement where Foothills County is expected to contribute 18% of the costs of the High River Recycle Depot.*
4 *Turner Valley data sourced from the 2018 Budget (Turner Valley, 2018).*
5 *Black Diamond data provided by Black Diamond staff to GHD. Black Diamond reported only net revenue for the Town associated with access to the Oilfields Recycling Centre. Black Diamond contributes to the operating expenses of the Oilfields Recycling Centre and shares the revenue accordingly.*
6 *Limited financial data available for Nanton, sourced from the Nanton's 2017 Financial Statements, which separated out waste and recycling services expenses but not revenues (Nanton, 2018).*

2. Gross Waste Management Costs per Household per Month

The gross costs by waste stream (residual, recyclable, and organic waste) on a per household per month bases is illustrated in Figure A.1 below.

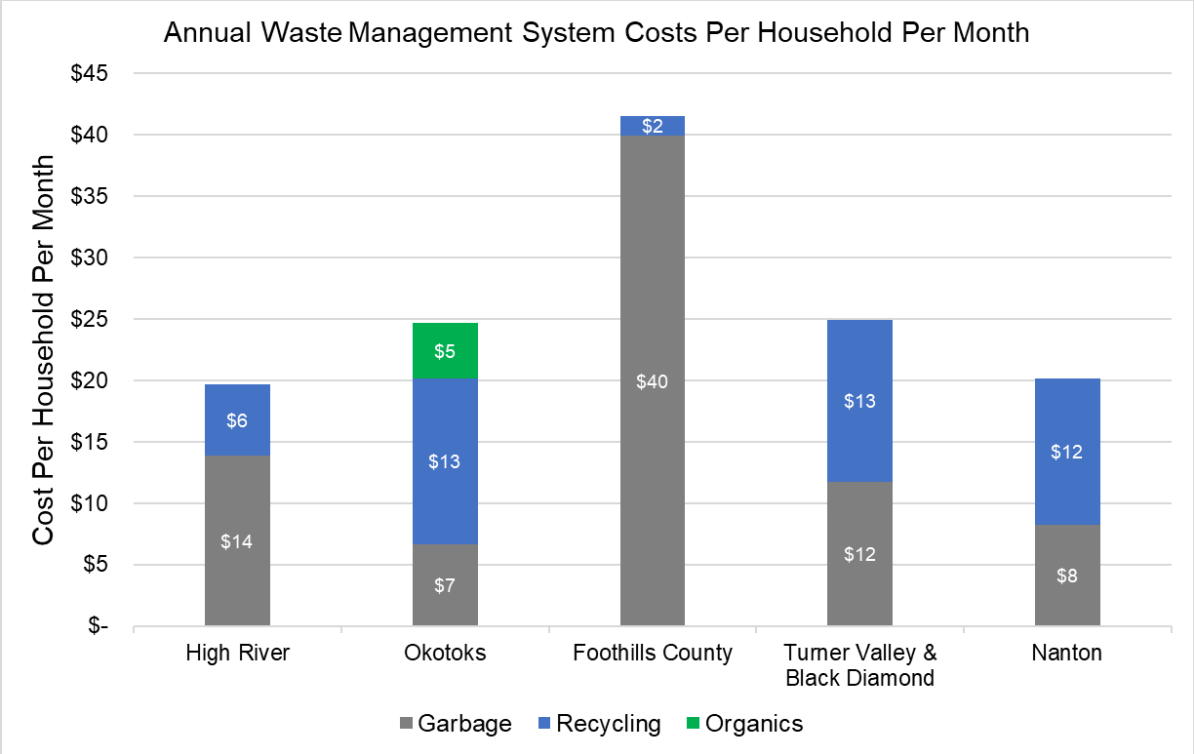

Figure A.1 **Gross System Costs per Household per Month** (Annual expenses paid by each municipality for waste management on a cost per household per month basis, not the monthly fee paid by residents)

Note that there are two types of households in Foothills County: only approx. 400 households receive weekly garbage collection, hence the high regional spending per household involved in the program shown by the grey bar in Figure A.1, and all households - approx. 9,900 households (Alberta Government, 2019) – pay for access to any of the recycling centers in the regions, hence the low regional recycling spending per household. Households in Foothills County can also either enter into private contracts with a waste hauler, self-haul their waste to a transfer station or the LRRC, or engage in on-property burning of waste. The costs for a rural collection program on a small scale are considerably higher than the costs seen in the more densely populated towns in the Region. Efficiencies may be found in increasing the communities involved in the program or combining the existing program with other Partners.

The following insights can be drawn from Figure A.1:

- Okotoks and Nanton offer similar levels of recycling services; they have similar recycling program costs and lower residual waste management costs compared to High River, Turner Valley and Black Diamond. The lower residual waste costs are likely due to reduced disposal costs for the residual waste stream, as well as overall system efficiencies.
- Turner Valley/Black Diamond and High River offer similar level of service for recyclable waste, by operating a recycle centre for drop-off. The per household per month costs incurred to own and operate the Oilfields Recycling Centre in Turner Valley are considerably higher than the costs in High River, although it is not clear why this is the case. Okotoks sees nearly equal per household per

month costs to Turner Valley for operating both a recycling centre and curbside recycling collection, while Turner Valley exclusively operates a recycle centre. This highlights the opportunities for cost savings with higher levels of service.

- Excluding Foothills County, the average total system costs across the Partners is $22.40 per household per month. Okotoks' system is only slightly higher than this average, despite offering an additional stream of collection over the other Partners.
- Excluding Foothills County, the average residual waste system costs per household per month is $10.13. Nanton and Okotoks, who offer additional curbside collection streams, have below-average costs while High River and Turner Valley/Black Diamond, who only offer curbside collection of residual waste, have above-average costs.
- Okotoks has a low per household per month cost for organics of about $5. This is considered quite low for curbside collection and disposal, and is likely due to the efficiencies found by sharing administration, education, staff, etc. costs with the other streams.

3. Gross Waste Management Costs per Capita per Year

The annual gross costs per capita for each waste stream are visualized in Figure A.2 below.

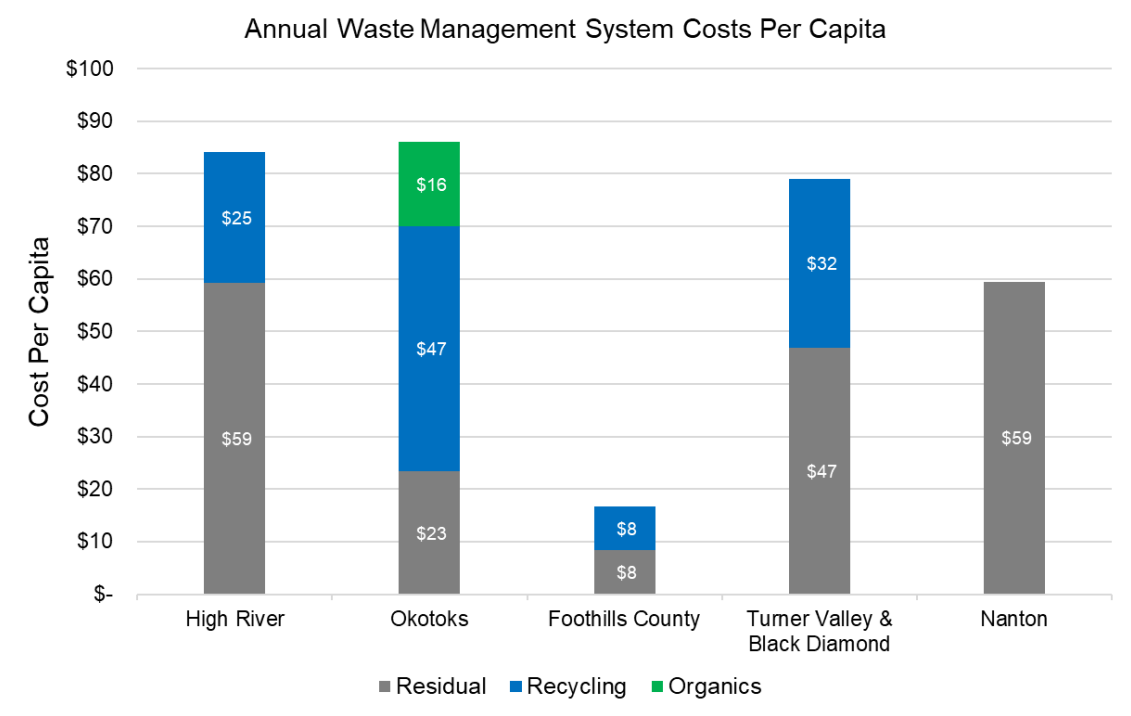

Figure A.2 Gross Costs per Capita per Year

The gross costs per capita data shows a slightly different story than the cost per household per month data, due to the differences in housing between the Partners. Residual waste management costs for Okotoks and Nanton for example, which were roughly equal on a per household per year basis, are now vastly different, with Nanton's cost per capita more than double that of Okotoks'. This is likely due to the greater number of multi-family residences (apartments, etc.) in Okotoks that are not included in the household count for curbside programs.

In general, the cost per household per month shows more reliable data for comparison than the cost per capita, since it includes exclusively the households involved in municipally controlled collection programs.

4. Gross Waste Management Costs per Tonne

The annual waste management system gross costs per tonne of material processed for each waste stream is presented in Figure A.3 below.

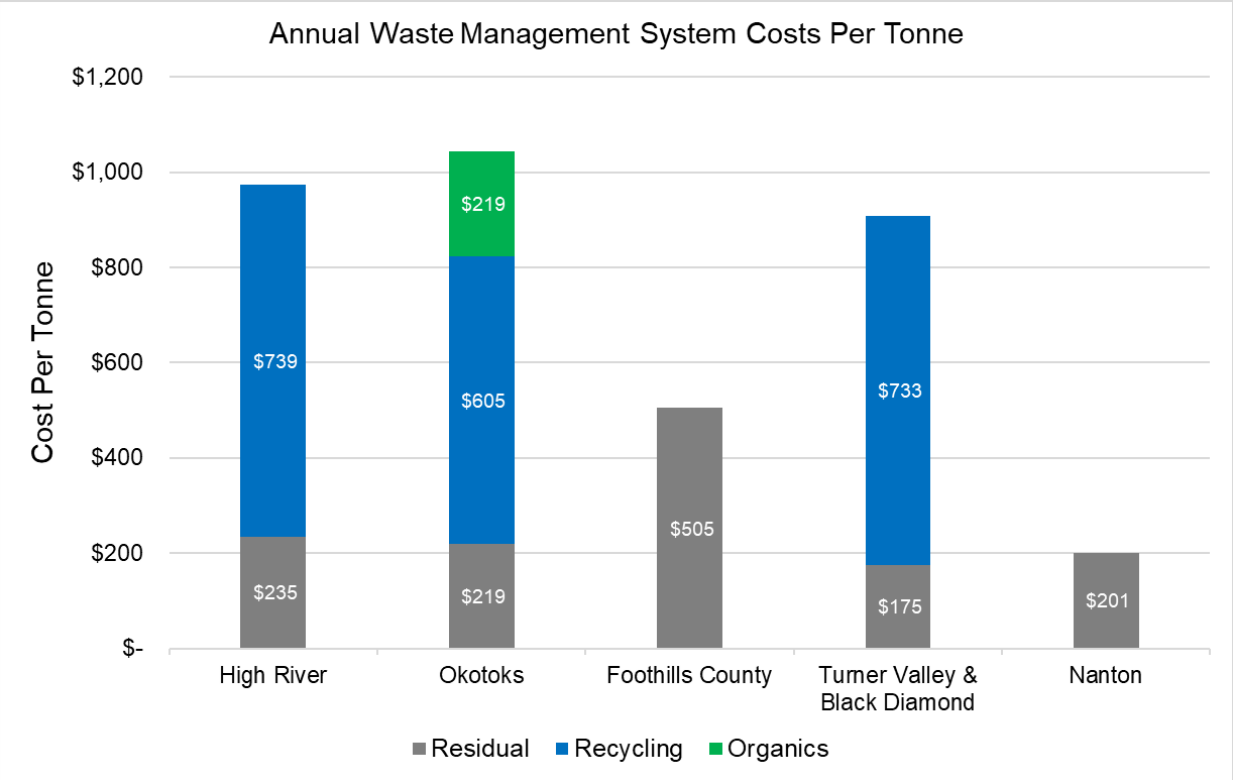

Figure A.3 Gross Waste Management Costs per Tonne

Analyzing the data on a gross cost per tonne basis is an effective way to analyze the efficiencies of different systems. Note that recycling program spending data was not available for this analysis from the Town of Nanton. The following insights can be drawn from the data presented in Figure A.3:

- On a gross cost per tonne basis, the rural residual waste management system in Foothills County is exposed as the least efficient among the Partners. This is due to the low quantities of waste dealt with, low density of households involved in curbside waste collection, and high costs relative to the waste management systems in the more densely populated towns.
- Turner Valley and Black Diamond together have the most efficient residual waste management system at the lowest cost per tonne. This is potentially due to the partnership between the two towns, where assets and resources are shared to execute the curbside collection program. That Okotoks is not the most efficient system on a cost per tonne basis is likely due to the lower tonnage collected as more waste is diverted through curbside recycling and organics collection programs.
- Regarding recycling management, the most efficient system is shown to be Okotoks. This is an expected result because of Okotoks' curbside recycling collection program, which collects a higher tonnage of recyclables at lower cost than recycling depots. High River and Turner Valley/Black

Diamond have relatively equivalent costs per tonne, which aligns with their equivalent level of service. Both operate a recycling centre for drop-off of materials.

- Okotoks' curbside organics collection program is showing a cost per tonne approximately equal to the cost per tonne for residual waste management, despite the processing fees being considerably higher for organic material than the tipping fees for residual waste. This is likely due to the sharing of overhead costs with the other streams. From Okotoks' financial data provided, the Town is paying approximately $210 per tonne of curbside organics collected and processed to the private contractor managing the material. The other $9 per tonne is for overhead expenses for the Town. Considering disposal costs of approximately $100 per tonne of organics, this indicates that the contracted collection service itself is costing approximately $110 per tonne collected.

Appendix B
Service Level and User Fee Comparisons to Similar Regions

Appendix B Service Level and User Fee Comparisons to Similar Regions

The waste management programs offered by the Partners were assessed against similar municipalities and regions in Alberta. Communities outside of Alberta were not considered for direct comparison due to regulatory and societal differences. For example, since British Columbia has an extended producer responsibility (EPR) program in place at the provincial level, the waste streams and waste management systems in BC are not easily comparable to those in Alberta. Table 3.1 below presents the municipalities and regions that were compared against each Partner. 2018 Population data for each jurisdiction is provided for reference.

Table B.1 Waste Management System Comparisons for the Partners

Partner(s)	Municipalities/Regions Compared Against
Nanton (2,181) Turner Valley (2,559) Black Diamond (2,700)	Hanna (2,559) Magrath (2,435) Tofield (2,081) Vulcan (1,917)
High River (13,584)	Lacombe (13,057) Cold Lake (14,961)
Foothills County (22,766)	County of Grande Prairie (22,502) Red Deer County (19,541) Sturgeon County (20,495)
Okotoks (29,002)	Cochrane (27,960) Chestermere (20,732) Spruce Grove (35,766)

The following sections discuss the conclusions drawn when comparing between the Partners and these other municipalities/regions. Detailed information on the waste management systems in the other municipalities/regions is provided in Table B.6 at the end of Attachment B.

1.1 Nanton, Turner Valley, and Black Diamond

Nanton, Turner Valley and Black Diamond were compared against the Towns of Hanna, Magrath, Tofield and Vulcan.

Table B.2 Nanton, Turner Valley and Black Diamond Comparisons against Similar Towns

Waste Stream	Conclusions
Residual Waste	• Nanton, Turner Valley and Black Diamond compare well in terms of collection frequency and type (automatic), but lack the multi-family and ICI services offered by the other similarly-sized towns. • In terms of overall rates for residents, all of the towns are within $5 to $20 monthly, with Turner Valley on the upper end, Nanton and Hanna on the lower-end, and Black Diamond and Magrath having median rates around $14 per month.

Waste Stream	Conclusions
Recyclables	• The Towns of Hanna, Magrath, Tofield and Vulcan each offer drop-off locations recyclable materials that are comparable the depots available to residents of Nanton, Turner Valley and Black Diamond. • Magrath offers curbside recycling collection on a bi-weekly basis, to both single-family and multi-family residences. The collection service is contracted out to a private collector and comes with an extra fee for residents of $12 per month. This is comparable to the curbside collection service offered in Nanton.
Organic Waste	• The Towns of Hanna and Tofield offer a drop-off locations for yard waste and do not offer curbside organics collection, matching the level of service in Turner Valley, Black Diamond and Nanton. • In Hanna and Tofield, food waste can also be dropped off with yard waste. • Hanna also offers curbside yard waste pick-ups in the spring and fall. • Magrath and Vulcan do not offer any food or yard waste diversion opportunities.

1.2 High River

High River was compared against the Cities of Cold Lake and Lacombe.

Table B.3 High River Comparisons to Similar Regions

Waste Stream	Conclusions
Residual Waste	• Both Lacombe and Cold Lake offer weekly, automated, curbside garbage collection using vehicles owned and operated by the municipalities. Service is provided to single-family and some multi-family residences. • Cold Lake also has its own transfer station for bulky items, recyclables, and ICI customers. • At $19 per month, the monthly fee for waste collection and transfer station drop off charged by Cold Lake is considerably higher than the monthly fee charged in High River ($13.65). • Lacombe's whole curbside program charged approximately $27 per month when the curbside recycling program was offered; the new cost to residents now that recycling collection has expired is not yet known.
Recyclables	• Lacombe recently ended its curbside recycling program due to market constraints and high costs. Lacombe still operates a recycling depot for residents; the depot collects slightly fewer streams than the depot in High River. • Cold Lake collects recyclables manually for both single-family and multi-family residences. The collection assets and program is owned and operated by Cold Lake, at a cost to residents of $9.25 monthly.
Organic Waste	• Cold Lake offers curbside organics collection during half the year for yard and food waste as well as a drop-off location for both streams, for an additional monthly charge of $1.50. Curbside collection is provided bi-weekly from April through October, and is primarily intended for grass, leaf and yard waste, though residents can add kitchen scraps to their collection bags. • Lacombe does not offer regular curbside organics collection or a drop-off location, but does run a grass and yard waste pick-up occasionally throughout the year. • High River does not accept food waste and does not offer a curbside collection service, but does operate the yard waste drop off facility year-round.

1.3 Foothills County

Foothills County was compared against the County of Grande Prairie, Red Deer County, and Sturgeon County.

Table B.4 Foothills County Comparisons to Similar Regions

Waste Stream	Conclusions
Residual Waste	• The County of Grande Prairie provides automated, weekly, curbside collection to single-family and some multi-family households in select communities that make up a small fraction of the County's rural population. The monthly rate for households is $9.25. Carts are the property of the County, while the collection service is contracted out to Prairie Disposal. • Red Deer County provides bagged garbage collection on a weekly basis, also to a fraction of select communities. The monthly rate for households is $15.50. Bags are purchased by residents and placed at the curb for collection, and the collection service is contracted out to a private hauler. • Sturgeon County does not provide any form of collection service to residents. Residents can self-haul to a transfer station or landfill. • The level of service provided by Foothills County most aligns with that provided by the County of Grande Prairie, and is a higher level of service than that offered by Sturgeon County. Foothills County has a higher monthly rate to households in the program, at $21.00.
Recyclables	• Red Deer County and Sturgeon County offer levels of service very similar to each other and to Foothills County. The County of Grande Prairie offers community drop-off bins that are collected weekly in ten communities in the County. Residents in all three regions have the option of separating recyclables at transfer stations or landfills in the area.
Organic Waste	• The County of Grande Prairie provides backyard composting solutions for residents to encourage diversion from landfill. There are no composting operations at the landfill. • Red Deer County also promotes and sells backyard composting solutions. • Sturgeon County does not provide organics waste reduction initiatives to residents, nor does it collect yard waste separately from household waste at the landfill or transfer station.

1.4 Okotoks

Okotoks was compared to the Towns of Chestermere, Cochrane, and Spruce Grove.

Fees in all four towns are combined into packages for residents rather than separated out by stream. Okotoks charges single-family dwellings a fee of $22.07 per month that covers the cost of standard services for garbage, recycling and organics collection (120 L residual waste cart, 120 L organics, 240 L recycling). Cochrane, Chestermere, and Spruce Grove likewise charge a combined fee for all three streams. Cochrane charges $22.55 per month (120 L residual waste cart, 120 L organics, 240 L recycling), Chestermere charges $23.03 per month (biweekly bagged residual waste, 120 L organics, 120 L recycling), and Spruce Grove charges $25.25 per month (120 L residual waste cart, 240 L organics, blue bag recycling). Due to the combination of the fees for all three streams, it is not possible to compare fees on a stream by stream basis. However, the total fee charged by the four towns are very similar for similar services.

Table B.5 Okotoks Comparisons to Similar Regions

Waste Stream	Conclusions
Residual Waste	• Cochrane and Spruce Grove provide weekly, automated collection for single-family residents and a select number of multi-family and ICI customers, with 120 L carts for single-family residents. Spruce Grove offers the choice of a 240 L cart for a higher fee. • Chestermere provides bi-weekly bagged garbage curbside collection for single-family and multi-family residences. • Cochrane contracts out the service to a private collector, while Chestermere uses the municipally-controlled Chestermere Utilities Inc. to provide the service.
Recyclables	• Cochrane, Chestermere, and Spruce Grove all offer weekly curbside collection of recyclables that is similar to the service in Okotoks. The services are contracted out to third party collectors in all jurisdictions covered by the review. Cochrane provides 240 L carts to residents, Chestermere offers 120 L or 360 L options, and Spruce Grove residents place materials in blue recycling bags. All three municipalities also provide drop-off locations for additional recyclables.
Organic Waste	• Cochrane and Chestermere both offer comingled curbside organics collection with 120 L and 240 L carts collected weekly from April through October and bi-weekly from November through March. In Chestermere, residents living on the lake are given an extra 360 L cart for lake weeds. The service is offered for single-family and multi-family residences, excluding commercial businesses, in both municipalities. • Spruce Grove offers comingled curbside organics collection on a weekly schedule from April to November with 240 L carts; collection frequency is reduced to monthly pick-ups from December through March. The service is offered for single-family residents only. • In all three municipalities, the service is provided by a third-party contractor, and yard waste can also be dropped off at local eco/recycling centres.

Table B.6 Waste Collection Programs in Similar Regions/Municipalities

Regional Solid Waste Management Plan for the Foothills Region Partners
Prepared by GHD Limited
Data Gathered and Valid for July 2019

		Residual Waste Collection						Recycling Collection						Organic Waste Collection					
Community Name	Pop. (2016)	Cart Size	Collection Frequency	Who Is Serviced	Who Operates Collection	Monthly Rate for Residents	Self-Haul available?	Cart Size	Collection Frequency	Who Is Serviced	Who Operates Collection	Monthly Rate for Residents	Recycle Depot	Cart Size	Collection Frequency	Who Is Serviced	Who Operates Collection	Monthly Rate for Residents	Drop-Off Location?
Cochrane	27,960	120L	Weekly	SF, MF, and ICI	Private	$21.55 (Jan-April) and $22.55 (May to Dec)	Yes	240L	Weekly	SF and MF	Private	Collection cost included in garbage collection rate, $5 for Eco Centre	Yes	240L for SF & duplexes, 120L for Townhomes	Weekly mid-Apr. to mid-Oct., bi-weekly mid-Oct. to mid-Apr.	SF and MF	Private	Incl. in garbage rate	Yard only
Chestermere	20,732	Use bags	Bi-weekly	SF and MF	Municipally-controlled private entity (Chestermere Utilities Incorporated)	$23.03	Yes	360L or 120L	Weekly	SF and MF	Private	Collection cost included in garbage collection rate, $4.09 for Recycle Centre	Yes	240L or 120L	Weekly Apr. to Oct., bi-weekly Nov. to Mar.	SF and MF	Private	Incl. in garbage rate	Yard only
Spruce Grove	35,766	120L or 240L	Weekly	SF and MF	Private	$25.25 for 120L $28.50 for 240L	Yes	Use bags	Weekly	SF and MF	Private	Included in garbage collection price	Yes	240 L	Weekly mid-Apr. to mid-Nov., monthly mid-Nov. to mid-Apr.	SF	Private	Incl. in garbage rate	Yard only
Lacombe	13,057		Weekly	SF and MF	City	$26.98 for dwelling unit and $15.84 for apartments	No	Curbside recycling collection expired on May 31, 2019, City decided to no longer collect recyclables					Yes	Curbside collection not available					No
Cold Lake	14,961	240L	Weekly	SF and MF	City	$19	Yes	Use bags	Bi-weekly	SF and MF	City	$9.25	Yes	Large paper bags or bundle branches	Bi-weekly Apr. to mid-Nov., no collection mid-Nov. to Mar.	SF and MF	City	$1.50	Yard & Food
Hanna	2,559	Use bags	Weekly	SF and MF	Private	$5.50	Yes	Curbside collection not available					Yes	Curbside collection not available. 2 annual cleanups in spring and fall.					Yard & Food
Magrath	2,435	360L or 240L	Weekly	SF, MF, and ICI	Town	$14	Yes	Small blue box	Bi-weekly	SF and MF	Private	$12	Yes	Curbside collection not available					No
Tofield	2,081		Weekly	SF, MF, and ICI	Regional commission (Beaver Municipal Solutions)	$10 for residential, $15 for grocery stores, and $20 for restaurants	Yes	Curbside collection not available					Yes	Curbside collection not available					Yard & Food
Vulcan	1,917		Weekly	SF, MF, and ICI	Regional commission (Vulcan District & Waste Commission)	$10	Yes	Curbside collection not available					Yes	Curbside collection not available					No
County of Grande Prairie	22,502	240L	Weekly	SF, and MF	Private (Prairie Disposal Ltd.)	$9.25	Yes	Use bags	Weekly	SF and MF	Private (Prairie Disposal Ltd.)	$4.50	Yes	Curbside collection not available					No
Red Deer County	19,541	Use bags	Weekly	SF, and MF	Private	$15.50	Yes	Curbside collection not available					No	Curbside collection not available					Yard only
Sturgeon County	20,495	Curbside collection not available					Yes	Curbside collection not available					No	Curbside collection not available					No

Appendix C
Waste Tonnage Projections

Appendix C Waste Tonnage Projections

Waste tonnage projections were completed for four waste management system options:

1. Regional curbside collection of residual waste only, with collection systems for other streams remaining under status quo operation.
2. Regional curbside collection of residual and recyclable waste, with collection systems for other streams and depot recycling systems remaining under status quo operation.
3. Regional curbside collection of residual and organic waste, with collection systems for other streams and self-haul of yard waste to the LRRC remaining under status quo operation.
4. Regional curbside collection of residual, recyclable, and organic waste, with depot recycling and self-haul of yard waste to the LRRC remaining under status quo operation.

The generation and potential collection quantities of each waste stream (residual, recyclable, and organic waste) was estimated overtime and the results used to evaluate the needs of each option in terms of assets, resources, and costs. The following sections describe the assumptions used to generate the waste tonnage projections and present the projections gathered.

1. Assumptions

Projected waste generation and collection tonnages are ultimately based on two values: household growth over time and the rate of generation or collection per household per year.

- Household growth rates are estimated based on planning data provided by each municipality where available. Each municipality provided the number of households currently enrolled in curbside collection programs, which primarily consisted of single-family households, and the expected annual growth in households enrolled over the coming years. Household growth rate estimates were not available for Nanton, Black Diamond and Turner Valley. For these towns, the growth rate was estimated to be 0.5 percent based on current trends.
- Tonnes per household per year for waste collection were based on historical data for all cases except in the cases of new programs of curbside recycling collection and curbside organics collection.
    - For curbside recycling collection, it was assumed that new collection programs would ramp up over a period of 5-years to the current collection rates seen in Okotoks, since Okotoks' system is well established and operating at best practice levels when compared to other programs across Canada. Quantities collected at local recycling depots are also expected to be impacted by the introduction of curbside collection programs, as there is reduced effort required to place recyclables at the curb than to self-haul and self-sort material at drop-off locations. To account for this, the projection models assume that collection quantities at local depots drop to the levels seen at the Okotoks Eco Centre, on a tonnes per household basis.
    - For curbside organics collection, it was assumed that the new collection programs would ramp up over a period of 5-years to the current collection rates seen in Okotoks, then further ramp up over another 5-years to best practice levels seen by the City of Guelph. Guelph has achieved best practice levels from their green cart collection program that operates similarly to the program in Okotoks, at 334 kg collected per household per year (RPRA, 2018). The collection program in

Okotoks is also assumed to ramp up from current levels in 2020 to Guelph levels by 2025, to account for advanced public education and efficiencies under a regionalized system.

- Waste generation quantities and breakdown by stream were estimated based on historical total waste generation (determined from total waste collection across all streams and collection methods) and waste composition results for the Town of Okotoks. Total waste generation per household per year remained constant overtime, while material shifted from the residual waste category into diversion categories as curbside recycling and organics programs were introduced into the models. GHD used waste composition data from the single-family residential sector in the Town of Okotoks to estimate the residential waste composition across all Partners. The composition of waste generated in Okotoks was determined from the combination of the three-stream curbside collection program, the Eco Centre, and yard waste delivered to the LRRC. The results of the Waste Composition Study for the Town of Okotoks (Tetra Tech, 2018) also contributed to GHD's understanding of contamination levels in the curbside residual waste and recycling streams. As there is no available data on the proportion of food waste and yard waste collected in the curbside organics program, GHD applied the average food waste capture rate from three organic waste collection programs that collect food-waste only (BC Government, 2012a, 2012b, 2012c) to estimate the portion of green cart material that is food waste, and assumed the rest of the material collected in Okotoks' green cart program is yard waste.

2. Tonnage Projections Overtime

The tonnes of material collected in each stream for the collective Partners and each regional options are presented in the figures that follow.

2.1 Regionalization of Residual Waste Collection Only

The regionalization of residual waste collection only represents approximately a status quo situation where, at least from the perspective of residents, there is minimal change to waste collection. While ownership of assets and resources may change, the actual collection of materials will not. Under this option, residual waste collection is regionalized across the Partners while other existing waste management systems (i.e. recycling centres, curbside recycling and organics collection, yard waste self-haul to the LRRC) is not regionalized.

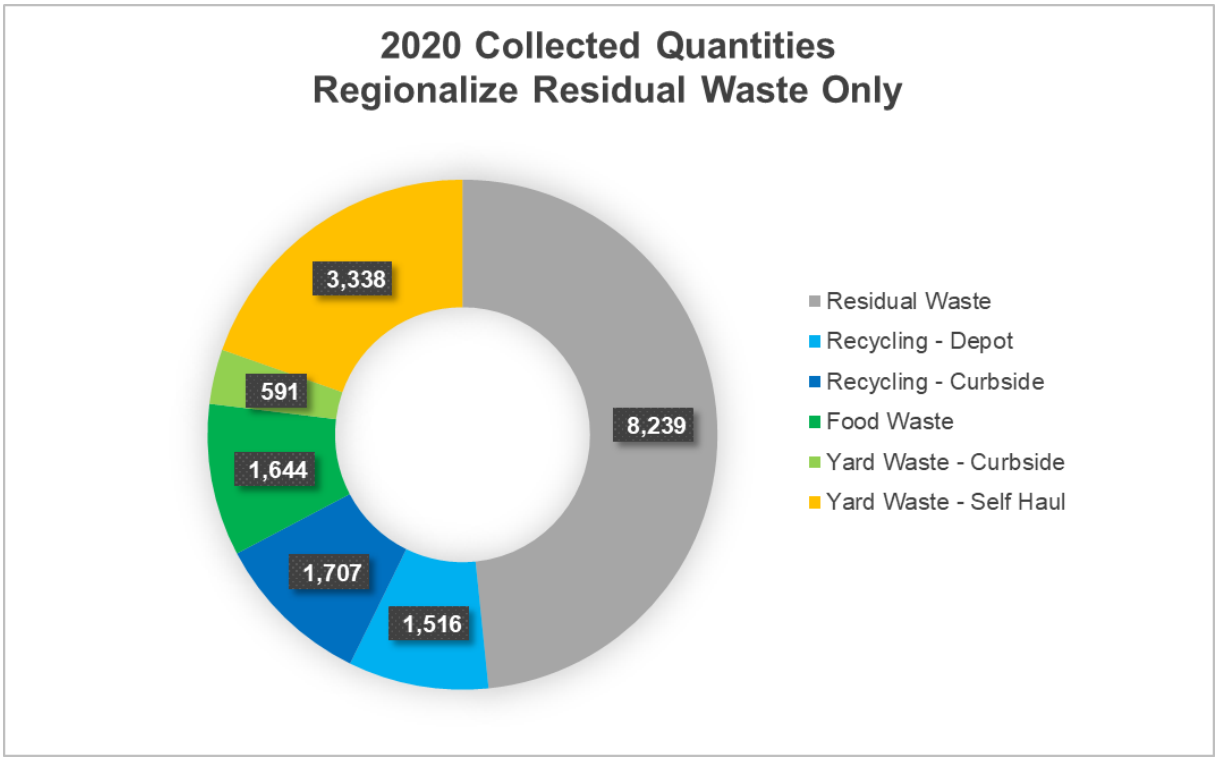

Figure C.1 2020 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste Collection, with Other Systems Operating as Status-Quo

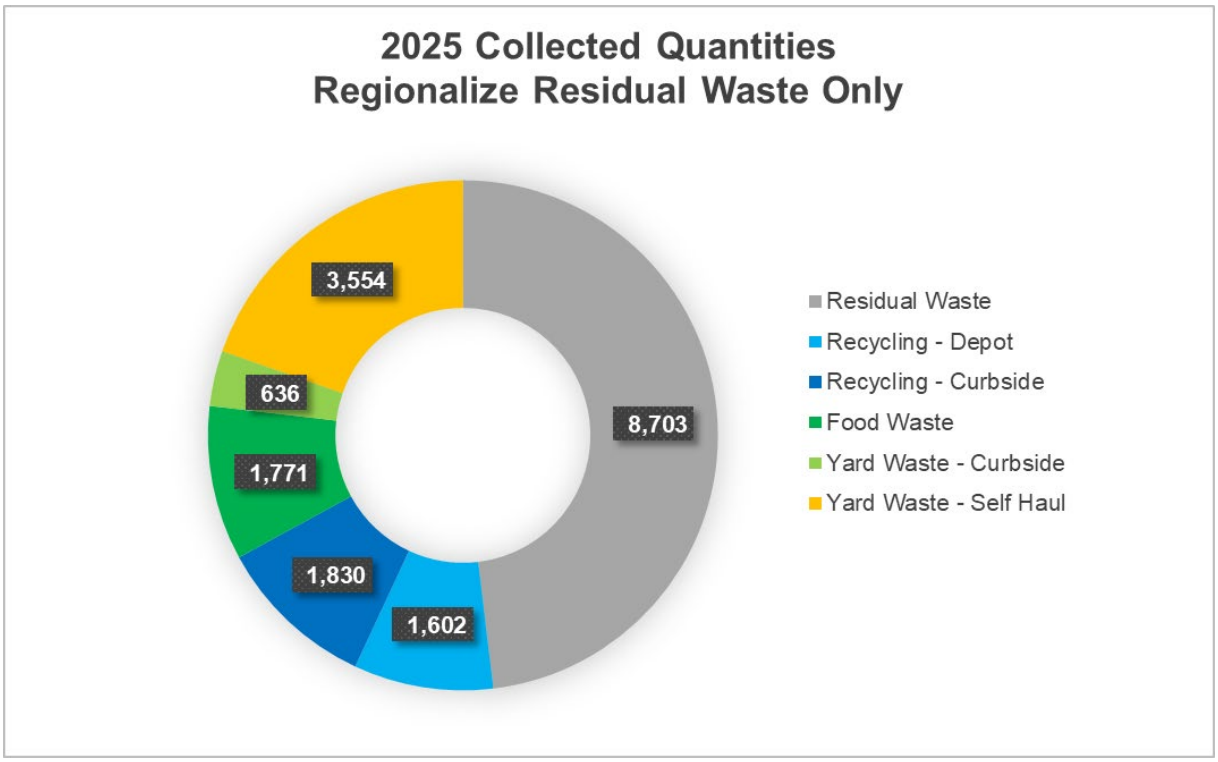

Figure C.2 2025 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste Collection, with Other Systems Operating as Status-Quo

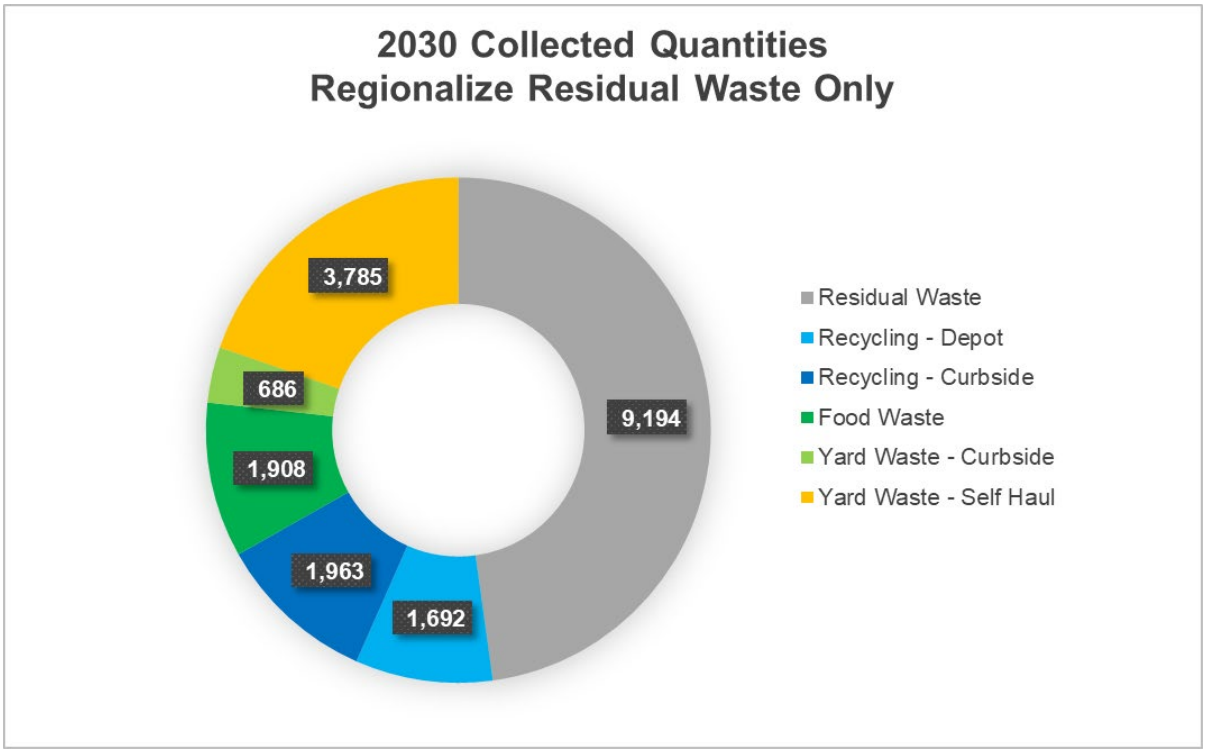

Figure C.3 2030 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste Collection, with Other Systems Operating as Status-Quo

2.2 Regional Residual and Recycling Waste Collection

In option 2, the curbside collection of residual waste is regionalized as well as the curbside collection of recyclable waste. For High River, Turner Valley, Black Diamond, and the households enrolled in the curbside program in Foothills County, this means launching a new curbside recycling collection program. The resulting tonnages for 2020, 2025, and 2030 are presented below. The other existing programs, such as Okotoks' curbside organics collection program, continues operating as status-quo.

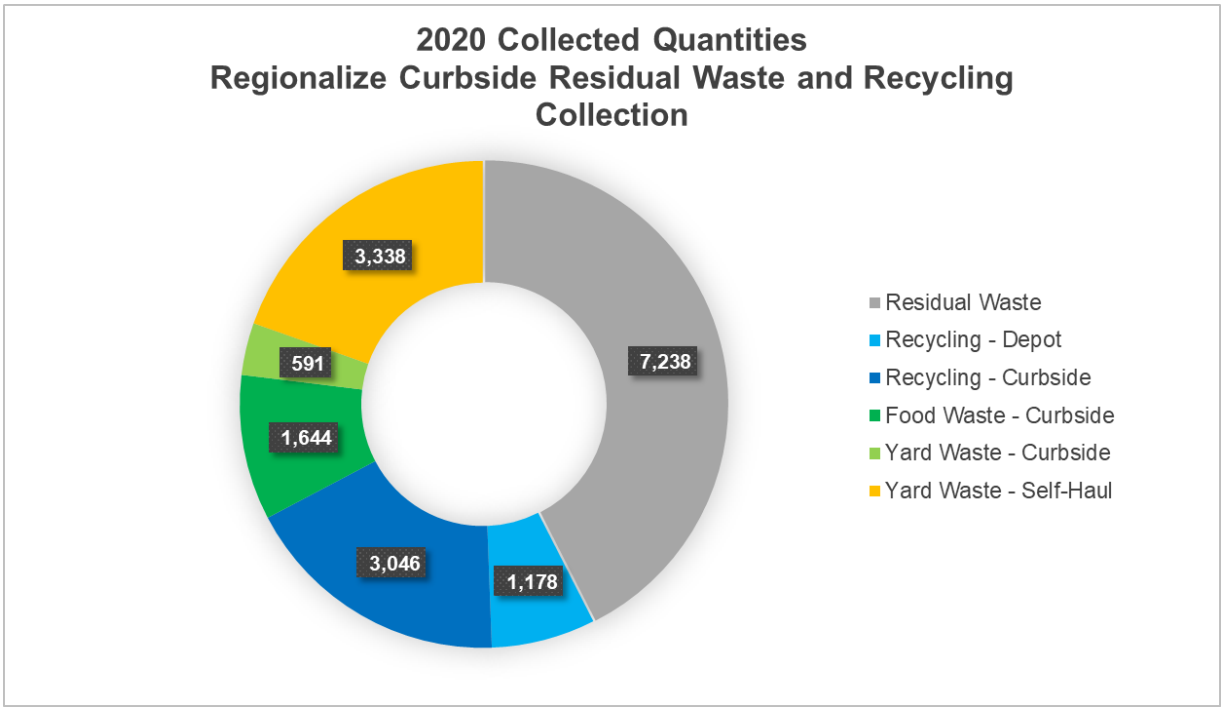

Figure C.4 2020 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Recycling Collection, with Other Systems Operating as Status-Quo

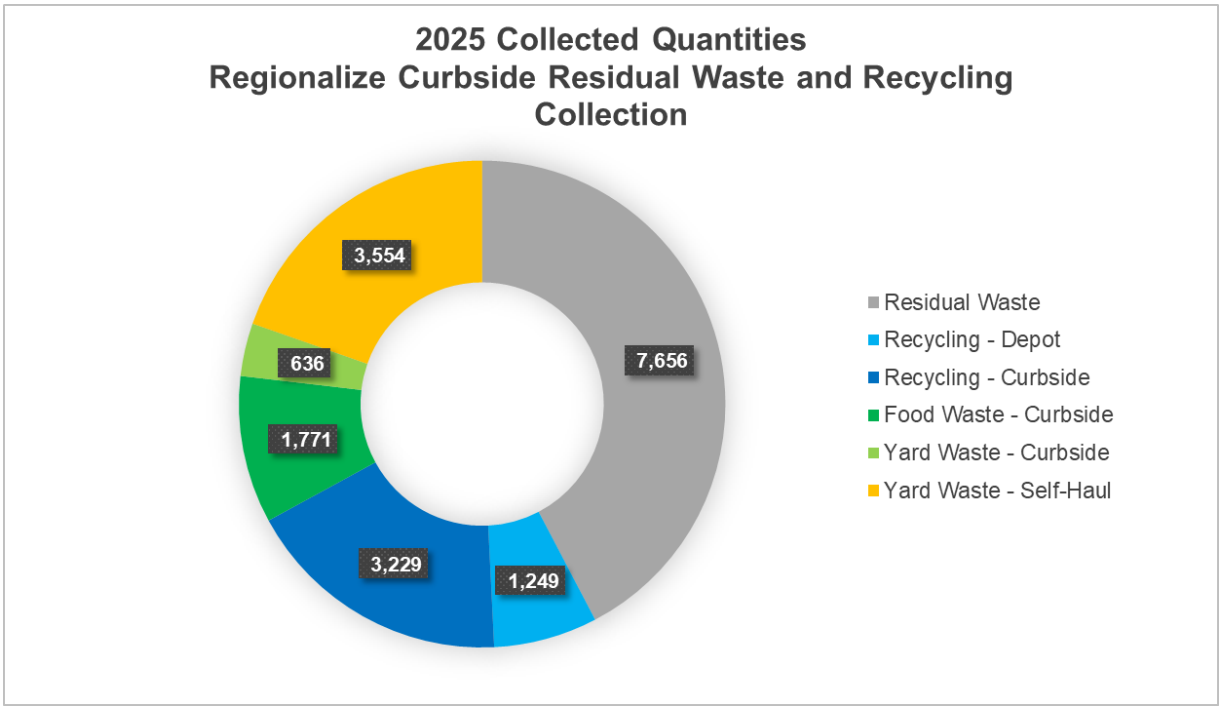

Figure C.5 2025 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Recycling Collection, with Other Systems Operating as Status-Quo

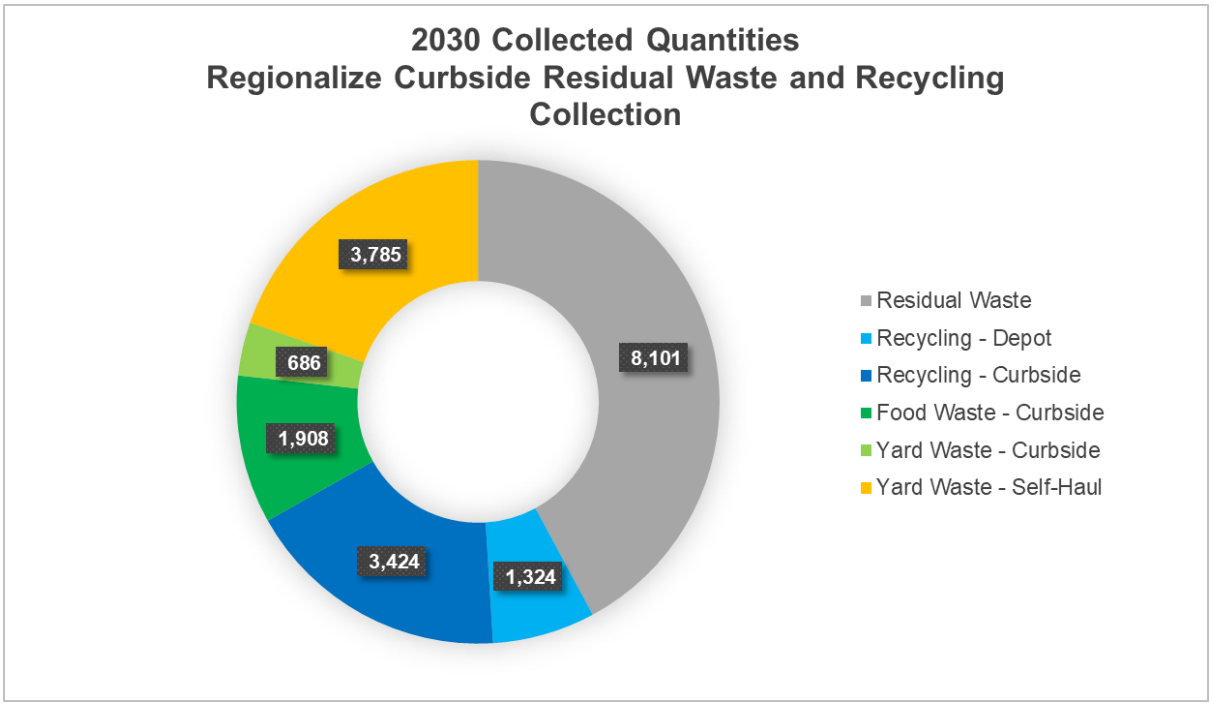

Figure C.6 2030 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Recycling Collection, with Other Systems Operating as Status-Quo

2.3 Regional Residual and Organic Waste Collection

In option 3, the curbside collection of residual waste is regionalized as well as the curbside collection of organic waste. For Nanton, High River, Turner Valley, Black Diamond, and the households enrolled in the curbside program in Foothills County, this means launching a new curbside organics collection program. The resulting tonnages for 2020, 2025, and 2030 are presented below. The other existing programs, such as the curbside recycling collection programs in Nanton and Okotoks, continue operating as status-quo. As can be seen in the data presented, significant diversion from the residual waste stream is achieved through implementation of a curbside organics collection program, particularly as public participation and buy-in increases overtime with regionalized education and outreach efforts.

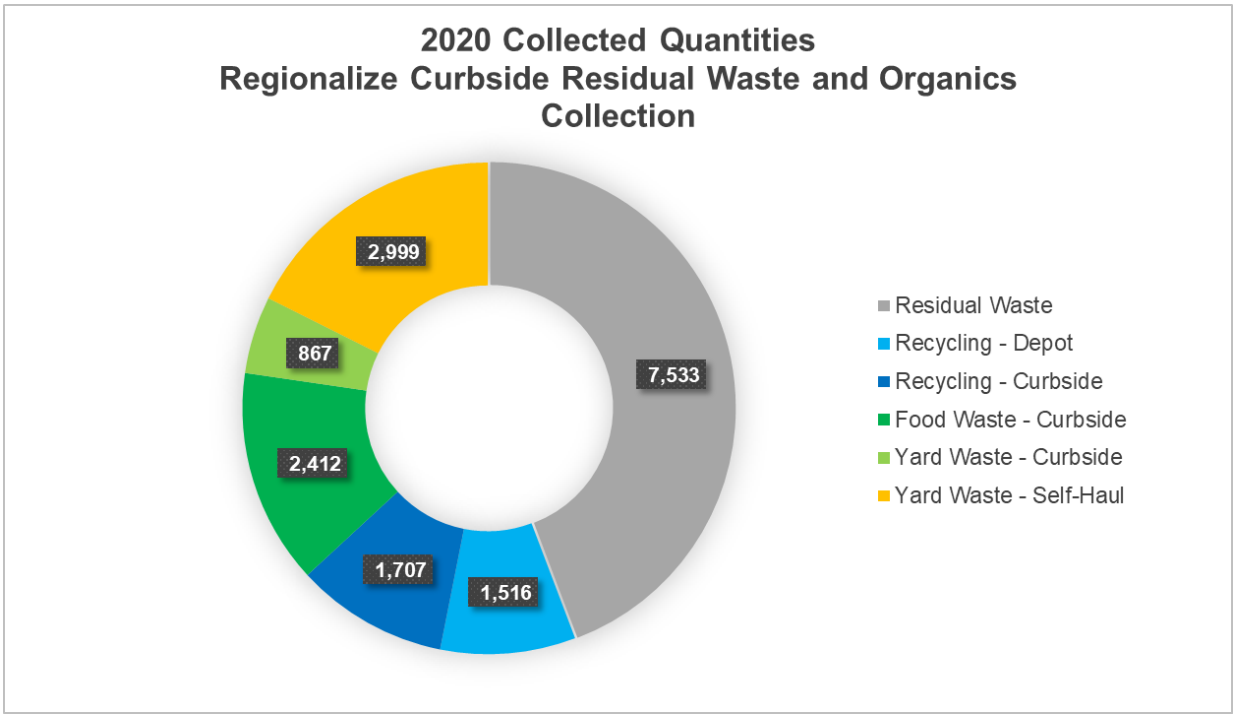

Figure C.7 2020 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Organics Collection, with Other Systems Operating as Status-Quo

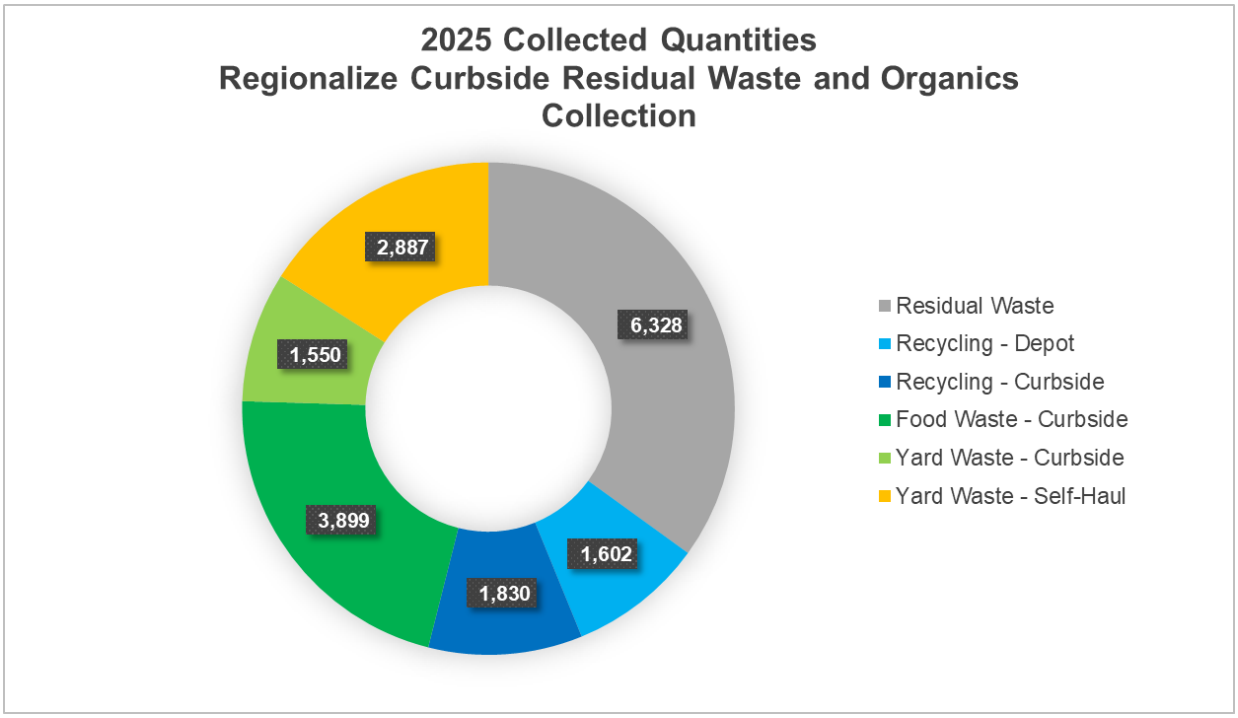

Figure C.8 2025 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Organics Collection, with Other Systems Operating as Status-Quo

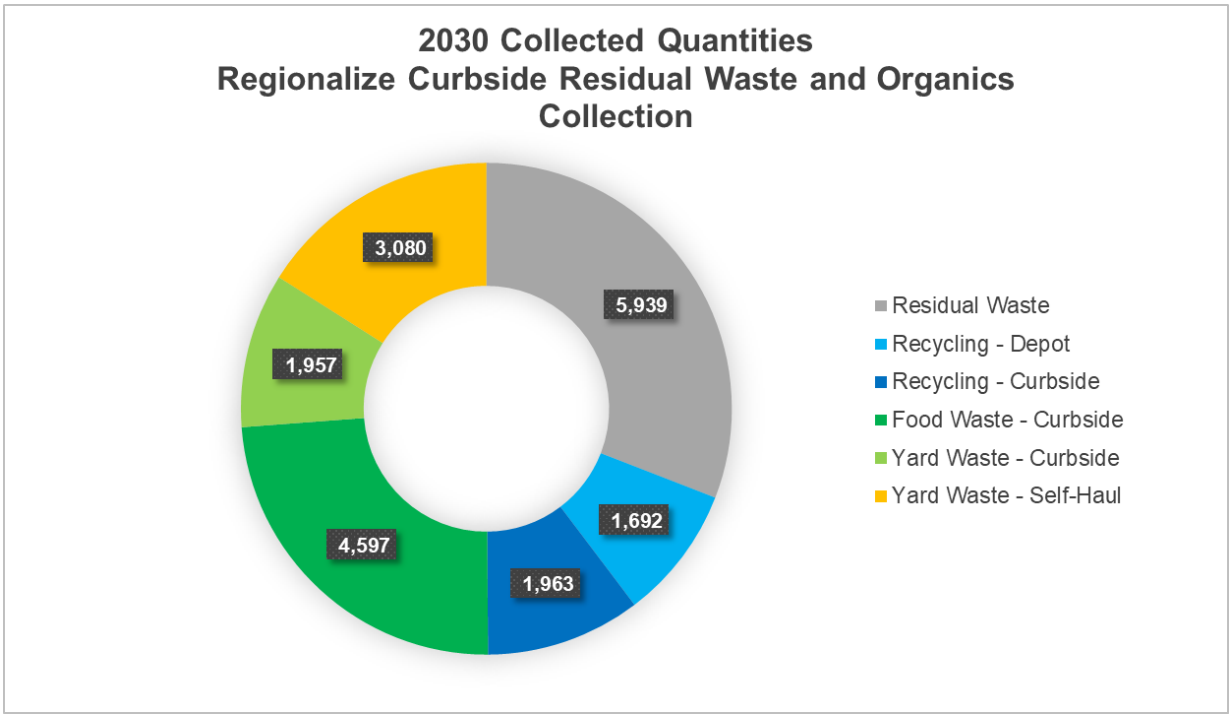

Figure C.9 2030 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste and Organics Collection, with Other Systems Operating as Status-Quo

2.4 Regional Three-Stream Curbside Collection

In option 3, the curbside collection of residual waste is regionalized as well as the curbside collection of recyclables and organic waste. For Nanton, High River, Turner Valley, Black Diamond, and the households enrolled in the curbside program in Foothills County, this means launching a new curbside organics collection program and a new curbside recycling collection program for each Partner except Nanton and Okotoks. These additional diversion streams contribute to significant diversion from the residual waste stream. The resulting tonnages for 2020, 2025, and 2030 are presented below.

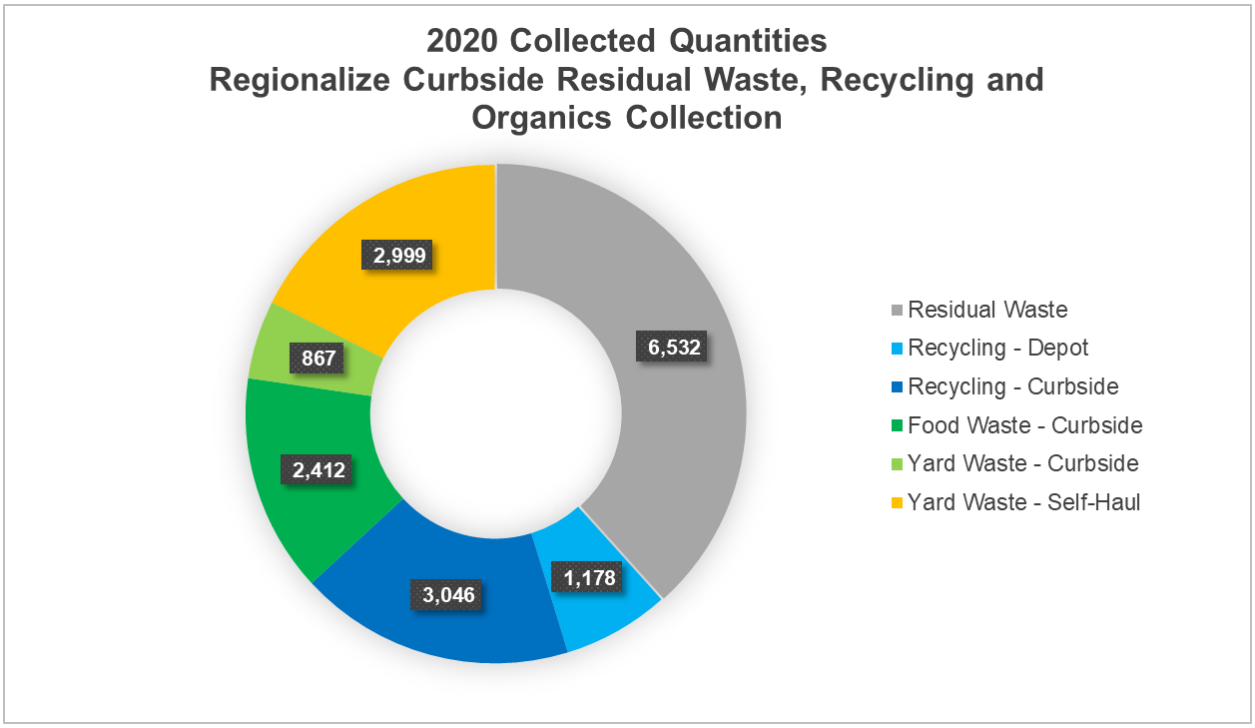

Figure C.10 2020 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste, Recyclables and Organic Waste Collection

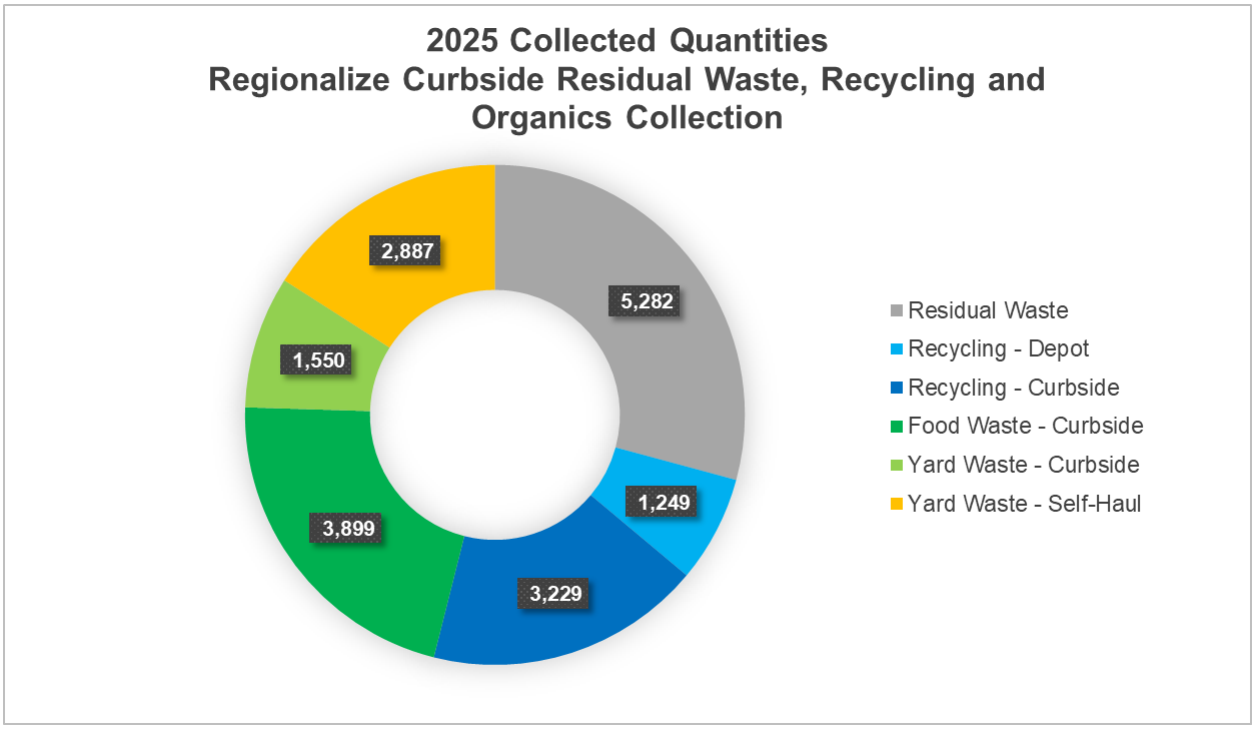

Figure C.11 2025 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste, Recyclables and Organic Waste Collection

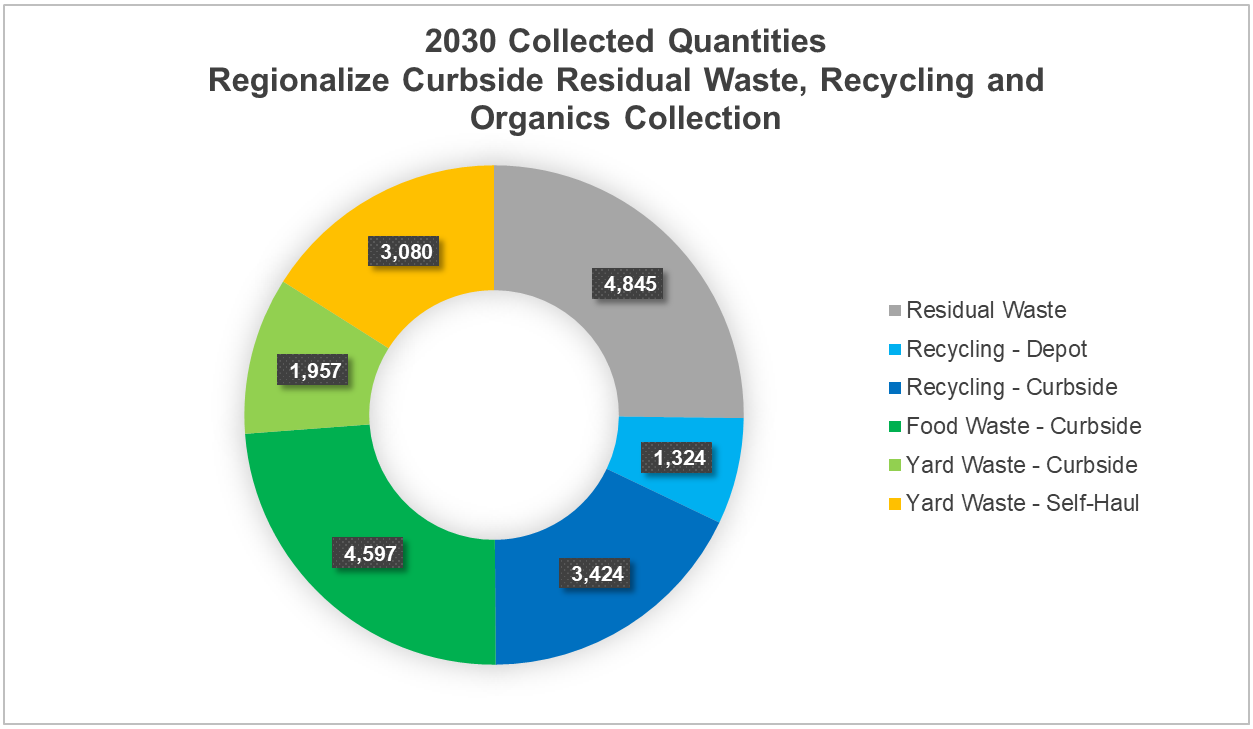

Figure C.12 2030 Waste Material Collection by Stream and Collection Method for Regionalized Residual Waste, Recyclables and Organic Waste Collection

3. References

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Appendix D
Assessment of Regional Collection Options

Appendix D Assessment of Regional Collection Options

Each Partner runs its own waste collection programs, with the exception of the trucks shared by Turner Valley and Black Diamond for residual waste collection. The overall regional efficiency could be improved by regionalizing collection programs. For example, collection assets (i.e. trucks, storage), resources required to run the program (i.e. administration, financing), and education and public outreach efforts could be shared. If the collection service is contracted out to a third party, as is currently the case for Okotoks' recycling and organics collection programs, the Partners could enter under the same contract, which is likely to reduce the costs and administrative complexity.

GHD understands that all Partners are interested in joining a regionalized collection program, dependent on the impact on the costs for the households involved. For the purposes of this study, we have called the regionalized municipalities "the Partnership".

The evaluation below begins by discussing the characteristics of waste management programs and best practices. Waste generation and collection projections, presented in Appendix C, are then used to evaluate collection and disposal costs for each of the following regionalization options:

1. Regionalized collection of residual waste only
2. Regionalized collection of residual waste and recyclables
3. Regionalized collection of residual waste and organic waste
4. Regionalized collection of all three waste streams

1. Characteristics of Collection Programs and Best Practices

Curbside waste collection programs can be described by a set of key characteristics that include:

- Automated vs. manual collection
- Frequency of collection, i.e. weekly, bi-weekly, monthly
- Dual-stream vs. single-stream recycling and organics collection
- Type and size of collection carts/bags
- Included and excluded materials
- Customers included in the program, i.e. single-family residential, multi-family residential, ICI organizations
- Ownership and operation of the service (public vs. private/contracted out)

These characteristics are discussed in the following sub-sections.

1.1 Automated vs. Manual Collection

Automated collection of waste has existed in North America for at least 30-years. Automated collection offers increased efficiency and safety compared to manual collection. With fully automated collection, staff are not required to exit the collection truck during collection, and manual lifting of waste receptacles is not required. These factors increase collection route efficiency and greatly mitigate safety concerns for collection truck operators.

All Partners provide automated collection services. There is no need to consider changing the current programs with respect to this characteristic.

1.2 Frequency of Collection

The frequency of collection is tied-in to the number of waste streams collected at the curb and the size of carts that residents are given. When the only collection service is for residual waste, collection should be offered weekly. Services that collect both residual waste and recyclables, or residual waste and organics, typically collect both streams weekly. Depending on the quantity and composition of waste generated in the area, reducing the residual waste collection to bi-weekly may be considered to increase diversion and save on collection costs.

A fully integrated system that seeks to maximize both efficiency and diversion typically offers collection of organic waste every week, and alternates weeks of collecting recyclables and residual waste. Weekly collection of organic waste is preferred at least from spring to fall due to the potential for the waste stream to generate odours and the higher quantities of yard waste produced. If residents use their organic waste carts well (i.e. with minimal contamination), the residual waste should be largely inert and the quantity collected per capita should be greatly reduced, making bi-weekly collection of residual waste a viable option.

Higher operating costs are associated with higher frequency of collection. If collection costs are not a major consideration, collection of all three streams can be offered weekly, or weekly collection of recyclables can be offered with weekly collection of organics and bi-weekly collection of residual waste. Collecting recyclables weekly encourages residents to fully utilize the service and divert material from the residual stream, particularly with the present popularity of online shopping, which has had an observable impact on the quantity of cardboard generated by households.

1.3 Dual-Stream vs. Single-Stream Recycling Collection

Recyclable waste can be collected as a single stream, with all recyclable materials placed together in a single collection cart, or as two or more streams. Dual stream systems focus on separating fibres from other materials; multi-stream systems further separate specific types of fibres and/or container types. Table 4.1 outlines some of the advantages and disadvantages of each approach.

Table D.1 Assessment of Recycling Collection Models

Collection Model	Advantages	Disadvantages
Single Stream	• Increased participation since rules are easier to understand • Reduced collection costs • Opportunity to use automated collection and to implement a fully integrated system	• Higher material recovery and processing costs, including both capital investment (need for high tech equipment) & operating cost per tonne • Perceived higher levels of contamination • Perceived lower recovery rates & quality of recovered materials

Collection Model	Advantages	Disadvantages
Dual Stream	• Relies on increased & more effective separation at source by resident • Lower processing costs, including both capital expenditure (less high tech sorting equipment) and operating costs per tonne • Perceived higher recovery rates & quality of recovered materials • Perceived lower contamination	• Can lead to decreased participation when residents are not sure what to do, or not motivated enough to participate with the higher level of effort required • Higher collection costs to collect multiple containers and difficult to implement automated collection • Typical to experience high levels of cross contamination. Fibre migrates into container stream and vice versa. Cross contamination can originate at source and/or during collection.

The following additional notes should be considered when comparing single and dual/multi-stream collection models:

- The contamination level is more a function of awareness and education than the collection system used. High contamination rates can occur in either system if residents do not buy-in to the program.
- Cross contamination is often over looked, is difficult to remedy at the source, and is difficult to manage it effectively.
- Lowest net cost can be found with either approach and is dependent on local factors & circumstances.
- There is no universally preferred model; the choice of systems must be evaluated by each community.
- The impact of glass is similar within both systems. Glass should be separated at the curb or excluded from the system.

1.4 Dual-Stream vs. Single-Stream Organic Waste Collection

Curbside organic waste collection programs are either single-stream or dual-stream. In dual-stream collection, food waste (i.e. kitchen scraps) and yard waste (i.e. grass, leaf, yard waste) are collected separately, while in single-stream collection (also referred to as comingled collection) all organic material is collected in the same cart. The choice of dual-stream or single-stream collection has implications for the choice of organics processing technology, as the collection system determines the feedstock quality and quantity. Collecting the streams separately has higher collection costs than collecting them together, whereas processing separate streams is less expensive than processing comingled streams. Processing costs are generally lower when the streams are collected separately due to easier requirements for managing clean yard waste, compared to food waste. Comingled material must be processed according to the higher standards and controls associated with food waste, while a yard waste-only stream can be processed with minimal controls.

Ideally, the decision about collection should be made in conjunction with a decision about the preferred organics processing technology. If the Partners decide to invest in developing an organics processing facility (OPF), whether it maintains ownership itself or collaborates with a private organization, the collection method will have a significant impact on the processing technology options. If the Partners decide to send collected material to an existing merchant facility, the feedstock requirements of the facility will dictate the acceptable types of organic waste collected.

1.5 Container Size and Bagging Material

The frequency of collection is related to the quantity and size of collection carts/bags. Frequent collection means smaller collection containers can be used, while less frequent collection typically requires larger containers. The size of collection container for each stream can also be set to encourage the use of diversion programs.

Automated collection carts for single-family residences generally range in size from 120 L to 360 L. Equivalent garbage bag capacity is presented in Table 4.2. Note that jurisdictions offering food-waste only organics collection programs often use smaller carts, such as 45 L. Smaller carts for food waste only are collected either manually or with a semi-automated system (the worker manually attaches the cart to a lifting mechanism, which then tips the cart contents into the truck).

Table D.2 Cart Sizes and Bag Equivalents (City of Kelowna, 2007)

Cart Size	Standard Garbage Bag Equivalent
120 L	1.5 bags
180 L	2.3 bags
245 L	3.2 bags
360 L	4.7 bags

The preferred size of the container is also a function of the density of the material stream; bulky and light materials such as recyclable containers need larger containers than materials that are dense, such as food scraps.

It is generally advised that curbside recyclable programs within automated collection systems utilize large carts (240 L to 360 L) to maximize the amount of recyclables that residents can set out each week. Manual collection programs require smaller carts/bags for the safety of the collection operators; typically, the weight is limited to 22 kg (50 lb) and residents are allowed to use multiple containers.

There are special considerations related to containing organic waste. Organic waste can be collected at the curb in either reusable carts or single-use bags. Collection of comingled organic waste typically uses automated collection carts or dedicated (labeled) garbage cans; food waste and yard waste together are heavy, and manual collection can lead to safety issues. Carts for comingle organic waste need to be large to accommodate high volumes of yard waste in the spring and fall seasons. Separate collection of food waste is not uncommon in Canada, particularly on Vancouver Island and in southern Ontario. In those communities, small (45 L) carts are used for manual or semi-automated collection of food waste. Single stream collection of yard waste can use dedicated garbage cans, automated collection carts or paper bags. Plastic bags should be avoided as they are difficult to remove before composting and are difficult to recycle.

When food waste is collected (whether comingled with yard waste or as a dedicated stream), residents should be given a kitchen container as part of program implementation. The kitchen container is used inside to collect food waste before bringing it to the larger collection cart. In some cases, collection programs allow residents to use compostable plastic bags or compostable paper bags in the kitchen container (this is the case in Okotoks and Calgary). In other cases, residents may be more heavily restricted and may only be allowed to line their kitchen containers with paper towel or newsprint. Restrictions such as this reduce the front-end costs at processing facilities, but may negatively affect participation rates as maintaining cleanliness of the kitchen container and green collection cart is more challenging when the food waste is not contained.

The Organics Working Group (OWG) of the Recycling Council of British Columbia (RCBC) recommends not allowing any plastic or plastic-like bags for food waste collection, including compostable bags. This is due to the inability of many processing technologies to completely decompose compostable plastic within the standard processing timeframe. If compostable plastic bags are allowed, priority should be placed on ensuring residents use compostable bags that align with ASTM or Canadian standards. The RCBC OWG recommends paper bags or newspaper for lining kitchen containers (RCBC, 2009). Wet AD processing technologies are able to handle plastic bag contamination as plastics float to the top of wet digesters and can be removed relatively easily.

If services are to be combined among the Partnership, the same cart sizes should be offered across participating municipalities to allow for shared inventory and reduced overhead costs. Collection frequency does not require alignment, although the frequency of collection will impact the number of collection vehicles owned and operated by the Partners.

1.6 Included and Excluded Materials

Each waste stream will have a list of accepted materials; anything not on the list is excluded from the program. Materials may be excluded due to health and safety issues, cost, and/or contamination. Since it is very difficult to enforce sorting rules with automatic collection, public education and engagement is key to achieving clean streams.

In the residual waste stream, excluded materials generally include household hazardous wastes such as propane tanks, bear spray, paint, and cleaning chemicals, automobile waste such as oils and tires, appliances such as microwaves, and e-waste such as cell-phones and batteries. These items are typically excluded due to the damaging impacts they can have in landfills as chemicals and toxins are released, and should instead be brought to dedicated drop-off centres such as the existing recycling centres and depots among the Partners.

Curbside recycling programs should only include items that can be recycled and that do not have the potential to cause health and safety issues at material recovery facilities (MRFs). To customers, some excluded items are more obvious than others (e.g. electronics may be perceived as being recyclable). Items typically excluded include:

- Expanded polystyrene (EPS, commonly known as Styrofoam): Many programs exclude EPS as there are limited options for recycling the material, though Alberta is home to an EPS-recycling company called StyroGo that address this niche market. EPS also tends to break apart in collection vehicles and cause cross-contamination. EPS is best suited to depot collection, rather than curbside collection.
- E-waste: Though recoverable and recyclable, e-waste is almost always excluded from curbside collection due to potential issues in MRFs, as cellphone batteries and other electronic parts can combust or leak chemicals. There are multiple accounts of electronics causing fires in collection trucks and MRFs. Public education is important to ensure residents know where to take their e-waste.
- Reusable items: Items that can be reused should be excluded as well and directed towards salvage or reuse drop-offs. This includes toys, clothes, appliances, kitchenware, bedding, backpacks, etc.
- Mixed packaging: Composite packaging, where the constituent materials cannot be easily separated, should be excluded from recycling collection, as the materials cannot be recycled without significant processing costs and are essentially contamination, unless the program operates in an area with a specialized MRF. In most cases, these items should go into the residual waste stream or be taken to a depot. There may be specialized companies that can separate and recycle some items, such as coffee pods.

- Non-container plastics: Plastic food wrap, mesh bags, pens, straws, etc. cannot be recycled at MRFs and should go into the residual waste stream.
- Construction material: Bricks, concrete, drywall, tile, nails, siding, and treated lumber should not be included in curbside recycling collection and should either be placed in the garbage cart or, in cases of larger quantities, brought to a construction and demolition material recovery drop-off location.

Organic waste collection programs generally allow items that can be broken down at the OPF that will receive the material. Additional items may include food-soiled paper (greasy pizza boxes and used paper coffee cups) and natural fibres (used tissue, hair and nail clippings). Pet waste (animal bedding or excrement) and used diapers may also be included depending on the technology used at the OPF. Most programs do not accept diapers; the City of Toronto is a notable exception. Toronto allows diapers in its green carts, because city staff anticipated that many residents would put diapers into their green carts regardless of whether or not they were allowed. The anaerobic digestion (AD) system in Toronto was designed from the outset to handle diapers. The human waste material in the diaper contributes to biogas production during AD processing, but the diaper itself is contamination and can cause processing issues depending on the type of AD process used. Any system that utilizes composting or dry digestion to process organics should exclude diapers, as there is no effective way to remove the contamination.

The Okotoks organics collection program allows all the additional items listed previously except for diapers, which should be placed in the residual waste stream. According to the 2018 Town of Okotoks Waste Composition Study, diapers comprised approximately 22 percent of household residual waste by weight (Tetra Tech, 2018). This is unusually high, as diapers typically comprise approximately 8-10 percent of the single-family residential residual waste stream (Tetra Tech, 2016, 2017).

1.7 Customers

Waste collection can be offered to single-family residences, multi-family residences, and/or institutional, commercial and industrial (ICI) customers. Generally, curbside collection is offered to all single-family residences, while multi-family and ICI customers may be included on a case-by-case basis. Multi-family residences that receive municipal collection service are typically ground-oriented, so that they can be serviced with the same collection vehicle as single-family residences. The larger carts typically used in high-rise apartment buildings and larger ICI establishments may not be able to be collected by the same trucks that service single-family residences, as the automated loading mechanism is different.

Since it may not be economically or technically feasible for a municipality to offer collection services to multi-family dwellings and ICI businesses, these generators are typically required to contract directly with a private service provider for collection services. However, some smaller municipalities (such as Three Hills, AB) choose to provide collection to multi-family and ICI establishments since there are few private haulers available. In those cases, the collection vehicle must be able to collect both residential and commercial quantities of waste.

1.8 Ownership of Collection Programs and Assets

Collection services can either be owned and operated by a local government or contracted out to a third party. The Towns of Okotoks, High River, Black Diamond and Turner Valley each own and operate their own residual waste collection assets and services, while Nanton and Foothills County contract the service out. There are benefits and drawbacks to each, as presented in Table D.3.

Table D.3 Analysis of Publicly Owned versus Privately Contracted Collection Services

Category	Criteria	Indicators	Publicly owned and Operated Collection Services	Privately Contracted Collection Services
Technical	**Complexity**	• Number of components • Special requirements	• Low to medium complexity in terms of implementation as it reflects the current service model for four of the six Partner • Moderate complexity in terms of daily operations	• Moderate short-term complexity as it reflects a change from the current service model for four of the six Partners • Low complexity long-term as management responsibilities shift to private contractor
	Compatibility with Existing Infrastructure	• Compatibility with equipment • Compatibility with facilities	• Compatible with existing program setup, equipment, and facilities for four of the six Partners for residual waste collection • Additional assets (trucks, storage) would be required if implementing owned services for recycling and organics streams	• For organics and recycling stream, where collection trucks and operations are not currently owned, private collection is more compatible with the existing systems
	Effectiveness	• Potential Efficiencies	• Reported efficiency gains for public collection over private are highly variable	• Some municipalities with private collection report increased customer complaints for missed pick-ups and issues with safety practices

Category	Criteria	Indicators	Publicly owned and Operated Collection Services	Privately Contracted Collection Services
Impact on Operations	**Impact on Future Planning**	• Potential constraints for future planning • Potential updates to municipal plans or policies	• Future planning responsibilities would be with Partners; control maintained	• Could require program changes to implement • Uncertain future costs and conditions once contract ends
	Labour	• Staffing requirements • Productivity • Training requirements • Unionized jobs	• Additional staffing would be required for added streams, may not be required if staffing is shared for the existing residual waste stream collection	• Management of staff shifts to private contractor • Minimal gains in productivity anticipated
	Equipment and Materials	• Amount of equipment • Complexity of equipment • Function of equipment • Materials required	• Additional collection vehicles, equipment and materials would be required for additional streams • Existing assets may be shared for a regional owned and operated system, potentially resulting in reduced total number of assets required	• Equipment and material requirements shift to private contractor • For residual stream, Partners with existing owned and operated systems would be left with stranded assets
	Health and Safety	• Health and safety improvements or additional requirements	• Could result in additional health and safety requirements for the two of the six Partners that currently have private collection	• Shifts many health and safety requirements away from the Partners and onto private contractor
	Contract Requirements	• Effort required to establish contracts	• Contracts for waste collection in the Town of Nanton and Foothills County, the recyclable and	• Requires negotiation and implementation of new collection contract

Category	Criteria	Indicators	Publicly owned and Operated Collection Services	Privately Contracted Collection Services
			organic collection for the Towns of Okotoks and Nanton and organic collection for the Town of Okotoks would have to completed / terminated	• Long-term contract development and management for a regional system required
Maintenance	**Equipment and Facility Requirements**	• Management of equipment and materials • Storage of equipment and materials	• Potential increase in management or storage of vehicles • Potential changes to management of existing facilities	• Equipment and facility management requirements shift to private contractor
	Reliability	• Amount of maintenance • Frequency of maintenance	• Potential for additional maintenance requirements, spare truck is required to mitigate risk of a collection vehicle being out of service	• Maintenance requirements shift to private contractor • Contractor responsible for ensuring contractual level of service is achieved, therefore if one truck is down for maintenance there is no issue to the Partners
Economic	**Capital Costs**	• Cost of equipment, building modifications, design, permitting/approvals	• Additional costs associated with obtaining new collection vehicles and maintaining older vehicles and with any building modifications or additional equipment needed	• Potential savings anticipated compared to current capital costs

Category	Criteria	Indicators	Publicly owned and Operated Collection Services	Privately Contracted Collection Services
	Operational Costs	• Cost of labour • Haul distances • Cost of equipment/building operation • Tonnage rates • Tipping fees	• Minimal increase anticipated to current operational costs for the four Partners that currently have public collection	• Due to economies of scale, private contractors are able to achieve lower operational costs than small municipal programs, and a collection contract may realize these savings for the Partners
Environmental	**Waste Diversion and Reduction**	• Percentage of solid waste diverted from landfill	• No change to waste diverted from landfill	• No change to waste diverted from landfill
	Greenhouse Gas (GHG) Emissions	• Distance traveled • Number of vehicles	• Potential for decrease in the distance travel as trucks would be stored locally	• Potential for increase in amount of distance travelled as a result from private contractor travel to and from collection areas
Social	**Staff Acceptance**	• Agreement of proposed changes to waste management system	• Maintains current staffing so acceptance expected to be high and could create additional jobs by bringing in house the collection that is currently contracted out (Nanton and Foothills County, the recyclable collection and organic collection for Okotoks and Nanton)	• Eliminates current municipal jobs associated with waste collection for four Partners, so acceptance possible poses a challenge

Category	Criteria	Indicators	Publicly owned and Operated Collection Services	Privately Contracted Collection Services
	Public Acceptance and Customer Satisfaction	• Promotional and education requirements • Agreement of proposed changes to waste management system	• May require changes to existing collection routes • Services that are publicly delivered are often more devoted to customer service and tend to be accountable to the public • Provides well-paying jobs within the area	• May require changes to existing collection routes • Removes well-paying jobs within the area

2. Evaluation of Regionalization Options

2.1 Residual Waste Stream

2.1.1 Ownership of Regional Residual Waste Collection

The members of the Partnership own a total of eight automated, side-load collection trucks designated for residual waste collection: two shared by Turner Valley and Black Diamond, three owned by High River, and three owned by Okotoks. Foothills County and Nanton currently contract out their residual waste collection service. While body volume differs between the owned vehicles, the automated loading arms are similar and the trucks can be utilized interchangeably for curbside collection. Therefore, the currently owned collection trucks and carts can continue to be used in a regionalized service, meaning that there would be no upfront capital cost for transitioning to a regionalized residual waste collection system. However, annualized collection truck costs should be included in residential charges regardless, to ensure accumulation of a capital reserve to fund the purchase of new trucks when required.

Each municipality collects the residual waste weekly. The current collection schedule is:

- High River: Collection is completed over 4-days: Tuesday, Wednesday, Thursday and Friday.
- Turner Valley and Black Diamond: Turner Valley uses the truck for 1.25-days (partial day Tuesday and full day Wednesday) and Black Diamond uses the truck for 2-days (Thursday and Friday). The back-up truck is only used in case of a breakdown or other issue with the primary truck.
- Okotoks: Collection is completed over 4-days: Tuesday, Wednesday, Thursday and Friday.
- Nanton: Collection is completed on Tuesday.
- Foothills County: Collection is completed on Tuesday and Wednesday.

If a regional system is implemented under a municipally owned-and-operated model, it is recommended that curbside collection occurs over 4-days of each week while the last day is allocated for truck maintenance and holidays.

GHD's analysis of the system, presented in Tables D.9 through D.12 at the end of this Appendix, indicates that if collection resources were fully shared, five trucks operating on a weekly collection schedule would be sufficient to service all households that currently receive collection service. The Partnership would need to own six trucks in order to have a spare. However, even with the low expected household growth indicated by members of the Partnership, an additional truck would be required by 2025 to service all the households on a 4-day-per-week collection schedule. Of the eight trucks currently in operation, four are 2015 or newer, and four are 2011 or older. The four newer trucks are expected to continue to be in service until about 2023. The purchase of additional new trucks may therefore be required relatively soon, and financing costs should be included in system cost analysis.

Collection carts should be owned by the local governments. Local governments can maintain inventory and amortize the cost over a longer period than a homeowner.

A conversion of the garbage collection system to a contracted service is not desirable in the short term, because of the four relatively new trucks in operation. As trucks come up for replacement, the Towns may choose to consider the potential benefits of converting to a contracted, regional system A contracted service could result in less complexity, as the operation and maintenance of the vehicles and the need to provide customer service would shift to the private contractor.

However, privatizing services results in less control for local governments, which can result in increased customer complaints for missed pick-ups and issues with safety practices. A switch to privately contracted service must also consider the preservation of existing unionized positions; with careful planning this can be managed through reassignment and retirement. Once a collection system is converted to being contracted out, it becomes expensive and complicated to convert back to a publicly owned-and-operated service.

It is unlikely that individual smaller local governments could obtain collection services for the same price as a regional service, since a regional service benefits from economies of scale. Therefore, a switch to contracted services will likely be most economical as a regional system, rather than individual systems.

Discussion with the Partners has resulted in the decision that regional residual waste collection evaluation should consider only an own-and-operate model, since it the benefits of maintaining ownership of the system outweigh the potential benefits of contracting out the service.

2.1.2 Hauling Distance

Each day, the collection trucks deliver waste from their collection routes to the LRRC for disposal. The hauling distances from each member of the Partnership to the LRRC are:

- Nanton to LRRC: 46 km
- Okotoks to LRRC: 9 km
- High River to LRRC: 15 km
- Black Diamond to LRRC: 25 km
- Turner Valley to LRRC: 29 km
- Foothills County:
  - Aldersyde to LRRC: 10 km
  - Blackie to LRRC: 31 km
  - Silvertip to LRRC: 14 km

- Cayley to LRRC: 31 km

Since the Towns are relatively close together, the concept of sharing collection trucks in the case of breakdowns etc. is feasible and has already been demonstrated. Turner Valley and Black Diamond have an extra truck, which has been shared with Okotoks and could also be made available to High River under an agreement.

2.2 Recyclables Stream

2.2.1 Ownership of Regional Recyclables Collection

None of the municipalities own collection vehicles for curbside collection of recycling. Assets are limited to recycling carts in Okotoks and Nanton, and the recycling depots and associated infrastructure.

Recycling Depots and Drop-Off Locations

Operation and maintenance of recycling depots is unlikely to be of interest to the private sector, since there is little opportunity for profit. Local governments should continue to operate depots and look for opportunities to maximize their efficiency. The operations of individual depots should be reviewed to ensure that the mix of materials collected and the streams materials are collected minimize costs and maximize level of service. This may mean eliminating some material streams (such as expanded polystyrene and film plastic), consolidating or further segregating other streams, and reviewing which products are baled and which are shipped loose.

A review should also be conducted of operating hours; it may be possible to reduce staffing costs by reducing hours of individual depots or reducing the number of staff onsite at non-peak times. It is recommended that there be at least one staff person present at all times the depots are accessible, in order to mitigate contamination. When not staffed, facilities should be inaccessible to users.

Regionalizing the recycling depot system would go one step further in increasing efficiency. Services could be harmonized, and the operating hours could be staggered depending on proximity to other depots to reduce duplication of service and ensure that there is a depot open every day of the week. A joint hauling and processing contract could be more advantageous than the contracts obtained by individual depot operators.

Curbside Recycling Collection

As no curbside recycling collection vehicles are currently owned, implementation of a regionally owned collection service would require joint purchase of collection vehicles. Alternatively, the collection service could be contracted out for reduced complexity and upfront costs, although uncertainties about future terms after the end of the original contract pose risks. If the service is contracted out, the carts should still be owned by the members, as the lifespan of a cart is longer than the duration of a typical contract (8-12 years for a cart vs. 3-5 years for a typical contract).

Okotoks currently contracts out its curbside recycling collection program to a private contractor; the contract expires in 2021. Okotoks structured the contract to allow other members of the Partnership to join the service on the same terms. This greatly reduces the complexity of beginning a curbside collection program and allows collection costs to be well-understood up front.

If the collection vehicles were to be owned and operated by members of the Partnership, the most efficient option for ownership would be joint ownership and operation of the assets. A governance structure would need to be established to manage the joint assets. The purchase and operation of assets would have high capital costs, but would give the Partnership full control over collection schedule and routes. Analysis of

trucks required and costs for ownership of the collection service are presented in Section 2.4, and further compared against the cost of contracting out the collection service.

2.2.2 Special Considerations for Recycling

The recycling landscape in Canada changed significantly following China's ban of foreign recyclables that began in January 2018. The market for post-consumer recyclables became weaker after the enforcement of the ban. Some provinces in Canada with Extended Producer Responsibility (EPR) programs in place have been better able to handle the changes, however, Alberta is not among them (EPR Canada, 2017). With no EPR programs in place and a relatively small market, the financial viability of curbside recycling programs is under question as recyclers are accepting fewer materials with stricter rules for contamination and higher costs. The City of Lacombe, a municipality with similar population to High River, announced the end of its curbside recyclables collection contract on May 27, 2019 (City of Lacombe, 2019). The decision was made on the basis of the single response received to the City's Request for Proposals for the recycling collection program, which proposed to collect fewer types of recyclables for a 66 percent increase in cost. The City of Calgary has been stockpiling plastic containers that no longer have an end-market, filling over 100 trailers with the material (Southwick, 2019). The Town of Innisfail launched a new automated curbside collection program in early June 2019, which collects only garbage and organics, as Council determined that it did not make fiscal sense to collect recyclables at this time (Spackman, 2019). In an effort to increase the marketability of the material collected in its new (April 2019) curbside recycling collection program, the City of Red Deer does not accept glass in the curbside program (it can be taken to the local recycling centre instead) (Spackman, 2019).

Other municipalities in Alberta are finding new ways to utilize recyclables that would otherwise end up in landfill. The City of Lethbridge, for instance, is going to use 300 tonnes of stockpiled household glass – which typically cannot be recycled as it breaks up too easily in the collection and sorting process – as base material for pathways instead of gravel (Southwick, 2019).

2.3 Organic Waste Stream

2.3.1 Ownership of Organic Waste Collection Services

None of the municipalities own collection vehicles for curbside collection of organics. Assets are limited to organic waste carts in Okotoks, and the facilities for accepting yard waste the recycling depots and the LRRC.

Collection vehicles can be owned and operated by members of the Partnership or the collection service can be contracted out to a third party. If the service is contracted out, the carts should still be owned by the members, as the lifespan of a cart is longer than the duration of a typical contract (8-10 years for a cart vs. 3-5 years for a typical contract).

If the collection vehicles were to be owned and operated by members of the Partnership, the most efficient option for ownership would be joint ownership and operation of the assets. A governance structure would need to be established to manage the joint assets. The purchase and operation of assets would have high capital costs, but would give the Partnership full control over collection schedule and routes. Analysis of trucks required and costs for ownership of the collection service are presented in Section 2.4, and further compared against the cost of contracting out the collection service.

It is important to consider that collection capacity (i.e. number of trucks) needs to be able to accommodate more frequent collection from the spring to fall for higher quantities of yard waste. This would likely result

in trucks being underutilized in the winter months, when quantities of organics drop to include mostly food waste.

2.4 Regionalizing Services in the Partnership

2.4.1 Current Costs

GHD estimated the cost per household per month for regionalized collection programs, including disposal and processing costs. Disposal and processing costs are important to consider, since disposal of residual waste at landfills is generally less expensive than processing organic and recyclable waste. Therefore, as additional services are added to divert waste it is expected that costs will increase. The costs estimated for each regionalization option are compared against the current costs in each municipality, estimated using financial data provided by each municipality. Current costs are presented in Figure D.1 below.

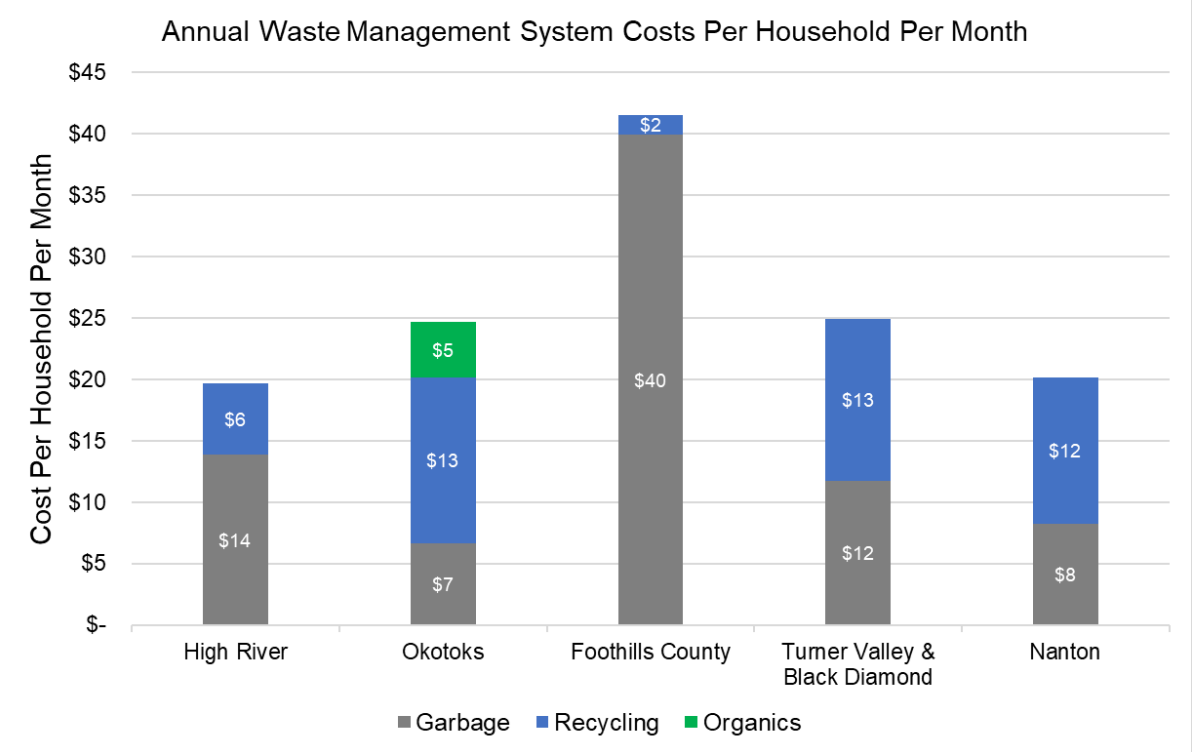

Figure D.1 Current Waste Management System Costs by Stream among the Partners (2018 Data)

All FRSC members use a utility fee model to fund the service. These fees are summarized below, and represent the status quo charges per household per month. Charges for recycle depot access are included here since the regionalization options all include ongoing operation of the depots. Note that the costs charged to residents is generally lower than the actual system costs shown in Figure D.1.

Table D.4 Current Monthly Residential Charges for Waste Management

Partner	Cost Includes	Fee per Household per Month
Okotoks	Collection & disposal of 120 L garbage, 240 L recycling, 120 L organics Okotoks Eco Centre	$ 22.08
High River	Collection & disposal of 240 L garbage High River Recycling Centre	$ 13.85

Partner	Cost Includes	Fee per Household per Month
Black Diamond	Collection & disposal of 240 L garbage Access to Oilfields Recycling Centre	$ 14.89
Turner Valley	Collection & disposal of 240 L garbage Oilfields Recycling Centre	$ 20.00
Nanton	Collection & disposal of 240 L garbage and 240 L recycling (Depot charge unreported)	$ 14.00
Foothills County	Collection & disposal of 340 L garbage (404 households only) Access to recycling depots (all households)	$ 21.00

2.4.2 Option 1: Residual Waste Stream Only

The simplest option for regionalizing services within the Partnership is to regionalize the collection of residual waste only. This option requires the least amount of change for the members of the Partnership. Each of Okotoks, High River, Turner Valley and Black Diamond owns and operates a residual waste collection service, which means that there is no need to alter contracts with private waste collectors or purchase collection vehicles. Nanton's current collection contract ends in 2020, and the Town could join the Partnership at that time. Foothills County's current contract ends in 2021 for the communities of Aldersyde, Blackie, Cayley and Silvertip. These communities could join the Partnership at that time, while communities such as Heritage Point (which do not currently receive curbside collection service from the County) could join sooner. The existing services are aligned on the following collection characteristics:

- Automated collection using trucks with side-load arms
- Cart sizes within range of 120 L to 340 L that any of the existing trucks are capable of lifting
- Weekly collection service

There would be minimal change for the customers already receiving curbside residual waste collection. The Partnership may also decide to offer the service to smaller and/or ground-oriented multi-family residences and ICI customers, as long they can be serviced by standard automated collection carts. Larger multi-family and ICI customers would continue to be serviced by private collectors. Efficiencies and cost savings may be seen with regionalizing the service and managing the administration side of the service under one team, as opposed to managing separate systems.

The Partners currently operate a total of six trucks to meet the needs of their individual programs (plus two backup trucks, for a total of eight trucks); additional collection capacity is contracted out in Nanton and Foothills County. GHD's analysis of tonnage, number of households[1], and truck routing capacity shows that for a regionalized weekly curbside residual waste collection program that collects 4-days per week, five collection trucks would be required in the Partnership (plus a spare, for a total of six), with no additional contracted services. This analysis is presented in Table D.9 at the end of this Appendix. The analysis shows that the total system costs, when owning and operating trucks in the Partnership and including disposal and existing average recycle depot costs, would be approximately $15.00 per household per month in 2020[2]. Compared to the costs presented in Figure D.1, this is lower than the current costs for similar level of service in Black Diamond/Turner Valley and Foothills County.

[1] Number of households for Foothills County includes only the communities of Aldersyde, Blackie, Cayley and Silvertip.

[2] All cost model results are rounded to the nearest dollar to account for uncertainty in assumptions.

A benefit of this option is that as trucks need replacing, the capital costs would be shared among the members of the partnership. Existing excess truck capacity in the system (older vehicles) could be kept as back-up, or sold to generate revenue.

By 2025, an additional truck will be needed to service the growing population, triggered by the increase in households in the region. Six operating trucks plus a seventh spare truck are estimated to be sufficient until at least 2035 based on household growth projects provided by each municipality. The additional truck will increase costs slightly in 2025. The cost then reduces slightly overtime as the number of households dividing the cost of the additional truck increase.

The estimated cost per household per month for owning and operating the residual waste stream until 2035 are summarized in Table D.5 below.

Table D.5 Option 1 Cost Summary 2020 through 2035

	2020	2025	2030	2035
Cost of Carts[1]	$ 0.00	$ 0.00	$ 0.00	$ 0.00
Fleet Ownership and Operation[2]	$ 8.00	$ 8.00	$ 8.00	$ 7.00
Disposal Costs[3]	$ 3.00	$ 3.00	$ 3.00	$ 3.00
Recycle Depot Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 15.00**	**$ 15.00**	**$ 15.00**	**$ 15.00**

Notes:
All values are rounded to the nearest dollar to account for uncertainty. Totals may not be exactly the sum of the rounded parts, as rounding is completed after the sum. See Tables D.10 through D.13 for detailed results.

1 Assuming that Turner Valley will continue to use blue carts for residual garbage collection, there is no need at this time to purchase additional carts (sufficient inventory exists for household growth). However, if the Region wishes to enforce alignment of the carts, Turner Valley residents will see approx. $1.00 cost per household per month for the purchase of black garbage collection carts.

2 Six trucks needed in 2020 (five operating plus one spare), seven needed from 2025 through 2035 (six operating plus one spare). Fluctuations in household cost due to growth of total households sharing the cost over time.

3 Based on constant residual waste disposal cost of $69 per tonne.

4 Calculated as the weighted average per household per month gross costs for the High River Recycling Depot, Nanton Recycling Depot, Okotoks Eco Centre, and Oilfields Recycling Centre, with a conservative 25% increase.

2.4.3 Option 2: Residual Waste and Recyclables Streams

Regionalizing the curbside collection of recyclables across the Partnership would require more significant changes. As High River, Turner Valley, Foothills County, and Black Diamond do not currently offer curbside recycling collection, collection carts would need to be purchased for those customers. Based on the number of households in these areas, approximately 6,240 blue carts and 1,200 black carts would be required[3]. Financed over a 10-year period at 3 percent[4], this works out to cost $1.00 per household per month for a 10-year cart life (rounded to the nearest dollar).

GHD is aware that Okotoks currently has an excess supply of approximately 1,000 carts in its inventory. These carts may be made available to other members of the Partnership, with the price to be determined.

The Partnership would also need to make a decision on whether to own and operate the collection service itself or to contract out the service, as Okotoks is currently doing. Contracting out the service comes with

[3] Based on expected household counts in 2020 provided by each municipality, and considering that Turner Valley would repurpose existing blue carts currently used for residual waste collection as recycling collection carts, thus needing to purchase new residual waste collection carts.

[4] Borrowing rate for Study agreed upon during July 2019 TAG Meeting.

the benefits of significantly reduced capital costs and simplicity as Okotoks has an existing contract with a private collector that allows the other members of the Partnership to sign on. The drawbacks of contracting out the service include limited control over the final destination of the recyclables and no control over potential revenues from recyclables, as well as uncertainties around contract renewal terms. Some contracts, as is the current case in Okotoks, specify which facilities will be used for processing the material. However, what happens to the material at the facility may be out of the control of the municipality.

The analysis in Tables D.10 through D.13 shows that the Partnership would require five collection trucks for a regionalized service for each stream in 2020. However, this increases to six trucks by 2025. Disposal costs for recyclables are higher than disposal costs for residual waste, at approx. $150 per tonne compared to $69 per tonne[5]. Total costs for Option 2 for both owning and operating the recycling collection service or contracting out the service are summarized in Table D.6 below.

Table D.6 Option 2 Cost Summary from 2020 through 2035

	2020	2025	2030	2035
Own and Operate Collection Services				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation[2]	$ 14.00	$ 15.00	$ 14.00	$ 13.00
Disposal Costs[3]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 24.00**	**$ 25.00**	**$ 24.00**	**$ 23.00**
Own and Operate Residual Waste Collection, Contract Out Recycling Collection				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation (Residual only)	$ 8.00	$ 8.00	$ 8.00	$ 7.00
Contracted Services[5]	$ 4.00	$ 5.00	$ 6.00	$ 6.00
Disposal Costs[3]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 22.00**	**$ 23.00**	**$ 23.00**	**$ 24.00**

Notes:
All values are rounded to the nearest dollar to account for uncertainty. Totals may not be exactly the sum of the rounded parts, as rounding is completed after the sum. See Tables D.10 through D.13 for detailed results.

1 Cost of carts applies to Turner Valley, Black Diamond, Foothills County and High River only, as residents in Okotoks and Nanton already have both black and blue carts from existing programs. Turner Valley expected to repurpose current blue carts for recycling collection and purchase new black carts.
2 Six trucks needed in 2020 (five operating plus one spare), seven need from 2025 through 2035 (six operating plus one spare) for each stream. Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on residual waste disposal cost of $69 per tonne and recycling disposal cost of $150 per tonne constant overtime.
4 Calculated as the weighted average per household per month gross costs for the High River Recycling Depot, Nanton Recycling Depot, Okotoks Eco Centre, and Oilfields Recycling Centre, with a conservative 25% increase.
5 Based on Okotoks' current contract price, increasing 25% for 2025 and additional 10% each period thereafter.

[5] $150 per tonne for recycling is the agreed upon average disposal price for the Partners from the July 2019 TAG Meeting. $69 per tonne for residual waste is calculated as average fees paid by each Partner to the LRRC.

The decision to begin a curbside recycling program with the current market conditions is a difficult one, as discussed in Section 2.2.2. Any new program may want to consider excluding items that are not actually recyclable today, film plastics, expanded polystyrene, and contaminated cardboard or paper products. Such a program requires investment in public education and engagement to ensure customers understand the limitations of the recycling program.

2.4.4 Option 3: Residual Waste and Organics Streams

Another option for increasing diversion among the Partnership is to focus on diverting organic waste by providing curbside organics collection and residual waste collection. This option is attractive due to the uncertain market conditions for recyclables and increasing regulations and opportunities associated with diverting organic waste from landfill. If the Region decides to invest in a facility to process the organic waste, revenue can also be made from GHG offset credits and the sale of end products.

As with Option 2, providing a new organic waste collection service would require the purchase of curbside collection carts for High River, Foothills County, Black Diamond, Nanton and Turner Valley. Over a 10-year life, these carts have a monthly cost of $1.00 per household (rounded up to nearest dollar).

As with the recycling collection service discussed in the previous section, the Partnership would need to decide if the collection vehicles should be owned and operated or if the service should be contracted out. For comingled food and yard waste collection, the seasonal changes in throughput of the system needs to be considered. A sufficient number of trucks would need to be purchased to service the fall and spring levels of yard waste generation, which could result in trucks sitting idle during the winter months when yard waste generation drops significantly. In order to provide weekly collection during peak season, five collection trucks would be required (six including a spare).

A summary of the costs for owning and operating both collection services and for owning and operating residual waste collection while contracting out organics collection is provided in Table D.7 below.

Table D.7 Option 3 Summary of Costs for 2020 through 2035

	2020	2025	2030	2035
Own and Operate Both Collection Services				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation[2]	$ 14.00	$ 15.00	$ 14.00	$ 13.00
Disposal Costs[3]	$ 4.00	$ 5.00	$ 5.00	$ 5.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 23.00**	**$ 25.00**	**$ 24.00**	**$ 23.00**
Own and Operate Residual Waste Collection, Contract Out Organics Collection				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation (Residual only)	$ 8.00	$ 8.00	$ 8.00	$ 7.00
Contracted Services[5]	$ 4.00	$ 5.00	$ 6.00	$ 6.00
Disposal Costs[3]	$ 4.00	$ 5.00	$ 5.00	$ 5.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 21.00**	**$ 23.00**	**$ 23.00**	**$ 23.00**

Notes:
All values are rounded to the nearest dollar to account for uncertainty. Totals may not be exactly the sum of the rounded parts, as rounding is completed after the sum. See Tables D.10 through D.13 for detailed results.

1 Cost of carts applies to Turner Valley, Black Diamond, Foothills County, Nanton and High River only for purchase of green organics carts, as residents in Okotoks already have both black and green carts from existing programs.

2 Six trucks needed in 2020 (five operating plus one spare), seven need from 2025 through 2035 (six operating plus one spare) for each stream. Fluctuations in household cost due to growth of total households sharing the cost over time.

3 Based on residual waste disposal cost of $69 per tonne and organics disposal cost of $100 per tonne constant over time. Increase in cost over time due to increasing organics diversion as public participation grows, resulting in more tonnage being disposed at the higher cost.

4 Calculated as the weighted average per household per month gross costs for the High River Recycling Depot, Nanton Recycling Depot, Okotoks Eco Centre, and Oilfields Recycling Centre, with a conservative 25% increase.

5 Based on Okotoks' experience on contract price, increasing 25% for 2025 and additional 10% each period thereafter.

Costs would be similar for a food-waste only collection system. Rather than running parallel food and yard waste collection programs year-round and doubling collection costs, a seasonal yard waste collection service could be offered. This would reduce the amount of yard waste collected (and reduce the diversion rate), but also reduce collection and processing costs. This option has not been modeled, as Okotoks is committed to maintaining its current comingled collection service, and the technology selection for the organics processing facility will be driven by that decision.

2.4.5 Option 4: Three Stream Collection

The last option modeled is for the Partnership to provide curbside collection of residual waste, recyclables and organic waste. In a fully integrated system, recycling collection is often offered biweekly, so that two streams are collected each week (e.g. organics and garbage one week, and organics and recycling the next week). While this is common in other jurisdictions, GHD notes that most municipalities reviewed in Alberta maintain weekly recycling collection when adding organics. This is likely intended to support participation in recycling, although it is associated with additional collection costs. For the purposes of costing Option 4, we have assumed weekly collection of all three stream based on direction from the TAG as a starting point.

The cost of recycling and organics carts is $2.00 / HH / month for in High River, Black Diamond, Foothills County and Turner Valley, and a cost of $1.00 / HH / month for organics carts in Nanton (rounded to the nearest dollar). The total costs for owning and operating the collection fleet for all three streams, including carts, continued operation of recycling centres, and disposal/processing costs is estimated to be $32.00 / HH / month in 2020. Alternatively, if the curbside collection service for recycling and organics is contracted out, the cost is estimated to be $28.00 / HH / month in 2020.

A summary of costs for 2020 through 2035 is provided in the Table D.8 below.

Table D.8 Option 4 Cost Summary for 2020 through 2035

	2020	2025	2030	2035
Own and Operate Collection Services				
Cost of Carts[1]	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Fleet Ownership and Operation[2]	$ 20.00	$ 22.00	$ 21.00	$ 19.00
Disposal Costs[3]	$ 6.00	$ 7.00	$ 7.00	$ 7.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 32.00**	**$ 34.00**	**$ 33.00**	**$ 32.00**
Own and Operate Residual Waste Collection, Contract Out Recycling and Organics Collection				
Cost of Carts[1]	$ 2.00	$ 2.00	$ 2.00	$ 2.00

	2020	2025	2030	2035
Fleet Ownership and Operation (Residual only)	$ 8.00	$ 8.00	$ 8.00	$ 7.00
Contracted Services[5]	$ 8.00	$ 11.00	$ 12.00	$ 13.00
Disposal Costs[3]	$ 6.00	$ 7.00	$ 7.00	$ 7.00
Recycling Centre Costs[4]	$ 5.00	$ 5.00	$ 5.00	$ 5.00
Total Cost	**$ 28.00**	**$ 31.00**	**$ 32.00**	**$ 32.00**

Notes:
All values are rounded to the nearest dollar to account for uncertainty. Totals may not be exactly the sum of the rounded parts, as rounding is completed after the sum. See Tables D.10 through D.13 for detailed results.

1 Full cost of carts ($2.00) applies to Turner Valley, Black Diamond, Foothills County and High River for purchase of blue recycling and green organics carts. Nanton would have half the cost as only the purchase of green carts in needed. Residents in Okotoks already have black, blue and green carts from existing programs.
2 Six trucks needed in 2020 (five operating plus one spare), seven need from 2025 through 2035 (six operating plus one spare) for each stream. Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on residual waste disposal cost of $69 per tonne, recycling of $150 per tonne, and organics of $100 per tonne constant over time. Increase in cost over time due to increasing organics diversion as public participation grows, resulting in more tonnage being disposed at the higher cost.
4 Calculated as the weighted average per household per month gross costs for the High River Recycling Depot, Nanton Recycling Depot, Okotoks Eco Centre, and Oilfields Recycling Centre, with a conservative 25% increase.
5 Based on Okotoks' current contract price, increasing 25% for 2025 and additional 10% each period thereafter.

There is an increasing trend towards three-stream collection across Canada, as more municipalities work to divert waste from landfills and turn the waste into valuable end products. However, as previously discussed, there are significant risks in the recyclables market that can act as a barrier to a successful recycling program.

2.4.6 Summary – Collection Costs and Comparisons

Table D.9 below provides an overview of the four options for the Partnership, the diversion rate associate with each option, cost estimates per household, and overall benefits and drawbacks.

Table D.9 Summary of Partnership Regionalization Options

	Summary of Costs incl. Collection, Disposal, & Recycle Centres ($/HH/Month)	Benefits / Drawbacks
Option 1 – Residual Waste Only	**2020** $15.00 **2035** $15.00	Efficiencies and cost savings can result from regionalizing the service. As each municipality already owns and operates residual waste collection assets, there are no significant additional costs to regionalization.
Option 2 – Residual Waste and Recyclables	**2020** Own & operate With carts: $24.00 Without carts: $23.00 Contract out With carts: $22.00 Without carts: $21.00 **2035** Own & operate With carts: $23.00 Without carts: $23.00 Contract out With carts: $24.00 Without carts: $23.00	Reduce waste going to landfill, increase diversion rate. Okotoks already has a contracted out collection system for recyclables, thus beginning and managing a contracted out collection system is not a new concept and the challenges are already well understood. Contracting out the service is generally less expensive than regionally operating, and comes with fewer risks and lower management requirements. Management of the system could be completed by one centralized team, providing efficiencies and cost savings. Main drawback/risk is the current recyclables market, which is suffering under a lack of end markets and high contamination levels.
Option 3 – Residual Waste and Organics	**2020** Own & operate With carts: $23.00 Without carts: $22.00 Contract out With carts: $21.00 Without carts: $20.00 **2035** Own & operate With carts: $23.00 Without carts: $22.00 Contract out With carts: $23.00 Without carts: $22.00	Reduce waste going to landfill, increase diversion rate. Okotoks already has a contracted out collection system for organics, thus beginning and managing a new contracted-out collection system is not a new concept and the challenges are already well understood. Contracting out the service is generally less expensive than ownership, and comes with fewer risks and lower management requirements. Management of the system could be completed by one centralized team, providing efficiencies and cost savings. Organic waste processing is well established in Canada and associated with limited risk at this point, depending on the technology chosen. There are established end-markets for renewable natural gas at high prices, and although compost may not be a reliable source of revenue, the material is used extensively across Alberta and can be given to residents as a bonus of the program.
Option 4 – All Three Streams	**2020** Own & operate With carts: $32.00 Without carts: $32.00 Contract out With carts: $28.00	Reduce waste going to landfill, increase diversion rate. Benefits and drawbacks discussed in Options 2 and 3 apply.

	Summary of Costs incl. Collection, Disposal, & Recycle Centres ($/HH/Month)	Benefits / Drawbacks
	Without carts: $27.00 **2035** Own & operate With carts: $32.00 Without carts: $31.00 Contract out With carts: $32.00 Without carts: $31.00	

2.5 Detailed Cost Analysis

Detailed cost analysis is presented in Tables D.10 through D.13 at the end of this appendix.

3. References

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Table D.10 Cost Analysis for Regionalization Options in the Partnership - 2020 Tonnage and Households

Regionalization between Okotoks, High River, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	16,960	16,960	16,960	16,960	16,960	16,960	16,960	16,960
kg/house weekly (one collection day/home)[2]	9.4	8.3	3.5	8.1	3.7	7.0	3.5	3.7
Tonnes total projected (2020)	8,300	7,300	3,100	7,100	3,300	6,200	3,100	3,300
kg of material on collection week	159,424	140,768	59,360	137,376	62,752	118,720	59,360	62,752
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)	4,240	4,240	4,240	4,240	4,240	4,240	4,240	4,240
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	957	1,084	1,143	1,111	2,432	1,286	1,143	2,432
Average number of routes per day (4 days/week)	4	4	4	4	2	3	4	2
Number of trucks needed for best practice collection performance	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Number of trucks needed	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	6	6	6	6	6	6	6	6
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879
Total Fleet Capital Cost per Household per Month	**$ 1.68**	**$ 1.68**	**$ 1.68**	**$ 1.68**	**$ 1.68**	**$ 1.68**	**$ 1.68**	**$ 1.68**
Cart Costs								
Total Number of carts[4]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	5	5	5	5	5	5	5	5
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	5	5	5	5	5	5	5	5
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
Estimated Annual Maintenance and Fuel Costs per Truck[5]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000
Storage costs for Trucks[6]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[7]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,143,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 943,000
Total Operating Costs per Household per Month	**$ 5.62**	**$ 5.62**	**$ 4.63**	**$ 5.62**	**$ 4.63**	**$ 5.62**	**$ 4.63**	**$ 4.63**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[8]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 572,700	$ 503,700	$ 465,000	$ 489,900	$ 330,000	$ 427,800	$ 465,000	$ 330,000
Disposal Cost per Household per Month	**$ 2.81**	**$ 2.47**	**$ 2.28**	**$ 2.41**	**$ 1.62**	**$ 2.10**	**$ 2.28**	**$ 1.62**
Recycling Depot/Centre Costs								
Recycling Depot/Centre Costs per Household per Month[9]	**$ 4.60**	**$ 4.60**		**$ 4.60**		**$ 4.60**		
Total Fleet Costs per Household per Month	**$ 7.30**	**$ 7.30**	**$ 6.31**	**$ 7.30**	**$ 6.31**	**$ 7.30**	**$ 6.31**	**$ 6.31**
Total Fleet and Cart Costs per Household per Month	**$ 7.30**	**$ 8.08**	**$ 7.09**	**$ 8.08**	**$ 7.09**	**$ 8.08**	**$ 7.09**	**$ 7.09**
Total Disposal Costs per Household per Month	**$ 2.81**	**$ 2.47**	**$ 2.28**	**$ 2.41**	**$ 1.62**	**$ 2.10**	**$ 2.28**	**$ 1.62**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$7.30**	**$13.61**		**$13.61**		**$19.92**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$7.30**	**$14.39**		**$14.39**		**$21.49**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$10.11**	**$19.15**		**$18.42**		**$27.49**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$14.71**	**$23.75**		**$23.02**		**$32.09**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), High River (4,900), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip).

(2) Tonnes collected weekly for each stream based on waste generation and capture rates projection modelling completed for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, High River, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, High River, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table D.11 Cost Analysis for Regionalization Options in the Partnership - 2025 Tonnage and Households

Regionalization between Okotoks, High River, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
kg/house weekly (one collection day/home)[2]	9.4	8.2	3.5	6.0	5.8	4.9	3.5	5.8
Tonnes total projected (2020)	8,800	7,700	3,300	5,600	5,400	4,600	3,300	5,400
kg of material on collection week	169,200	147,600	63,000	108,000	104,400	88,200	63,000	104,400
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	957	1,098	1,143	1,500	1,552	1,837	1,143	1,552
Average number of routes per day (4 days/week)	5	4	4	3	3	2	4	3
Number of trucks needed for best practice collection performance	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
Number of trucks needed	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	7	7	7	7	7	7	7	7
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858
Total Fleet Capital Cost per Household per Month	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	6	6	6	6	6	6	6	6
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	6	6	6	6	6	6	6	6
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,288,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,088,000
Total Operating Costs per Household per Month	**$ 5.96**	**$ 5.96**	**$ 5.04**	**$ 5.96**	**$ 5.04**	**$ 5.96**	**$ 5.04**	**$ 5.04**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 607,200	$ 531,300	$ 495,000	$ 386,400	$ 540,000	$ 317,400	$ 495,000	$ 540,000
Disposal Cost per Household per Month	**$ 2.81**	**$ 2.46**	**$ 2.29**	**$ 1.79**	**$ 2.50**	**$ 1.47**	**$ 2.29**	**$ 2.50**
Recycling Depot/Centre Costs								
Average Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**		**$ 4.60**		**$ 4.60**		
Total Fleet Costs per Household per Month	**$ 7.81**	**$ 7.81**	**$ 6.88**	**$ 7.81**	**$ 6.88**	**$ 7.81**	**$ 6.88**	**$ 6.88**
Total Fleet and Cart Costs per Household per Month	**$ 7.81**	**$ 8.59**	**$ 7.67**	**$ 8.59**	**$ 7.67**	**$ 8.59**	**$ 7.67**	**$ 7.67**
Total Disposal Costs per Household per Month	**$ 2.81**	**$ 2.46**	**$ 2.29**	**$ 1.79**	**$ 2.50**	**$ 1.47**	**$ 2.29**	**$ 2.50**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$7.81**	**$14.69**		**$14.69**		**$21.58**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$7.81**	**$15.47**		**$15.47**		**$23.14**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$10.62**	**$20.23**		**$19.76**		**$29.40**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$15.22**	**$24.83**		**$24.36**		**$34.00**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), High River (4,900), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly for each stream based on waste generation and capture rates projection modelling completed for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, High River, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, High River, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table D.12 Cost Analysis for Regionalization Options in the Partnership - 2030 Tonnage and Households

Regionalization between Okotoks, High River, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	19,130	19,130	19,130	19,130	19,130	19,130	19,130	19,130
kg/house weekly (one collection day/home)[2]	9.4	8.2	3.5	5.3	6.6	4.2	3.5	6.6
Tonnes total projected (2020)	9,400	8,200	3,500	5,300	6,600	4,200	3,500	6,600
kg of material on collection week	179,822	156,866	66,955	101,389	126,258	80,346	66,955	126,258
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	957	1,098	1,143	1,698	1,364	2,143	1,143	1,364
Average number of routes per day (4 days/week)	5	4	4	3	4	2	4	4
Number of trucks needed for best practice collection performance	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Number of trucks needed	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	7	7	7	7	7	7	7	7
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858
Total Fleet Capital Cost per Household per Month	**$ 1.74**	**$ 1.74**	**$ 1.74**	**$ 1.74**	**$ 1.74**	**$ 1.74**	**$ 1.74**	**$ 1.74**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	6	6	6	6	6	6	6	6
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	6	6	6	6	6	6	6	6
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,288,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,088,000
Total Operating Costs per Household per Month	**$ 5.61**	**$ 5.61**	**$ 4.74**	**$ 5.61**	**$ 4.74**	**$ 5.61**	**$ 4.74**	**$ 4.74**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 648,600	$ 565,800	$ 525,000	$ 365,700	$ 660,000	$ 289,800	$ 525,000	$ 660,000
Disposal Cost per Household per Month	**$ 2.83**	**$ 2.46**	**$ 2.29**	**$ 1.59**	**$ 2.88**	**$ 1.26**	**$ 2.29**	**$ 2.88**
Recycling Depot/Centre Costs								
Average Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**		**$ 4.60**		**$ 4.60**		
Total Fleet Costs per Household per Month	**$ 7.35**	**$ 7.35**	**$ 6.48**	**$ 7.35**	**$ 6.48**	**$ 7.35**	**$ 6.48**	**$ 6.48**
Total Fleet and Cart Costs per Household per Month	**$ 7.35**	**$ 8.13**	**$ 7.26**	**$ 8.13**	**$ 7.26**	**$ 8.13**	**$ 7.26**	**$ 7.26**
Total Disposal Costs per Household per Month	**$ 2.83**	**$ 2.46**	**$ 2.29**	**$ 1.59**	**$ 2.88**	**$ 1.26**	**$ 2.29**	**$ 2.88**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$7.35**	**$13.83**		**$13.83**		**$20.30**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$7.35**	**$14.61**		**$14.61**		**$21.87**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$10.17**	**$19.36**		**$19.07**		**$28.29**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$14.77**	**$23.96**		**$23.67**		**$32.89**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), High River (4,900), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly for each stream based on waste generation and capture rates projection modelling completed for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.
(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, High River, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, High River, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table D.13 Cost Analysis for Regionalization Options in the Partnership - 2035 Tonnage and Households

Regionalization between Okotoks, High River, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	20,340	20,340	20,340	20,340	20,340	20,340	20,340	20,340
kg/house weekly (one collection day/home)[2]	9.4	8.2	3.5	5.3	6.6	4.2	3.5	6.6
Tonnes total projected (2020)	9,900	8,700	3,700	5,600	7,000	4,400	3,700	7,000
kg of material on collection week	191,196	166,788	71,190	107,802	134,244	85,428	71,190	134,244
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	5,085	5,085	5,085	5,085	5,085	5,085	5,085	5,085
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	957	1,098	1,143	1,698	1,364	2,143	1,143	1,364
Average number of routes per day (4 days/week)	5	5	4	3	4	2	4	4
Number of trucks needed for best practice collection performance	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Number of trucks needed	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	7	7	7	7	7	7	7	7
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000	$ 2,485,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858	$ 398,858
Total Fleet Capital Cost per Household per Month	**$ 1.63**	**$ 1.63**	**$ 1.63**	**$ 1.63**	**$ 1.63**	**$ 1.63**	**$ 1.63**	**$ 1.63**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	6	6	6	6	6	6	6	6
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	6	6	6	6	6	6	6	6
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000	$ 540,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000	$ 330,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,288,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,288,000	$ 1,088,000	$ 1,088,000
Total Operating Costs per Household per Month	**$ 5.28**	**$ 5.28**	**$ 4.46**	**$ 5.28**	**$ 4.46**	**$ 5.28**	**$ 4.46**	**$ 4.46**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 683,100	$ 600,300	$ 555,000	$ 386,400	$ 700,000	$ 303,600	$ 555,000	$ 700,000
Disposal Cost per Household per Month	**$ 2.80**	**$ 2.46**	**$ 2.27**	**$ 1.58**	**$ 2.87**	**$ 1.24**	**$ 2.27**	**$ 2.87**
Average Recycling Depot/Centre Costs per Household per Month								
Average Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**		**$ 4.60**		**$ 4.60**		
Total Fleet Costs per Household per Month	**$ 6.91**	**$ 6.91**	**$ 6.09**	**$ 6.91**	**$ 6.09**	**$ 6.91**	**$ 6.09**	**$ 6.09**
Total Fleet and Cart Costs per Household per Month	**$ 6.91**	**$ 7.69**	**$ 6.87**	**$ 7.69**	**$ 6.87**	**$ 7.69**	**$ 6.87**	**$ 6.87**
Total Disposal Costs per Household per Month	**$ 2.80**	**$ 2.46**	**$ 2.27**	**$ 1.58**	**$ 2.87**	**$ 1.24**	**$ 2.27**	**$ 2.87**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.60**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ 4.60**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$6.91**	**$13.00**		**$13.00**		**$19.09**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$6.91**	**$13.78**		**$13.78**		**$20.66**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$9.71**	**$18.52**		**$18.24**		**$27.04**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$14.31**	**$23.12**		**$22.84**		**$31.64**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), High River (4,900), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly for each stream based on waste generation and capture rates projection modelling completed for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, High River, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, High River, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Appendix E
Regional Material Recovery Facility Analysis

Appendix E Regional Material Recovery Facility Analysis

Key to the development of the regional SWMP was an evaluation of the feasibility of developing a materials recovery facility (MRF) to process recyclable materials collected by all member municipalities (or through a regional collection program), and determine the potential for such a facility to provide a regional solution for managing and processing recyclable material. This analysis draws on previous efforts by CH2M HILL (2014) and Tetra Tech (2017) to assess the costs and benefits associated with the development of a MRF.

The analysis presented in this Appendix considers:

- The potential quantities from both residential and commercial sectors.
- Capital and operating costs of a new, local MRF.
- End-use markets for recyclable materials, especially in light recent tightening of the market for recyclables.
- Various ownership models (public and private).
- Alignment of Region goals and the recently established regional vision and objectives.
- Potential impacts of EPR and other regulatory changes.

1. Summary of Previous Studies

1.1 CH2M HILL (2014)

CH2M HILL conducted an initial assessment of options for locating and developing a centralized facility for processing recyclables collected in Turner Valley, Black Diamond, Okotoks, High River and Nanton (note that the Foothills County was not included). This involved:

- Reviewing existing collection and processing facilities in each municipality.
- Reviewing historical quantities of recyclable materials diverted through each municipal program.
- Developing scenarios that involve either (i) consolidation of materials collected in the region for forwarding to an existing processing facility, or (ii) construction of a new processing facility to service the region.
- Completing a 15-year cash-flow analysis of each scenario that considered both capital and operating costs, as well as any upgrades to municipal programs or facilities that are required to participate in the program represented by each scenario.

Six scenarios were developed jointly by Region staff and CH2M HILL staff. All scenarios were based on single-stream collection at depots and/or via curbside collection, and on a common set of materials being collected. The total quantity of recyclables considered by this study was based on the 2,275 tonnes collected in 2013. The 2013 per capita diversion rate in each municipality was held constant, and the population was modeled as increasing at 2 percent per year, except in Okotoks, which was modeled at increasing by 3.8 percent per year.

Three scenarios involved simply consolidating and storing the comingled recyclables, and then transferring them to a facility in the area for sorting and marketing; a budgetary cost for sorting and

marketing was obtained from a local processor ($100.00 per tonne). The second set of three scenarios involved building a new regional MRF that would receive, sort and market the recyclables; revenue from the marketing of the sorted materials was conservatively assumed to be zero. Both sets of scenarios considered sites at the Foothills Regional Landfill & Resource Recovery Centre (LRRC) and in Aldersyde.

The financial model calculated the net present value for each scenario over at 17-year period (2-years for design and construction, 15-years of operations). All three consolidation/transfer scenarios had significantly lower net present values than the net present values of building a regional MRF (in the order of $7,000,000 vs. $12,000,000). The option with the lowest net present value was scenario 2A, a reload facility at the Aldersyde MD Yard.

No recommendations were made, and the potential for increasing the quantity of recyclables by offering a regional curbside collection program or opening up the facility to commercial recyclable was not explored.

1.2 Tetra Tech (2017)

The study included a detailed review of the current waste management practices and associated costs, which were compared to a regional curbside recycling collection program and construction of a new material recovery facility (MRF). The conceptual design of the MRF was based on:

- Calgary's composition and quantity of recyclables per household (200 kg per household)
- Calgary peak recyclables (12 percent above average)
- Local growth rates
- Local numbers of people per household (2.76 people per household)
- Installation of a manual sort line, baler, loading dock, bale storage area
- 20-year facility life
- 250-days per year operation

Tetra Tech estimated the cost of a regional residential recycling curbside collection program at $8.39 per household per month. This is based on public ownership and operation of the collection system. The per household cost is based on capital costs for trucks and carts, operational costs for labour, fuel and maintenance, and the cost of administering the program. It does not include the cost of processing or marketing the recyclables, which was estimated separately.

The capital cost of a MRF capable of processing 7,250 tonnes of recyclables (based on a 20-year operating period and service population of 100,000 by 2036) was estimated to be $4.4 million. Operating costs were estimated to be $500,000 per year, and revenue was estimated using an average of $60/tonne. The annualized cost per tonne (at 6 percent year for the capital cost) $190/tonne at 2015 recovery levels and $123/tonne at 2036 recovery levels. This is equivalent to approximately $4.39 per household per month for capital and operations costs.

The total cost per household for collection and processing of recyclables was estimated to be $12.78 per month, or $153.36 per year.

A regional residential garbage collection program could also be implemented in parallel with the regional residential recycling curbside collection program. The cost was estimated to be in the order of $6.07 per household per month (for collection only; disposal fees would be additional).

The projected regional diversion rate of the system described by Tetra Tech is 12 percent. If recycling were made mandatory for the ICI sector, the diversion rate would increase; the MRF could operate a second shift to accommodate additional material. There would be no additional capital costs.

The administration of the regional waste management system including the recycling program could be provided through several governance models. A governance review found that enhancing the mandate of the FRSC would be the preferred governance model due to the efficiency of managing all services within one organizational structure, consistent accountability for service delivery, and support within the region.

No recommendations were made.

2. Current Analysis of MRF Sizing & Costs

2.1 Projections

GHD developed an independent estimate of the future quantity of residential recyclables. The approaches used by GHD, Tetra Tech and CH2M HILL were all different, but the results are fairly similar (Table E.1). Based on collecting recyclables from the current population that receives curbside garbage collection, the MRF should be sized to process approximately 5,500 to 8,000 tonnes per year, assuming a 20-year horizon.

Table E.1 Comparison of Estimates

Parameter	GHD (2019)	Tetra Tech (2018)	CH2M HILL (2014)
Future population (year noted in parentheses)	111,918 (2036) 121,370 (2040)	109,427 (2036) 117,289 (2040)	79,507 (2031)
Future number of serviced households (year noted in parentheses)	20,464 (2036) 21,461 (2040)	39,642 (2036)	N/A
Quantity of residential recyclables (year noted in parentheses)	5,097 (2036) 5,346 (2040)	7,929 (2036)	8,308 (2030)

Neither Tetra Tech nor CH2M HILL estimated the quantity of recyclable material generated by the institutional, commercial and industrial (ICI) sector. None of the member municipalities provide recycling collection service to the ICI sector, although Okotoks intends to make recycling mandatory for ICI establishments by 2020. The proposed recycling requirements in Okotoks will require recyclable materials to be collected separately from garbage and organic waste, but it will not set any requirements about what entity collects the materials or where they are taken for processing.

The remainder of this subsection presents an estimate of the quantity of recyclable material generated by the ICI sector.

- In 2018, 34,170 tonnes of MSW were disposed of at the LRRC.
- 7,874 tonnes of MSW were delivered by municipal curbside collection trucks (i.e. residential waste).
- The balance, 26,296 tonnes, is assumed to be primarily from the ICI sector with some amounts of self-hauled material. The detailed composition of this material is not known.
- Waste composition studies that focus on ICI waste in other jurisdictions indicate that 45-50 percent of the material is paper, plastic, metal and glass (Tetra Tech, 2016a, 2016b). A relatively successful ICI recycling program would capture about 50 percent of the recyclable material.

- These numbers indicate that about 6,500 tonnes per year could be captured from sources outside of municipal collection programs, based on 2018 data.

If the intention is for the MRF to process recyclable material from the ICI sector in addition to the municipality collected material, the total capacity would need to be approximately 12,000 tonnes per year. As noted by Tetra Tech, capacity for ICI recycling can be obtained by running a second shift in the MRF. In order for the MRF to successfully receive recyclables from the ICI sector, the municipalities would need a mechanism to require ICI recyclables be delivered to the regional MRF (rather than a MRF in Calgary), or the regional MRF would need to offer a tipping low enough to be competitive with the MRFs in Calgary.

2.2 Costs

GHD reviewed the capital and operating cost estimates developed by Tetra Tech. Based on our experience, the operating costs are low for a MRF that relies primarily on manual sorting, such as the MRF in the Tetra Tech report.

Tetra Tech's proposed design principally relies on manual sorting and uses limited and conventional mechanical separation technology. This approach was likely chosen to make capital costs lower. This approach has proven to be ineffective in today's markets given increasingly contaminated inbound material and limited, quality-focused end market requirements. The operational costs for a manual system that is fundamentally reliant on labour to recover high quality marketable materials are expected to be 100 percent higher than estimated by Tetra Tech.

Municipalities across Canada are making technological and process improvements to address the increasingly contaminated inbound material stream and end market requirements for recyclable material of the highest quality. Successful MRF's are using "intuitive or smart technology" for both paper cleanup and recovery of plastics. This approach will recover the high quality materials end markets now expect and will be better able to adapt to the ongoing changes occurring in packaging design. This approach comes with increased capital costs but reduces labour and ongoing operating costs.

As a result, a capital budget in the range of $6M may be more realistic. The system would include an upfront fibre scalping screen, fines screen for the removal of glass and other small items, and two optical sorters, one for the cleanup of paper and one for plastic recovery.

A side by side comparison of the costs proposed by Tetra Tech and GHD is presented in Table E.2.

Table E.2 MRF Capital and Operating Costs

	Tetra Tech	GHD (Westerview subconsultant)	Notes
Capital Costs			
General Site Grading and Preparation	$100,000	$100,000	
MRF Building	$900,000	$900,000	
MRF Processing Equipment (w/o baler)	$2,000,000	$4,000,000	Westerview estimate includes fibre scalping screen, fines screen, and two optical sorters
Storage Building	$50,000	$50,000	
Equipment (Mobile – Loaders and Fork Lifts)	$150,000	$150,000	

	Tetra Tech	GHD (Westerview subconsultant)	Notes
Three Phase Power	$100,000	$100,000	
Subtotal Capital	**$3,300,000**	**$5,300,000**	Includes contingencies
Engineering (10 percent of non-mobile equipment capital)	$315,000	$515,000	
Contingency (25 percent of non-mobile equipment capital)	$787,500	$1,287,500	
Total Capital	**$4,402,500**	**$7,102,500**	
Annual Operating Costs			
Labour	$670,000	$800,000	Includes $100K sales, general and administration
Utilities	$80,000	$100,000	
Equipment Maintenance and Use	$100,000	$150,000	
Product Revenue (avg. $60/t)	$(432,000)	$(432,000)	
Subtotal	**$418,000**	**$618,000**	
Contingency (20 percent)	$83,600	$123,600	
Total Operating	**$501,600**	**$741,600**	
Annualized Cost per Tonne			
Annualized Capital	$383,830	$619,230	20-years at 6%
Annual Operating	$502,000	$741,600	
Annualized Total	$885,830	$1,360,830	
Cost per Tonne			
	$190	$292	At 2015 recovery levels of 4,660 TPY
	$123	$189	At 2036 recovery levels of 7,200 TPY
Monthly cost per household	**$4.39**	**$6.75**	**Assume 16,800 households**

Note that the product revenue estimate shown in Table E.2 may not be achievable in today's market. Eliminating the product revenue results in an annual operating cost of $933,600 for the Tetra Tech estimate and $1,173,600 for the revised estimate. The higher operating costs result in monthly costs per household of $6.53 – $8.89.

The remainder of the analysis in this memo is based on the revised costs presented in Table E.2, with the product revenue as shown in the table.

3. Ownership Models

The most common ownership models for MRFS are:

a. Public ownership, public operations under a prescriptive design build contract.

i. Least likely to attract expertise to the process beyond equipment suppliers.

b. Public ownership, private operation through a Design, Build, Operate & Maintain (DBMO) contract.

i. Bidders typically are experienced in the design and operations of MRFs, so the municipality can leverage their expertise.

ii. Design specifications are not precisely defined; instead general system performance and environmental outcomes are specified, such as minimum throughput rates, recovery rates and finished material quality specifications.

iii. Operations contract should be longer in duration to incentivize sector leaders to participate.

c. Merchant capacity ("Put or Pay") model where the municipality enters into a long-term supply agreement with a 3rd party processing facility that includes prescribed financial and environmental outcomes.

The strengths and weaknesses of each ownership model are presented in Table E.3.

Table E.3 Assessment of MRF Ownership Models

Ownership Model	Strengths	Weaknesses
Public ownership / Public operation	• Having a dedicated facility allows the local government to control the gate. • Since it is a dedicated facility, can add 3rd party materials for increased revenue, including materials from ICI sector. • Provides local employment and/or potential to assign to internal modified work employee. • Maximum flexibility to deal with changes at both an operational scale (addition/deletion of accepted materials, market specs, etc.) and also at a policy scale such as EPR. • Facility can becomes a "showcase" that promotes local pride in diversion programs and environmental ethos.	• Full capital cost financing. • Full market revenue risk. • Requires a detailed RFP, which includes prescriptive design-build specifications for equipment. Procurement process is complex with added risk. • Public procurement process for any capital changes needed which reduces flexibility to upgrade or replace equipment in a timely fashion. • Not able to leverage expertise of experienced private sector operators, greater reliance on consulting engineers for additional technical support.
Public / Private - DBOM (Design, Build, Operate & Maintain)	• Flexible financing options. - Re-payment in form of progress payments during construction. - Re-payment over term of operating contract. • Option to fully avoid or share marketing risk. • Less complex procurement process. RFP stipulates key environmental and economic outcomes. • Since it is a dedicated facility, can add 3rd party materials for increased revenue, including materials from ICI sector. • The facility can be a showcase that promotes local pride in diversion. • Provides local employment.	• Full capital cost financing. • Need to balance risk between municipality and contractor to ensure competitive bidding. • Requires administrative oversight and associated costs. • Requires long-term operations contract with flexible contract terms to address unanticipated changes and avoid future risks. • Subject to strength/weakness of market competition. • Asset management responsibilities and cost.

Ownership Model	Strengths	Weaknesses
	• Leverage operator experience and innovation in both facility design and facility operations. • Leverage operator-marketing experience. • Can site facility strategically.	
Private (Merchant Model)	• No upfront capital • Often the most cost-effective approach particularly for municipalities with low volumes of material. • Less complicated procurement process: identify environmental and economic outcomes. • Leverage operator marketing experience and operational dexterity based on market conditions. • Option to fully avoid or share marketing risk. • Added cost of bulking and transferring material to private MRF.	• Sophisticated contract management and administrative oversight required to ensure environmental outcomes are met. • Not a "dedicated" facility, so require nuanced contractual terms and conditions to ensure requirements are realized • General loss of control and associated additional risk. • Limited by capacity & capability of local marketplace: - Is local market mature? - Is there competitive market "tension"? - Does local market have requisite experience & expertise?

Based on the evaluation presented above, it is clear that the strengths of the public ownership and operation option are accompanied by significant risks, particularly in this current period of depressed recycling markets (see Section 6). The public/private option appears to be more attractive, but it may be difficult to find an experienced operator willing to invest in the relatively small size required by the Region, given the low revenue potential. The merchant model leverages the Region's proximity to the larger recycling market in Calgary, and has the potential to be successful if the contract is structured to allow enforcement of environmental requirements.

4. Alignment with Vision and Objectives

A sample vision statement was presented to the Technical Advisory Group (TAG) of the Region on May 2, 2019. Based on feedback from the TAG, the vision statement was revised to read as follows:

The members of the Region provide a high level of waste management service, in order to meet regional environmental objectives and provide long-term sustainability, at a reasonable cost.

This vision statement has not been formally adopted by any entity. TAG members noted that their primary goal was to run a cost-effective system.

The potential development of a MRF is evaluated in Table E.4 in the context of each of the key elements of the draft vision.

Table E.4 Analysis of MRF Development in the Context of Draft Vision

Element	Commentary on MRF Development
High level of service	No difference to residential customers; could improve efficiency for local haulers of recyclable materials (e.g. T&T Disposal). Owning a MRF will give member municipalities more incentive to provide increased customer education and to reject contaminated set outs; stricter enforcement of the rules could be perceived as a reduction in service level.
Environmental objectives	More control over end use of materials (ensure materials are not landfilled or incinerated after sorting).
Long term sustainability	The MRF could support emerging local markets by choosing to send recyclable materials to local users. This will improve the long-term outlook for recycling markets.
Reasonable cost	Likely to be more expensive than using already established facilities that operate at larger scales and benefit from economies of scale. TAG members emphasized that a key goal is to keep costs low.

Based on this analysis, it appears that the projected increase in cost from developing a MRF may outweigh the potential benefits.

5. Market Analysis

5.1 Global Recycling Markets

Commodity prices for recyclables have dropped significantly in the past 18-months, and many communities are having a difficult time finding buyers for their recyclables. Some municipalities have resorted to landfilling or incinerating recyclables (Corkery, 2019), while others (including local governments in Alberta) have reduced or eliminated their recycling programs (Small, 2018). Certain types of materials are particularly difficult (and costly) to find markets for. Plastics are particularly difficult to market. For example, the City of Calgary accepts all rigid plastics #1 through #7, plus various types of film plastics (this broad range of acceptable plastics is common in most large urban municipalities across Canada). Calgary produces Mixed Rigid Plastics (MRP) bales, which are a blend of various #1-7. These bales are shipped to a processor in British Columbia who resorts the material and ships it back to Calgary for further processing. The market is unable to take the 100+ loads of MRP that Calgary has warehoused since their export market collapsed last year; the solution described above is for new material only (Westerview Consulting, personal communication).

The Recycling Council of Ontario has made recommendations for improving recycling in Canada in light of limited foreign end-markets. The recommendations most relevant to the analysis of the need for a local MRF in the Region include (St. Godard, 2018):

- Focusing on the source: reducing packaging, implementing EPR, avoiding single-use plastics.
- Creating sustained markets: Employ policies and incentives to redirect materials away from landfills and towards recycling markets, providing a consistent source of material for the market to operate on.
- Growing domestic recycling solutions: Invest in local organizations and markets that manage and process recyclable material locally.

To date, the Region has managed to keep recyclables marketable (by keeping contamination low) and are having success marketing some paper products directly to mills. Additional local markets may slowly start

to emerge, as they have in British Columbia, thanks in part to EPR programs that guaranteed material to a local plastics processor, allowing it to invest in improved equipment.

5.2 Local Markets

Local producers of recyclable material (such as private MRFs) in the Calgary area are able to access markets in Western Canada and the United States. Some recyclable material may also be sold to brokers, who then market it further afield. The best prices for recyclable materials are obtained when it can be sold directly to the end user (e.g. paper mills or plastic manufacturers).

Some local MRFs have begun stockpiling recyclable material in anticipation of a future waste to energy facility. This is indicative of the low market value for recyclables at this time.

Cardboard is trading at historic lows, at less than $100/tonne. Mixed Paper is trading at $40 to $0, sometimes even at a loss, depending on quality and distance to end markets. The local market for plastics is weak, and plastics are now often a negative commodity (i.e. producers of recyclable plastics need to pay have to the plastics processed). The cost of recycling plastic may reach or exceed the tipping fees for landfilling.

5.3 The Evolving Tonne

The types of materials being discarded today are significantly different from the materials disposed of ten years ago. This phenomenon is referred to as “the evolving tonne” Major changes include an increase in the use of lighter plastics and a decrease in the use of heavier packaging materials such as glass and metal. Packaging is also being made lighter by changes in design (e.g. thinner walls), typically referred to as “light-weighting”. In addition, less printed paper is being generated, as fewer people receive daily newspapers, and newspapers have switched to smaller formats and fewer editions. These changes make processing recyclables more challenging. Recycling depot and processors must handle a larger volume of material in order to manage the same quantity by weight. This means that more work is needed to generate the same amount of revenue. In conjunction with falling commodity prices, it is difficult to recycle profitably.

The evolving tonne has been documented locally in the City of Calgary. The quantity captured by the curbside recycling system dropped from 58,000 tonnes in 2010 to 53,000 tonnes in 2013, even though more residents were added to the service, and recycling rates for individual materials remained steady (Morawski, Kelleher, & Millette, 2015).

6. Potential Impacts of EPR and Other Regulatory Changes

Developing a local MRF has inherent risks associated with commodity markets, as described in section 4. There are also risks associated with regulatory and economic changes, which are described in this section.

6.1 Extended Producer Responsibility

EPR is a policy approach that makes producers responsible (financially and/or physically) for the management of post-consumer products. The theory behind EPR is that making producers responsible for the end-of-life management of their products provides incentives to reduce waste and make the remaining waste easier to recycle.

EPR programs in Canada are implemented by provincial governments. Alberta is the only province not to have legislated EPR programs or requirements. The provincial government does not officially endorse EPR as a policy instrument. No formal policy intentions have been released, and no consultation has been conducted since 2013 (AEP, 2019), so no changes are expected in the near future.

The Canada-Wide Action Plan for Extended Producer Responsibility (CAP-EPR) was developed by the Canadian Council of Ministers of the Environment (CCME) and released in 2009. A Progress Report was issued in 2014. The purpose of CAP-EPR was to promote a harmonized approach to EPR policies and programs across Canada. CAP-EPR identifies timelines for the designation of materials and product categories to be managed under EPR programs or requirements, as shown in Table E.5.

Table E.5 Designated Materials under the Canada-Wide Action Plan for Extended Producer Responsibility

Phase 1 (2015)	Phase 2 (2017)
Packaging – all packaging currently handled by municipalities or generated from the industrial, commercial and institutional sectors.	Construction materials
Printed Materials – newspapers, advertising flyers, magazines, and directories, etc.	Demolition materials
Mercury-containing lamps and other mercury-containing products	Furniture
Electronics and electrical equipment.	Textiles and carpet
Household hazardous and special wastes.	Appliances, including ozone-depleting substances (ODS)
Automotive products – used oil, filters and containers, lead acid batteries, lamps, tires, refrigerants and anti-freeze, brake, transmission, other fluids and their containers.	

Almost half of the product categories for Phase 1 are now covered by legislated EPR programs or requirements across the county (except in Alberta).

Alberta has five regulated recycling programs (tires, electronics, paint, used oil materials, beverage containers), which are administered by delegated administrative organizations (DAOs) that are arms-length from government and are made up of a variety of stakeholder groups, including producers. They are enabled under the Environmental Protection and Enhancement Act.

The roll out of EPR programs for materials that are already managed by local governments (such as packaging and printed paper (PPP)), has the potential to disrupt municipal operations. British Columbia provides an example of this. In 2014, residential PPP was added to the list of materials covered by EPR programs in British Columbia. A product stewardship organization was formed to represent producers of PPP and to coordinate services (Recycle BC). Most local governments in British Columbia already provided some form of PPP collection, and the transition to service provision by Recycle BC required significant effort. Five years later, most local governments either receive funding from Recycle BC to subsidize their operations or have opted to have Recycle BC provide service directly through a contracted service provider. Recycle BC also issued a request for proposals for a network of consolidation and processing facilities to manage the PPP collected through its program. The successful proponent (Green By Nature) brought together existing facilities from across the province. Facilities that were not part of the Green By Nature consortium have had to find alternate sources of feedstock in order to stay in business.

Although there is no indication that EPR for PPP will happen in the near future, there is some risk associated with building substantial infrastructure to manage PPP.

6.2 The Circular Economy

The concept of the "circular economy" refers to the decoupling of economic activity from the consumption of finite resources, and designing waste out of the system. The circular model is based on three principles:

- Design out waste and pollution
- Keep products and materials in use
- Regenerate natural systems

Circular economy principles are currently being demonstrated on a limited basis, primarily in specially designed industrial parks, where the waste products from one process can be used as feedstock for a neighbouring facility. This approach to design and production has the potential to significantly reduce the quantity of waste produced in the long term.

There are both risks and potential benefits to developing a MRF in the context of the circular economy. If the MRF were developed as an integral part of an industrial park that included users of the recyclable materials, the risks associated with marketing the materials would be decreased. However, the development of innovative circular economy models, such as the Loop system, may reduce the quantity of recyclable material available to process. The Loop system is operated by TerraCycle, and features reuable/refillable containers from major brands such as Procter & Gamble, Nestlé, PepsiCo, Unilever, Mars, Clorox, Coca-Cola, Mondelēz, Danone, Carrefour, UPS and Suez (Makower, 2019). The system is currently launching in New York and Paris and an international expansion is planned.

7. Conclusions

7.1 Short Term

In the short term, it does not appear to make financial sense for the region to develop its own MRF as a public facility. It may also be difficult to find a private partner for the relatively small volume of recyclables from the Region, particularly since there are several private MRFs already operating in the Calgary region. The relatively low quantity of recyclable material generated in the Region, even assuming that all member municipalities are willing to initiate residential curbside collection and require recycling by the ICI sector, means that the region's ability to enter into a "put-or-pay" contract with a private developer is limited.

Furthermore, the number of MRFs in the region allows municipalities to obtain competitive pricing when signing a processing contract. ECCO Recycling, Cascades Recovery, and Capital Paper all have MRFs on the southeast side of Calgary, within 30 km of Okotoks. A brief summary of the potential costs associated with using each MRF is presented below:

- The current price per tonne charged by ECCO Recycling to sort and market comingled recyclables is about half the cost per tonne to own and operate a MRF (as estimated by Tetra Tech based on 2015 material recovery levels).
- A quote provided by Cascades Recovery in 2017 had a processing fee of $146 per tonne (higher than ECCO's current fee). This quote is still lower than the cost estimated by Tetra Tech. Cascades would also allow 100 percent of the revenue to return to the Region. When an estimate was provided in 2017, the projected revenue of $118/tonne resulted in a net cost of $32/tonne, which is one sixth of the cost estimated by Tetra Tech. Revenues now would be lower.
- Capital Paper has indicated that is currently paying for clean paper, although the mixed materials collected at curbside would likely have a net cost for processing.

Maintaining a contract with a private MRF will provide cost certainty for each contract period, and cost certainty is typically valued by local governments. Minor changes in the composition of material received at a MRF or commodity prices can make significant changes to the economics of the MRF. MRFs generally operate on tight margins and can be materially impacted by relatively small changes in conditions.

In addition, the significant uncertainty associated with the depressed international market for plastics, means it is not a strategic time to invest in a multi-million dollar facility designed to sort plastics from other recyclables. There is a distinct lack of domestic markets for plastics, and other municipalities are discovering the liability associated with unmarketable plastics. As noted in Section 6, Calgary had a very difficult and costly experience finding a solution to manage PET clamshells, which are difficult to recycle due to the adhesives used to attach labels) (Kaufmann, 2019).

By not being directly involved in sorting and marketing recyclables, the Partners will maximize their flexibility and ability to respond to the rapidly changing markets. A strong contract for the processing and marketing of recyclables will give the municipalities the power to ensure that the recyclables are actually recycled, and will give the municipalities flexibility to adjust what can be put in the recycling stream in response to market changes.

7.2 Long Term/Triggers for Development

While development of a MRF is not recommended at this time, the following triggers or conditions have been identified that could improve the viability of developing a MRF:

1. Closure, reduction in capacity or substantial increase in price at private MRFs in Calgary
    i) A change in the ability of private MRFs to accept recyclables from the Region could make development of a private MRF more desirable. If any of the existing MRFs closed or if their capacity became unavailable for materials from the Region's municipalities, competitive forces that are currently keeping prices relatively low would be reduced, and the price for processing could increase.
    ii) A dramatic increase in ICI recycling in Calgary could consume the capacity of the Calgary-based MRFs and make it harder for the Partners to gain access and/or result in higher prices. An increase in recycling in the Calgary ICI sector is expected as disposal bans and surcharges become more strictly enforced.
2. Improvement of local markets for recyclables (i.e. expanded capacity of western Canadian factories that process post-consumer recyclables into new products).
    i) Improved local markets for the materials departing the MRF would reduce the risk associated with operating the MRF. Local markets in BC are being strengthened as a result of the guaranteed supply of PPP through the EPR program. A concerted effort or contractual commitment from Alberta-area MRFs to supply recyclable materials to local mills and factories could stimulate the local market for recyclables.
3. Mandatory recycling for all ICI establishments throughout the Region and ability to require all ICI recycling be processed at the regional MRF.
    i) The Town of Okotoks is in the process of requiring all ICI establishments to separate the recyclable materials that are collected in the residential curbside collection program. When this program rolls out, and if a similar requirement is established in other member municipalities of the Region, the quantity of recyclables needing processing will nearly double. Under the current

regulatory scheme, the recyclables from the ICI sector can be hauled to any MRF. The increase in the tonnage would result in a decrease in the processing cost per tonne of a local MRF, because the increase is not enough to require an increase in equipment or building size. A second shift could be added at the MRF, which would increase operating costs, but the fixed capital costs would be shared among a higher quantity of recyclables. Based on the revised costs presented in Table 3.2, the cost per tonne when ICI materials are processed with residential materials is estimated to be $239 per tonne in 2018 (vs $292 for residential materials only) and $148 per tonne in 2040 (compared to $189 for residential materials only). This does not appear to offer a savings over the costs of using private MRFs in Calgary (at approximately $100 per tonne), even with the cost of transportation to Calgary factored in, at approximately $50/tonne.[1]

ii) Even if the cost of processing at a local MRF could be competitive with the cost of transportation to Calgary and processing in Calgary, the recyclables from the ICI sector would not necessarily flow to a local MRF without some form of regulatory flow control. Other factors, such as wait times at the facility and ease of offloading will also influence the behaviour of private haulers. Long wait or unload times contribute to off route lost time and costs. It is generally difficult for municipalities to compete with the private sector for the higher value, easy to recover recyclable materials from the ICI sector, such as clean, dry OCC. Private MRFs who already process those valuable materials will protect their supply vigorously. Municipal MRFs will often be left with the lower value, mixed streams that are more difficult and more costly to recycle, and that have much lower revenue. Municipal MRFs will also see more material during periods of low market demand, and less when markets are strong.

iii) As alluded to above, regulatory flow control could be required to compete successfully with private MRFs. Based on our understanding of the Region's priorities; we believe that the Region does not have the political will to compete for ICI recyclables material. Many local governments are uncomfortable using public assets to compete with facilities developed with private investments.

4. Changes to the materials collected in the blue box program

i) A recent study in Ontario classified recyclables as "core" and "non-core". In Ontario, core materials have the following qualities: 1) high recyclability 2) generated in significant quantities by households 3) low cost of material management and 4) accepted by most municipalities for inclusion in the blue box program. Using these criteria, the following eleven materials are classified as core materials: newsprint; magazines and catalogues; telephone books; other printed paper; corrugated cardboard; boxboard; PET bottles; HDPE bottles, steel packaging; aluminium packaging, and glass. Non-core materials have 1) low levels of recyclability 2) poorly developed end markets 3) high cost of material management and 4) low revenues from sale of material. Using these criteria, the following seven materials were classified as non-core materials: gable top cartons; aseptic containers; paper laminates; plastic film; plastic laminates; polystyrene, and other plastics. The analysis found that the presence of non-core materials within the recycling system results in significant cost increases, while contributing negligibly to overall diversion rates.

[1] Transportation costs were estimated as follows:
- Material is transported in non-compacted walking floor trailers (13 tonne loads)
- Loading costs of between $12-$15/tonne
- Haulage costs to Calgary of $35-$40 /tonne
- Total cost: $47-55

ii) The materials accepted in the recyclables collection program could be adjusted to minimize the market risk (following the concept of “core” and “non-core” materials described above). The core materials could be limited to:

(1) Newsprint

(2) Magazines and catalogues

(3) Telephone books

(4) Other printed paper

(5) Corrugated cardboard

(6) Boxboard

(7) HDPE bottles (resin code #2)

(8) PP plastic (resin code #5)

(9) Steel packaging

(10) Aluminium packaging

The facility would produce the following grades: Mixed Paper, OCC, HDPE-N, HDPE-C (perhaps with PP included), FE, AL.

Reducing the set of acceptable materials would not significantly reduce capital costs (from the $7 million estimate presented previously). Technology is still required to recover marketable materials (even a shorter list of target materials). If the stream were to be significantly cleaned up by reducing the list of acceptable materials, capital costs could be reduced. Operating costs could be reduced somewhat should the recovered material be limited to high value recyclable materials. Cost reduction would only be achieved to the extent that products that are removed from the recycling program were not put in the recycling stream and/or the extent to which contamination was reduced. There is a significant risk that the contamination level would increase, because it would be difficult to train residents to exclude materials that they are currently recycling (especially various types of plastics). However, Calgary’s recent difficulties with marketing mixed rigid plastics emphasizes the need to careful consider the acceptable set of materials for any new curbside collection programs.

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Appendix F
Regional Organics Processing Facility Analysis

Appendix F Regional Organics Processing Facility Analysis

Aerobic composting and anaerobic digestion (AD) are the primary methods for processing organic waste and producing valuable end products. Both are engineered biochemical conversion processes involving the decay of organic materials, but involve different conditions and produce different outputs, and have differing costs and revenue potential.

Both technologies are established across Canada for processing organic waste. The City of Calgary operates a large aerobic composting facility processing over 145,000 tonnes of mixed food and yard waste annually. The City of Edmonton recently closed their aerobic composting facility due to structural issues (closed May 29, 2019), and is in the process of commissioning a smaller AD facility that is set for full operation by the end of 2019. Edmonton is also beginning the process of replacing the closed composting facility with a new AD facility that would produce and sell renewable natural gas (RNG). The City of Toronto operates the two largest SSO AD facilities in Canada, processing organics from the Greater Toronto Area and producing RNG, while digestate is composted and applied in local parks.

The following section provide detailed information on the technologies and their benefits and drawbacks. These sections are followed by a summary of the analysis regarding the Partners, and the considerations for developing an organics processing facility (OPF) in the Region.

1. Organic Waste Processing Technologies

1.1 Aerobic Composting

Composting is the process of aerobic degradation of organic wastes through microbial activity. Compost facilities are designed to ensure effective degradation of organic material and to manage materials generated during the process, in particular the collection and disposal of leachate.

Composting facilities in Alberta are defined as Class I or Class II facilities. Class I facilities accept any type of organic waste excluding hazardous wastes, while Class II facilities accept only animal manure or vegetative matter. The majority of composting facilities in Alberta are Class II facilities servicing the agricultural and livestock industries. Composting facilities that accept municipal food waste are Class I facilities.

Composting Technologies

Composting technologies can be divided into two categories: windrow composting and in-vessel composting. Generally, in-vessel composting provides a higher degree of control over the aerobic process, which comes with higher capital and operating costs.

Windrow composting involves mixing organic waste with amendments (typically wood chips) and placing the mixture in long, relatively narrow piles with a height of typically less than 3 m. Well-managed windrows reach the high temperatures required to destroy pathogens and weed-seeds and provide a relatively low-cost method of composting yard waste, residential food scraps and biosolids. The rate of biodegradation is impacted most significantly by the availability of oxygen (i.e. aeration), moisture content and temperature. A wide variety of windrowing methods have been developed to manage these factors, such as static piles, mechanically mixed piles, aerated, covered and open windrowing.

In-vessel composting facilities can process larger quantities of organic waste on a smaller footprint. Organic feedstock is fed into a drum, silo, concrete-lined trench or similar vessel, in which the environmental conditions such as temperature, moisture levels, and oxygen levels are controlled. The material is typically mechanically turned and mixed on regular intervals. In-vessel composting produces compost in a few weeks, however additional time is required to cure the material (curing refers to a lessening of microbial activity and temperature). In-vessel composting allows for greater control compared to windrow composting.

End Product

Compost produced in Canada must meet the standards established in the Guidelines for Compost Quality published by the Canadian Council of Ministers of the Environment (CCME, 2005). Compost is divided into two categories depending on the concentrations of trace elements and foreign matter. Category A Compost is compost that can be used for any application, including agricultural lands, residential gardens and lawns, nursery industry, and other industries. Category A compost has lower maximum levels for trace elements such as mercury, cadmium, and lead than Category B compost. Category B compost has a restricted use due to the presence of sharp foreign matter or higher concentrations of trace elements. Sharp foreign matter includes contamination such as glass and metals shredded into the compost product. Category B compost cannot be used in pastures, parks, or for residential purposes.

Production of compost suitable for use on farms must meet requirements contained in the CanadaGAP Food Safety Manal for Fresh Fruits and Vegetables (CanadaGAP, 2018). For organically certified farms there are additional requirements contained in organic production systems permitted substances lists - CAN-CGSB-32.311-2015E and organic production systems general principles and management standards – CAN/CSB-32.210-2015. For both conventional and organically certified farms, compost may not contain sewage sludge and must be produced in facility, which is separate from any production site processing sewage sludge. Growers must also be provided with information on the composting process and letters of assurances (updated for each growing season).

In GHD's experience, the sale of compost should not be relied upon for revenue due to high supply, low demand, and uncertain final quality due to variations in feedstock.

1.2 Anaerobic Digestion

AD refers to a series of controlled biological processes in which microorganisms break down organic material in the absence of oxygen. The biological process occurs in a sealed vessel (called an anaerobic digester) and results in the production of biogas, liquid effluent, and a solid product. The solid is comprised of partially stabilized organic material, which after dewatering, is known as digestate. Biogas is comprised of methane, carbon dioxide, and other gases such as hydrogen sulphide and ammonia. The composition of the biogas depends on feedstock quality and process technology. Biogas can be combusted in an engine to produce electricity, processed into renewable natural gas (RNG), or processed to produce streams of other valuable gases such as hydrogen. The liquid effluent and digestate require further processing, stabilization, and disposal. Stabilized solids can be used as compost or fertilizer.

The AD process requires ancillary equipment and structures to effectively operate the process, including pre-processing, AD, and post-processing of the process outputs. These are briefly discussed in the following sections.

Pre-Processing

The physical and chemical characteristics of the organic waste feedstock are important parameters for designing and operating digesters as they affect biogas production and process stability. The main

characteristics include moisture content, volatile solids content, nutrient contents, particle size, and biodegradability.

Pre-processing is required to convert the heterogeneous, contaminated input feedstock into a homogenous feedstock. Pre-processing requirements depend on the type of AD process, and are generally divided into primary and secondary pre-processing. In primary pre-processing, contaminants are removed to a level required for secondary pre-processing technologies. In secondary pre-processing, the feedstock is further refined by removing contamination, altering total solids levels, and fragmentation.

Dry pre-processing includes upfront screening of the organic materials and any blending of amendment materials with the organic material. Dry pre-processing is commonly used with AD processes that require a higher solids content. Wet pre-processing is required for any AD process that requires a lower solids content. In wet pre-processing, the organics are processed into a mixed pulp or slurry for the subsequent AD processing.

Anaerobic Digestion Technologies

AD technologies can be split into three broad categories, which are defined based on the method of maintaining the material in the digester and the total solids (TS) content of the material in the digester:

- Continuously stirred tank reactors (CSTR): The TS in CSTR digesters are typically less than 12 percent; the appearance is a liquid slurry. CSTR digesters can be mixed continuously or at a frequent interval (e.g. hourly).
- Plug flow reactors: The TS in plug flow digesters is typically in the 15 to 30 percent range, and sometimes higher, depending on the feedstock. The digestate is moved through the digester as a single mass, rather than being mixed.
- Percolate bunker reactors: The TS in percolate bunker digesters is typically from 20 to 40 percent. Percolate bunkers are typically loaded with a front-end loader into a long pile and the material remains in place for the duration of the digestion period.

An additional consideration for AD technology selection is the temperature of the process and its effect on biogas generation. Digesters can be operated in either the mesophilic or thermophilic ranges. The mesophilic range is between 30 and 38 degrees Celsius (°C) with an average typically around 35°C. By contrast, thermophilic digesters operate in a range above 50°C. Thermophilic temperatures increase the rate of volatile solids destruction, resulting in smaller reactor sizes, and also provide an increased level of pasteurization and pathogen reduction compared to a mesophilic digestion system. The trade-off is increased energy requirements to maintain the higher temperatures and a reactor biology that is more sensitive to changes in feedstock and operating conditions. Mesophilic digesters are generally easier to operate and with adequate retention, time can provide similar biogas yields.

Provided below is a high-level comparison of the AD processing technologies.

CSTR

Typical characteristics of CSTR processes include the following:

- Low TS slurries are used to facilitate continual (or regular) agitation of the digestate. Regular agitation prevents floating of light and settling of heavy contaminants in the tank, which may reduce the effective volume of the digester, reducing the effective capacity and, therefore, biogas yield from the system.

- Mixing of the slurry in the tank may be done by several different methods including gas injection, impellors, plunge mixers, or pump mixing.
- Produces biogas and liquid digestate.

Plug Flow Reactors

Plug flow reactors are designed in either vertical or horizontal flow directions. Vertical plug flow reactors utilize minimal amounts of agitation, sufficient only to slowly move the material from one point to another through the digester during the retention period. Characteristics of vertical plug flow tanks typically include:

- Vertical column tank and a conical base to facilitate digestate removal.
- Digestate is removed from the bottom of the tank. During the retention period, the digestate slowly moves downwards through the vessel towards the outflow point. The ability to re-cycle digestate from the outflow to mix with fresh incoming material can be incorporated into the design to assist with inoculation of the incoming material and to increase gas yields.
- The reactor is operated with TS in the range of 18 to 30 percent, and is adjustable.
- Amendment material (e.g. yard waste) may be required to increase the TS of the slurry.
- The high solids content precludes extensive pre-processing; therefore, composting is typical used as the post processing step to clean the digestate to meet beneficial use criteria.
- Produces biogas, liquid digestate, and a high solids digestate.

Horizontal plug flow reactors operate on the same principals as vertical plug flow reactors. The differences of horizontal plug flow reactors include:

- Long and slender horizontal digester vessel.
- A horizontal shaft with widely spaced paddle arms that slowly move the feedstock forward while creating a minimal amount of mixing.
- A headspace above the material pile where biogas collects and is syphoned from the reactor.

Percolate Bunker Reactors

Percolate bunker reactors are similar in design to enclosed composting vessels but are operated in an anaerobic environment. Typical characteristics of percolate bunker reactors include the following:

- Vessels are typically constructed of concrete, but may be constructed of steel, and are large enough to drive material handling equipment (e.g. front-end loader), into the bunker to place the organic feedstock.
- Feedstock requires little pre-processing, beyond bag opening or shredding, depending on feedstock characteristics.
- Feedstock is loaded into the digester and the door sealed for the duration of the retention period, typically 21 to 28-days.
- Percolate water is sprayed onto the material piles to create anaerobic conditions and to harvest organic liquid from the feedstock. The anaerobic conditions create biogas within the reactors, and the harvested organic liquid can be separately digested to produce additional biogas.
- Percolate water may also be collected and sent for further digestion through a CSTR system to recover additional biogas.

- A TS content of 25 percent or more is required; amendment material (e.g. yard waste) may be required to increase the TS content.
- Produces biogas, liquid digestate, and a high solids digestate.

Post-Processing

The biogas and digestate produced require post-processing to produce marketable end products.

Biogas Post-Processing

Methane-rich biogas generated from the AD system can be collected and stored in the head space of the digestion tank or in a separate storage vessel to manage fluctuations in the production and consumption rates. Biogas can be scrubbed and upgraded for use as a fuel in combustion engines, producing electricity and heat, or further upgraded to produce a stream that is greater than 99 percent methane. The upgrading process involves removal of water, carbon dioxide, hydrogen sulfide, and other trace elements. The resulting biomethane is called renewable natural gas (RNG); its high methane content makes it comparable to conventional natural gas and thus a suitable energy source in applications that require pipeline-quality gas. RNG can be used as a transportation fuel in the form of compressed natural gas (CNG) or liquefied natural gas (LNG), and can be used for heating and other utility applications. RNG qualifies as an advanced biofuel under the United States' Environmental Protection Agency's (US EPA) Renewable Fuel Standard.

The options for marketing RNG are many and growing. Natural gas distributors, such as FortisBC out of British Columbia and Énergir (previously Gaz Metro) out of Quebec have been purchasing RNG to offset the fossil-fuel derived natural gas. In Alberta, ATCO has indicated interest in RNG and EPCOR is actively pursuing and developing RNG production projects. FortisBC launched the first RNG program in Canada in 2011, and the company has a standing offer for the purchase of RNG as well as funding available for new RNG projects. Currently, RNG-producing projects are able to lock in 20-year contracts with FortisBC for prices in the range of $22 to $30 per GJ. In comparison, conventional natural gas has a marketable value of approximately $2 per GJ. The high value of RNG is attributed to the greenhouse gas (GHG) offsets associated with its production and use. In Alberta, where electricity prices are low, GHD's experience has shown that RNG projects are currently more economically favourable than projects that combust biogas to produce electricity.

The California Low Carbon Fuel Standard also requires reduction in emissions intensity for fuels used by regulated facilities. The Standard allows facilities to achieve compliance by purchasing RNG virtually from other jurisdictions, without requiring the RNG to be physically transferred to California. This is currently a very viable mechanism for marketing RNG at a competitive price, although the current window for RNG sales under this program will close in 2022 (there is potential for renewal). There are multiple projects in Canada, both biogas and landfill gas, that are commoditizing RNG through the Low Carbon Fuel Standard and the Renewable Identification Number (RIN) program.

Digestate Processing

Anaerobic digestate is a valuable bio-fertilizer and has many benefits including the following: source of nitrogen, phosphorous and potassium; greater availability of nutrients for crop uptake; improved soil quality and structure; increased crop yields; odour reduction; reduced reliance on synthetic chemicals; reduced pathogens; and potential income from sales.

Digestate contains organic matter and nutrients such as phosphorous, nitrogen, potassium and sulphur. Anaerobic digestate can be managed in two different ways: direct land application and dewatering. Land

application of liquid digestate is a means of returning phosphorous, nitrogen, potassium, sulphur, and organic matter to the soil, thereby leading to a more efficient closing of the nutrient cycle. Land application of organic waste can also contribute to the long-term stabilization of carbon content in the soil, thereby decreasing atmospheric carbon dioxide levels. Dewatering is a preferable digestate management option as it allows for the handling of the solid and liquid portions of the digestate separately. Dewatering forms a cake-like material and liquid phase containing water, minerals, and solids. A centrifuge can be used for dewatering and can achieve 28 to 30 percent total solids in the digestate product. The liquid phase is termed centrate, and can be sent to an aerobic wastewater treatment facility for further contaminant removal before final disposal. The solid fraction of the dewatered digestate can be stored and transported via haulers for composting at a permitted facility.

2. Key Technology Considerations for the Partners

In order to determine the most appropriate organic waste processing technology for the Region, the technologies must be evaluated in the context of the local organic waste quantities and characteristics. Decisions about organic waste collection and processing must be coordinated. Table E.1 discusses the key considerations for an organic processing facility in the Region.

Table F.1 Organics Processing Technology Key Considerations

Consideration	Description	Considerations Specific to the Region
Feedstock and Collection Streams	Organics collection programs can collect either combined food and yard waste or only food waste (possibly augmented by separate seasonal yard waste collection). A combined food and yard waste stream can be processed by a dry AD facility or composting (covered or in-vessel to control odours and leachate associated with food waste). Yard waste has lower energy content than food waste and generates less biogas per tonne of feedstock than food waste. Food waste requires more stringent controls for effective treatment. A straight food waste stream can be processed by a wet AD system or by composting. Composting would require a bulking agent to provide structure and sufficient carbon to balance the microbial activity. AD with a separated food waste stream produces the highest amount of biogas, which can be used to produce and sell electricity or RNG.	Okotoks already collects yard and food waste together. It can be difficult and/or expensive to source the bulking agent (e.g. wood chips) that would be required to compost food waste. This could pose a challenge in the Region if the collection service collected food waste only, or if yard waste quantities are insufficient. There is no wet AD facility in the Calgary area, so any program collecting food waste only will need to consider how the material can be processed at existing facilities, or if constructing a new AD facility is feasible. By collecting yard waste, Okotoks sources the majority of the bulking agent through the collection program, at a marginal cost.

Consideration	Description	Considerations Specific to the Region
Feedstock Quantity	The capital costs of wet and dry AD facilities are typically higher than for composting. AD facilities are appropriate for larger scale applications, where economies of scale make the capital cost less of a barrier. Composting food waste with yard waste requires higher controls on the composting environment and nuisances, such that an in-vessel composting system would likely be required for quantities over 10,000 tonnes per year. Such a facility would be less economic for lower feedstock quantities and would benefit from economies of scale with higher quantities. Based on GHD's experience with AD facilities across Canada and the US, a 25,000 tonnes per year facility would have a capital cost in the range of $25 million to $35 million. The cost per tonne increases as the facility capacity decreases, and decreases with increasing scale. Based on GHD's experience with composting facilities across Canada, a 20,000 tonne per year covered aerated bunker or in-vessel facility would have a capital cost in the range of $4-6 million.	The residential sectors in Okotoks, High River, Turner Valley and Black Diamond generated approximately 12,000 tonnes of organic waste in 2018 (4,954 tonnes of food waste and 6,689 tonnes of yard waste). This is likely not enough feedstock to warrant the development of an AD facility or high-tech composting facility at the current time, unless combined with ICI organic waste. By 2040, the Partnership is expected to generate over 23,000 tonnes of organic waste annually. The ICI sector, both in the Region and the City of Calgary offers a significant opportunity to increase the quantity of feedstock. If ICI organic waste can be directed to an organics processing facility, either through competitive tipping fees or a regulatory approach, the economics of an AD facility may become attractive. The facility would also benefit from the additional revenue of accepting ICI organic waste. Processing facilities accepting ICI organics are currently lacking in Southern Alberta, and with more stringent landfill policies such as Calgary's landfill organics ban, these generators have a growing need of organics processing options.
Scalability and Modularity	AD facilities tend to modular in increments of 10-20,000 tonnes per year. Composting facilities are more easily scaled, depending on the type of facility. The operating hours of grinding and mixing equipment can be extended to increase throughput, and windrows or bunkers can be added (or made longer) to increase capacity. An in-vessel composting facility will either need to be designed from the outset for expected future increases in throughput, or built on land that allows expansion of the composting tunnels.	Population growth will drive the increase in waste generation in the Region. It is estimated that Okotoks, High River, Turner Valley and Black Diamond residents will generate over 23,000 tonnes of organic waste in 2040 (9,812 tonnes of food waste and 13,250 tonnes of yard waste), roughly double 2018 quantities. The growth is expected to be reflected in the ICI sector as well, which can contribute much larger quantities of food and yard waste if accepted.

Consideration	Description	Considerations Specific to the Region
End-Products	AD can produce electrical and/or heat energy, or RNG. RNG is the most attractive end product from organic waste at the current time, due to high prices and high demand. RNG can command high prices due to its environmental attributes and simple tie-in to existing natural gas systems. For composting operations, the quality of compost depends heavily on the quality of the feedstock; feedstock with low contamination can produce a Class A compost, which is a valuable product. The compost can be used at the LRRC as biocover or may be sold to generate revenue. AD will also produce digestate that can be composted and land-applied. Both AD and compost facilities will produce a residual stream of non-organic material from pre-screening, which will need to be landfilled.	Both RNG and compost could be sold in the Region. In GHD's experience, revenue from compost should not be relied upon for project economics due to the uncertain nature of final quality and large supply of compost in Alberta. If producing and marketing compost, the Region would be competing with the City of Calgary's composting operations as well as other private and agricultural composting operations. With an AD facility producing RNG, the Region would be one of the only producers in Alberta and could lock-in to a high price over a long-term contract. Pre-screening and final-screening of material in an organics processing facility will result in the removal of contamination (plastics, etc.). This contamination will need to be landfilled. Waste characterizations should be completed to understand the tonnage.
Regulatory Considerations	The regulations for composting and AD facilities in Alberta are established under the *Environmental Protection and Enhancement Act* (EPEA) and accompanying regulations (Province of Alberta, 2003). Compost facilities require an approval when more than 20,000 tonnes of material are processed. Smaller facilities that process only vegetative matter and manure require registration only. AD facilities are regulated as waste to energy facilities. AD is designated under Schedule 1 as an activity that requires approval (the construction, operation or reclamation of a fixed facility where more than 10 tonnes per month of waste are treated by physical, chemical, thermal or biological processes).	The quantity and quality of feedstock under consideration in the Region means that a Class I composting facility or AD facility (both of which require approval) would be necessary. The existing composting operations at the LRRC operate as a Class I facility under the LRRC's Approval.

Consideration	Description	Considerations Specific to the Region
Siting Considerations	The receiving, mixing and storage of organic waste can generate unpleasant odours, regardless of whether the material is composted or digested. It is important that the facility be located in an area with compatible land uses and that the receiving and mixing area be enclosed. AD facilities require a smaller footprint than composting facilities as the digestion tanks extend vertically, making these facilities more attractive for locations with limited land. The City of Toronto operates two large AD facilities on relatively small plots of land within the City.	Land is available in the region that could be suitable for either AD or composting.
GHG Offset Credits	GHG emissions offsets are generated by diverting organic waste from landfill cells into organics processing facilities. Within a landfill, organic material decomposes anaerobically producing and emitting methane to the atmosphere. In composting operations, oxygen is mixed with the organic waste effectively producing carbon dioxide instead of methane. The carbon dioxide is consider biogenic and does not contribute to regulated GHG emissions. In AD operations, the organic material produces large amounts of methane, which is completely captured from the AD tank, mitigating emissions to the atmosphere. The number of GHG emissions reductions generated in both cases is approximately the same, depending on process equipment and fugitive emission leaks, as they both effectively mitigate the release of methane that would have occurred if the organic waste was landfilled. RNG can further generate GHG emissions offsets due to the replacement of fossil-fuel natural gas. However, the RNG producer does not claim these GHG offsets; rather, it is	The LRRC is not currently required to pay for its GHG emissions. This means that the GHG offset credits could be a source of revenue if the composting operations were to be expanded at the site, reducing the amount of organic waste decomposing anaerobically within the landfill cells. An organics processing facility in the Region that is not located at the LRRC can generate and sell GHG offset credits as well, and can apply for capital funding through Emissions Reductions Alberta, among other funding opportunities.

Consideration	Description	Considerations Specific to the Region
	the organization that replaces natural gas with RNG that gets the environmental attributes (typically, a utility that injects RNG into its natural gas grid or an end-user that burns the RNG for electrical energy, etc.).	

3. Developing an Organics Processing Facility in the Region

Yard waste generated in the FSRC can be composted at the LRRC, as long as it is not mixed with food waste. The LRRC currently composts about 3,000 tonnes of yard waste per year.

Without a local organics processing facility capable of handling food waste, Okotoks is reliant on private composting facilities to process the mixed organics stream that it collects from residents. Due to the recent establishment of disposal bans on organic waste from the ICI sector at City of Calgary landfills, private composting facilities are operating at or near capacity. This makes it more difficult to secure processing capacity for the organics collected from Okotoks residents. There may be advantages to developing an organics processing facility in the Region that addresses this lack of organics processing options in the Region.

A number of service delivery models may be applied to the delivery and maintenance of a successful OPF in the Region. Similar to other types of infrastructure projects, there is no singular project delivery method that applies to all OPF projects. Each delivery method was evaluated on its own merits based on the key considerations outlined herein, together with any owner or project specific considerations that may apply.

The following project delivery models may be considered:

Design-Bid-Build (DBB) is a project delivery method in which the Region may contract with separate entities for the design and construction of a project. Operations and maintenance are contracted separately or completed by the Region. Capital financing is secured by the Region.

Design-Build (DB) is a turnkey project delivery method in which the Region may contract with a single entity, known as the design-builder or the design-build contractor, to design and build a project. Operations and maintenance are contracted separately or completed by the Region. Capital financing is secured by the Region.

Design-Build-Operate-Maintain (DBOM) is a turnkey project delivery method in which the Region may contract with a single entity to design, construct, operate, and maintain capital infrastructure. Operations and maintenance are for a defined period of time, after which control and operation of the facility is transferred back to the Region or to a subsequent operator.

Build-Own-Operate-Transfer (BOOT) is a turnkey project delivery method in which the Region may contract with a single entity to design, construct, finance, own, operate, and maintain capital infrastructure for an agreed upon period of time and then transfer ownership and operations back to the Region at the end of that period in a specified condition.

Build-Own-Operate (BOO) is turnkey project delivery method similar to BOOT except the contractor retains ownership of the OPF, including any residual value, of the infrastructure following the agreed upon contract period.

Integrated Project Delivery (IPD) is a relatively new project delivery method in which the Region may solicit a team to deliver a project based on high level functional and performance requirements. An open-book multi-party agreement is signed. The first task is to validate the project, including site conditions and the basis for design. If the team cannot validate the project, the agreement is terminated and team members are only eligible for reimbursable costs (and not profit). If the team is able to validate the project, reimbursable costs and profit are paid out for the validation phase and the subsequent design and construction phases. Liability is waived and risk is shared. The owner does not pay for anticipated risks or unknowns. The process is open-book. It is a methodology to share risk and minimize project costs that has been used successfully a number of times for a number of different types of projects throughout the United States and Canada. IPD is hybrid methodology between DBB and DB/DBO.

Figure E.1 summarizes which project delivery method provides the greatest and least benefit for the owner for key consideration in selecting a project delivery method. The project delivery methods are listed in order of increasing private sector involvement (private investors, operators, etc.). The main benefit of private sector involvement is that, as involvement from a private sector partner increases, project risk and administrative burden on part of the owner decreases. However, the owner also loses control over project details such as schedule and design. Reducing project risk will also increase project budget (excluding effort spent on the owner's part) as a private partner will want to create a financial buffer for risk assumed.

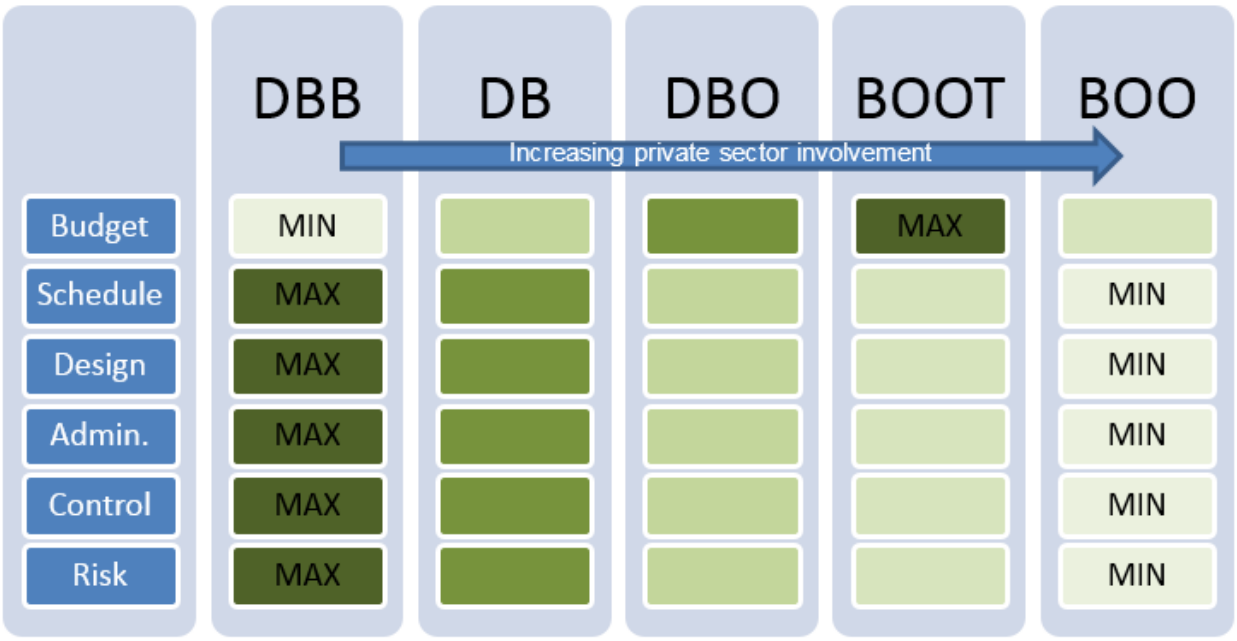

Figure F.1 Key Considerations for Project Delivery Methods

Notes:
1. Min/Max determinations are made from the perspective of the owner. For example, with DBB the owner retains greater design control and responsibility but also assumes greater project risk.

Any of the project delivery methods in which the Region partners with a private entity would be classified as a public-private partnership (P3) arrangement. The benefits of a P3 arrangement are reduced capital and risk on the part of the Region, while the drawbacks include less control over the facility and processes. Alternatively, the Region could decide to own the facility itself (and still contract out the design, construction, and operation as needed), or, the Region could send collected organic waste to a private facility in which the Region has no stake of ownership or control.

Variables for a local facility include the technology type (composting or AD), size (capacity for local feedstock only or larger to capture ICI feedstock) and the ownership model (public [regionally owned],

private [merchant facility], or P3). The overall advantages and disadvantages of various scenarios are described in Table E.2.

Table F.2 Organics Processing Options

	Public	Private (Merchant)	P3
Locally sized composting	Least amount of capital required; likely manageable by a regional entity.	Returns likely not sufficient to attract private investor.	
Locally sized AD	AD facility likely not economically feasible at this size (under 25,000 tonnes per year).		
Regionally sized composting	More capital required, may start to stretch finances of local governments. Tipping fees from ICI customers can provided valuable revenue.	Could be attractive if local government signs guaranteed supply contract ("put or pay" agreement). Disadvantage is lack of control and involvement in facility and revenues.	Local government could supply land as contribution, and lock-in a long-term agreement to process all of the Region's organic waste. The facility would benefit from accepting ICI organic waste for a higher tipping fee due to increasing landfill restrictions.
Regionally sized AD	Likely not within the financial risk tolerance of local governments considering high capital and operating costs.	Could be attractive if local government signs guaranteed supply contract ("put or pay" agreement).	Local government could supply land as contribution, and lock-in a long-term agreement to process all of the Region's organic waste. The facility would benefit from accepting ICI organic waste for a higher tipping fee due to increasing landfill restrictions.

Appendix G
Regionalization Analysis with High River Removed

Appendix G Regionalization Analysis with High River Removed

The Technical Advisory Group (TAG) requested an additional regionalization analysis including only the Towns of Okotoks, Turner Valley, Black Diamond, and Nanton, and Foothills County (together, called the "Consortium" in this Appendix). The analysis presented herein mirrors the assessment in Appendix D, except with the residents of High River no longer contributing to regional waste generation, collection, or cost sharing. Discussion around general benefits and drawbacks of each regionalization option is presented in Appendix D. Appendix G focuses on the final financial results of the analysis.

The following sections summarize the results of the analysis for the following four regionalization options.

1. Regionalized collection of residual waste only
2. Regionalized collection of residual waste and recyclables
3. Regionalized collection of residual waste and organic waste
4. Regionalized collection of all three waste streams

1. Background

As of 2019, the members of the Consortium own the following assets:

- Five automated garbage cart collection trucks
    - Three owned by Okotoks, two by Turner Valley/Black Diamond. Each keeps one truck as a spare, meaning that only three trucks are in operation
- Nanton and Foothills County contract out their garbage collection service
- One cart management vehicle owned by Okotoks
- Storage facility for up to five trucks owned by Okotoks
- Three drop-off recycling facility's
    - Okotoks Eco Centre
    - Nanton Recycling Depot
    - Oilfields Recycling Centre

In 2020, the estimated total number of households receiving municipally managed waste collection services (mainly single-family households) among the Consortium is 12,050. Okotoks comprises the majority of the households, approximately 71.3 percent. Turner Valley comprises, 9.1 percent, Black Diamond 8.6 percent, and Nanton 7.5 percent. The select communities of Aldersyde, Blackie, Cayley, and Silvertip from Foothills County is expected to comprise 3.4 percent.

2. Regionalized Collection of Residual Waste Only

The regionalization of residual waste collection only is the simplest first step option, since all customers in each member of the Consortium already have existing residual waste collection programs in place. Each

existing program utilizes garbage carts in the range of 120 to 240 L, collected by automated, side-load trucks.

Tables G.6 through G.9 present the analysis for each regionalization option, for projections from 2020 to 2035. Table G.6 shows that in 2020, four collection trucks would be needed to service the Consortium. With a spare truck added, five trucks would be needed in total. This is the current status quo of the consortium as discussed above. Therefore, no new truck purchases are required from the start of a regionalized residual collection program. Trucks will be replaced as they reach end-of-life.

A summary of the results for Option 1 is provided in Table G.1 below.

Table G.1 Option 1 Regionalization Costs among the Consortium

	2020	2025	2030	2035
Cost of Carts[1]	$ 0.00	$ 0.00	$ 0.00	$ 0.00
Fleet Ownership and Operation[2]	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Disposal Costs[3]	$ 3.00	$ 3.00	$ 3.00	$ 3.00
Avg. Recycle Depot Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 16.00**	**$ 15.00**	**$ 16.00**	**$ 15.00**

Notes:
All costs rounded to the nearest dollar to account for uncertainty. Total Cost line may not equal the sum of the parts shown in this table due to rounding. See Tables D.6 through D.9 for detailed results prior to rounding.
1 Assuming that Turner Valley will continue to use blue carts for residual garbage collection, there is no need at this time to purchase additional carts (sufficient inventory exists for household growth).
2 Five trucks needed in 2020 (four operating plus one spare), six needed from 2030 through 2035 (five operating plus one spare). Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on constant residual waste disposal cost of $69 per tonne.
4 Calculated as the weighted average per household per month gross costs for the Okotoks Eco Centre, Nanton Recycling Depot, and Oilfields Recycling Centre.

3. Regionalized Collection of Residual Waste and Recyclables

The analysis for adding curbside recycling collection considered both the option of owning and operating the recycling collection services and the option of contracting out the service to a third party. The existing curbside recycling programs in Okotoks and Nanton currently contract out their collection services. Detailed analysis of this option is presented in Tables G.6 through G.9 at the end of this appendix, for 2020 through 2035. A summary of the results for Option 2 is provided in Table G.2 below. Note that the Cost of Carts applies only to residents of Turner Valley, Black Diamond, and Foothills County, since residents of Okotoks and Nanton already have recycling carts.

Table G.2 Option 2 Regionalization Costs among the Consortium

	2020	**2025**	2030	2035
Own and Operate Collection Services				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation[2]	$ 17.00	$ 16.00	$ 17.00	$ 16.00
Disposal Costs[3]	$ 6.00	$ 6.00	$ 6.00	$ 6.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 27.00**	**$ 26.00**	**$ 27.00**	**$ 26.00**
Own and Operate Residual Waste Collection, Contract Out Recycling Collection				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation (Residual only)	$ 9.00	$ 9.00	$ 9.00	$ 9.00

	2020	2025	2030	2035
Contracted Services[5]	$ 4.00	$ 5.00	$ 6.00	$ 6.00
Disposal Costs[3]	$ 6.00	$ 6.00	$ 6.00	$ 6.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 23.00**	**$ 24.00**	**$ 25.00**	**$ 25.00**

Notes:
All costs rounded to the nearest dollar to account for uncertainty. Total Cost line may not equal the sum of the parts shown in this table due to rounding. See Tables D.6 through D.9 for detailed results prior to rounding.

1 Cost of carts applies to Turner Valley, Black Diamond and Foothills County only, as residents in Okotoks and Nanton already have both black and blue carts from existing programs. Turner Valley expected to repurpose current blue carts for recycling collection and purchase new black carts.
2 Five trucks needed in 2020 (four operating plus one spare), six needed from 2030 through 2035 (five operating plus one spare). Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on residual waste disposal cost of $69 per tonne and recycling disposal cost of $150 per tonne constant overtime.
4 Calculated as the weighted average per household per month gross costs for the Okotoks Eco Centre, Nanton Recycling Depot, and Oilfields Recycling Centre.
5 Based on Okotoks' current contract price in 2020, increasing 25% for 2025 and additional 10% each period thereafter.

4. Regionalized Collection of Residual and Organic Waste

Similar to above, the analysis for regionalizing curbside residual waste and organic waste collection considers two options for organic waste collection: (i) owning and operating the service and (ii) contracting out the service. Detailed analysis of this option is presented in Tables G.6 through G.9 at the end of this appendix, for 2020 through 2035. A summary of the results for Option 3 is provided in Table G.3 below. Note that the Cost of Carts applies only to residents of Turner Valley, Black Diamond, Nanton, and Foothills County, since residents of Okotoks already have organics carts.

Table G.3 Option 3 Regionalization Costs among the Consortium

	2020	2025	2030	2035
Own and Operate Both Collection Services				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation[2]	$ 17.00	$ 16.00	$ 17.00	$ 16.00
Disposal Costs[3]	$ 4.00	$ 5.00	$ 5.00	$ 5.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 26.00**	**$ 25.00**	**$ 26.00**	**$ 25.00**
Own and Operate Residual Waste Collection, Contract Out Organics Collection				
Cost of Carts[1]	$ 1.00	$ 1.00	$ 1.00	$ 1.00
Fleet Ownership and Operation (Residual only)	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Contracted Services[5]	$ 4.00	$ 5.00	$ 6.00	$ 6.00
Disposal Costs[3]	$ 4.00	$ 5.00	$ 5.00	$ 5.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 22.00**	**$ 23.00**	**$ 24.00**	**$ 24.00**

Notes:
All costs rounded to the nearest dollar to account for uncertainty. Total Cost line may not equal the sum of the parts shown in this table due to rounding. See Tables D.6 through D.9 for detailed results prior to rounding.

1 Cost of carts applies to Turner Valley, Black Diamond, Foothills County and Nanton only for purchase of green organics carts, as residents in Okotoks already have both black and green carts from existing programs.
2 Five trucks needed in 2020 (four operating plus one spare), six needed from 2030 through 2035 (five operating plus one spare). Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on residual waste disposal cost of $69 per tonne and organics disposal cost of $100 per tonne constant over time. Increase in cost over time due to increasing organics diversion as public participation grows, resulting in more tonnage being disposed at the higher cost.
4 Calculated as the weighted average per household per month gross costs for the Okotoks Eco Centre, Nanton Recycling Depot, and Oilfields Recycling Centre.
5 Based on Okotoks' current contract price in 2020, increasing 25% for 2025 and additional 10% each period thereafter.

5. Regionalized Collection of all Three Waste Streams

Option 4 considers the regionalization of all three waste streams. Regionalized residual waste collection is assumed to be owned and operated. For the recycling and organics streams, the assessment is completed for the option of owning and operating both streams or contracting out both streams. Detailed analysis of this option is presented in Tables G.6 through G.9 at the end of this appendix, for 2020 through 2035. A summary of the results for Option 4 is provided in Table G.4 below. Note that the Cost of Carts of $2.00 applies only to Turner Valley, Black Diamond and Foothills County. Nanton would see a Cost of Carts of $1.00 since residents only need to purchase a new organics cart, while residents of Okotoks do not need any new carts and thus the Cost of Carts would be $0.00.

Table G.4 Option 4 Regionalization Costs among the Consortium

	2020	2025	2030	2035
Own and Operate Collection Services				
Cost of Carts[1]	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Fleet Ownership and Operation[2]	$ 24.00	$ 23.00	$ 25.00	$ 24.00
Disposal Costs[3]	$ 7.00	$ 8.00	$ 8.00	$ 8.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 37.00**	**$ 36.00**	**$ 38.00**	**$ 37.00**
Own and Operate Residual Waste Collection, Contract Out Recycling and Organics Collection				
Cost of Carts[1]	$ 2.00	$ 2.00	$ 2.00	$ 2.00
Fleet Ownership and Operation (Residual only)	$ 9.00	$ 9.00	$ 9.00	$ 9.00
Contracted Services[5]	$ 8.00	$ 11.00	$ 12.00	$ 13.00
Disposal Costs[3]	$ 7.00	$ 8.00	$ 8.00	$ 8.00
Avg. Recycling Centre Costs[4]	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost	**$ 30.00**	**$ 32.00**	**$ 34.00**	**$ 34.00**

Notes:
All costs rounded to the nearest dollar to account for uncertainty. Total Cost line may not equal the sum of the parts shown in this table due to rounding. See Tables D.6 through D.9 for detailed results prior to rounding.

1 Full cost of carts ($1.60) applies to Turner Valley, Black Diamond and Foothills County for purchase of blue recycling and green organics carts. Nanton would have half the cost as only the purchase of green carts in needed. Residents in Okotoks already have black, blue and green carts from existing programs.
2 Five trucks needed in 2020 (four operating plus one spare), six needed from 2030 through 2035 (five operating plus one spare). Fluctuations in household cost due to growth of total households sharing the cost over time.
3 Based on residual waste disposal cost of $69 per tonne, recycling of $150 per tonne, and organics of $100 per tonne constant over time. Increase in cost over time due to increasing organics diversion as public participation grows, resulting in more tonnage being disposed at the higher cost.
4 Calculated as the weighted average per household per month gross costs for the Okotoks Eco Centre, Nanton Recycling Depot, and Oilfields Recycling Centre.
5 Based on Okotoks' current contract price in 2020, increasing 25% for 2025 and additional 10% each period thereafter.

6. Summary and Comparison

A summary of Options 1 through 4 is presented in Table G.5 below. Note that all costs are rounded here to the nearest dollar to account for uncertainty in future cost projections. Detailed model results prior to rounding are provided in Tables G.6 through G.9.

Table G.5 Summary of Options Analysis for Regionalization without High River

	Option 1		Option 2		Option 3		Option 4	
	Garbage Only		Garbage and Recycling		Garbage and Organics		Garbage, Recycling and Organics	
	2020	2030	2020	2030	2020	2030	2020	2030
Assets Required if Owned and Operated								
# Residual Waste Collection Trucks Needed incl. Spare	4	5	4	5	4	5	4	5
# Recyclable Waste Collection Trucks Needed incl. Spare	0	0	4	5	0	0	4	5
# Organic Waste Collection Trucks Needed incl. Spare	0	0	0	0	4	5	4	5
Total Trucks if all Streams Owned	**4**	**5**	**8**	**10**	**8**	**10**	**12**	**15**
Cost Summary - Own and Operate All Streams ($/HH/month)								
Collection Cost	$ 9.00	$ 9.00	$ 17.00	$ 18.00	$ 17.00	$ 18.00	$ 26.00	$27.00
Disposal Cost	$ 3.00	$ 3.00	$ 6.00	$ 6.00	$ 4.00	$ 5.00	$ 7.00	$ 8.00
Avg Recycling Centre/Depot	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost ($/HH/month)	**$ 16.00**	**$ 16.00**	**$ 27.00**	**$ 27.00**	**$ 26.00**	**$ 26.00**	**$ 37.00**	**$ 38.00**
Cost Summary - Own and Operate Residual Collection, Contract Out Recyclables/Organics								
Collection Cost ($/HH/month)	See above.		$ 14.00	$ 16.00	$ 14.00	$ 16.00	$ 19.00	$ 22.00
Disposal Cost ($/HH/month)			$ 6.00	$ 6.00	$ 4.00	$ 5.00	$ 7.00	$ 8.00
Avg Recycling Centre/Depot			$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00	$ 4.00
Total Cost ($/HH/month)			**$ 23.00**	**$ 25.00**	**$ 22.00**	**$ 24.00**	**$ 30.00**	**$ 34.00**

Cost savings of approximately $2.00 per stream can be realized for contracting out recycling and/or organics collection service, as opposed to owning and operating. Regionalizing the curbside collection of residual waste and organic waste has a lower overall cost than regionalizing residual waste and recyclable waste, due to the lower disposal/processing cost of organic material.

7. Conclusions

Across all options, the estimated total system cost per household per month is higher if High River is excluded from regionalization than if High River is included. However, costs are still reasonable for the level of service offered. Cost savings can be found by contracting recycling and/or organics collection out to a third-party collector.

Table G.6 Cost Analysis for Regionalization Options in the Partnership - 2020 Tonnage and Households

Regionalization between Okotoks, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	12,060	12,060	12,060	12,060	12,060	12,060	12,060	12,060
kg/house weekly (one collection day/home)[2]	8.0	7.4	4.8	7.4	4.3	6.8	4.8	4.3
Tonnes total projected (2020)	5,000	4,600	3,000	4,600	2,700	4,300	3,000	2,700
kg of material on collection week	96,480	89,244	57,888	89,244	51,858	82,008	57,888	51,858
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)	3,015	3,015	3,015	3,015	3,015	3,015	3,015	3,015
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	1,125	1,216	833	1,216	2,093	1,324	833	2,093
Average number of routes per day (4 days/week)	3	2	4	2	1	2	4	1
Number of trucks needed for best practice collection performance	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Number of trucks needed	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	5	5	5	5	5	5	5	5
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899
Total Fleet Capital Cost per Household per Month	**$ 1.97**	**$ 1.97**	**$ 1.97**	**$ 1.97**	**$ 1.97**	**$ 1.97**	**$ 1.97**	**$ 1.97**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	4	4	4	4	4	4	4	4
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	4	4	4	4	4	4	4	4
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 998,000	$ 998,000	$ 798,000	$ 998,000	$ 798,000	$ 998,000	$ 798,000	$ 798,000
Total Operating Costs per Household per Month	**$ 6.90**	**$ 6.90**	**$ 5.51**	**$ 6.90**	**$ 5.51**	**$ 6.90**	**$ 5.51**	**$ 5.51**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 345,000	$ 317,400	$ 450,000	$ 317,400	$ 270,000	$ 296,700	$ 450,000	$ 270,000
Disposal Cost per Household per Month	**$ 2.38**	**$ 2.19**	**$ 3.11**	**$ 2.19**	**$ 1.87**	**$ 2.05**	**$ 3.11**	**$ 1.87**
Recycling Depot/Centre Costs								
Recycling Depot/Centre Costs per Household per Month[9]	**$ 4.02**	**$ 4.02**		**$ 4.02**		**$ 4.02**		
Total Fleet Costs per Household per Month	**$ 8.86**	**$ 8.86**	**$ 7.48**	**$ 8.86**	**$ 7.48**	**$ 8.86**	**$ 7.48**	**$ 7.48**
Total Fleet and Cart Costs per Household per Month	**$ 8.86**	**$ 9.65**	**$ 8.26**	**$ 9.65**	**$ 8.26**	**$ 9.65**	**$ 8.26**	**$ 8.26**
Total Disposal Costs per Household per Month	**$ 2.38**	**$ 2.19**	**$ 3.11**	**$ 2.19**	**$ 1.87**	**$ 2.05**	**$ 3.11**	**$ 1.87**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.02**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$8.86**	**$16.35**		**$16.35**		**$23.83**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$8.86**	**$17.13**		**$17.13**		**$25.39**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$11.25**	**$22.43**		**$21.19**		**$32.42**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$15.27**	**$26.45**		**$25.21**		**$36.44**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip).

(2) Tonnes collected weekly from waste projection modelling for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table G.7 Cost Analysis for Regionalization Options in the Partnership - 2025 Tonnage and Households

Regionalization between Okotoks, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	12,820	12,820	12,820	12,820	12,820	12,820	12,820	12,820
kg/house weekly (one collection day/home)[2]	7.9	7.4	4.8	6.0	6.2	5.4	4.8	6.2
Tonnes total projected (2020)	5,300	4,900	3,200	4,000	4,100	3,600	3,200	4,100
kg of material on collection week	101,278	94,868	61,536	76,920	79,484	69,228	61,536	79,484
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	3,205	3,205	3,205	3,205	3,205	3,205	3,205	3,205
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	1,139	1,216	833	1,500	1,452	1,667	833	1,452
Average number of routes per day (4 days/week)	3	3	4	2	2	2	4	2
Number of trucks needed for best practice collection performance	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Number of trucks needed	**4**	**4**	**4**	**4**	**4**	**4**	**4**	**4**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	5	5	5	5	5	5	5	5
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000	$ 1,775,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899	$ 284,899
Total Fleet Capital Cost per Household per Month	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**	**$ 1.85**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	4	4	4	4	4	4	4	4
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	4	4	4	4	4	4	4	4
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000	$ 360,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000	$ 220,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 998,000	$ 998,000	$ 798,000	$ 998,000	$ 798,000	$ 998,000	$ 798,000	$ 798,000
Total Operating Costs per Household per Month	**$ 6.49**	**$ 6.49**	**$ 5.19**	**$ 6.49**	**$ 5.19**	**$ 6.49**	**$ 5.19**	**$ 5.19**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 365,700	$ 338,100	$ 480,000	$ 276,000	$ 410,000	$ 248,400	$ 480,000	$ 410,000
Disposal Cost per Household per Month	**$ 2.38**	**$ 2.20**	**$ 3.12**	**$ 1.79**	**$ 2.67**	**$ 1.61**	**$ 3.12**	**$ 2.67**
Recycling Depot/Centre Costs								
Recycling Depot/Centre Costs per Household per Month[9]	**$ 4.02**	**$ 4.02**		**$ 4.02**		**$ 4.02**		
Total Fleet Costs per Household per Month	**$ 8.34**	**$ 8.34**	**$ 7.04**	**$ 8.34**	**$ 7.04**	**$ 8.34**	**$ 7.04**	**$ 7.04**
Total Fleet and Cart Costs per Household per Month	**$ 8.34**	**$ 9.12**	**$ 7.82**	**$ 9.12**	**$ 7.82**	**$ 9.12**	**$ 7.82**	**$ 7.82**
Total Disposal Costs per Household per Month	**$ 2.38**	**$ 2.20**	**$ 3.12**	**$ 1.79**	**$ 2.67**	**$ 1.61**	**$ 3.12**	**$ 2.67**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.02**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$8.34**	**$15.38**		**$15.38**		**$22.42**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$8.34**	**$16.16**		**$16.16**		**$23.98**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$10.72**	**$21.48**		**$20.62**		**$31.38**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$14.74**	**$25.50**		**$24.64**		**$35.40**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly from waste projection modelling for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table G.8 Cost Analysis for Regionalization Options in the Partnership - 2030 Tonnage and Households

Regionalization between Okotoks, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	13,650	13,650	13,650	13,650	13,650	13,650	13,650	13,650
kg/house weekly (one collection day/home)[2]	7.9	7.4	4.8	5.5	6.6	5.0	4.8	6.6
Tonnes total projected (2020)	5,600	5,300	3,400	3,900	4,700	3,500	3,400	4,700
kg of material on collection week	107,835	101,010	65,520	75,075	90,090	68,250	65,520	90,090
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	3,413	3,413	3,413	3,413	3,413	3,413	3,413	3,413
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	1,139	1,216	833	1,636	1,364	1,800	833	1,364
Average number of routes per day (4 days/week)	3	3	4	2	3	2	4	3
Number of trucks needed for best practice collection performance	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Number of trucks needed	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	6	6	6	6	6	6	6	6
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879
Total Fleet Capital Cost per Household per Month	**$ 2.09**	**$ 2.09**	**$ 2.09**	**$ 2.09**	**$ 2.09**	**$ 2.09**	**$ 2.09**	**$ 2.09**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	5	5	5	5	5	5	5	5
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	5	5	5	5	5	5	5	5
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,143,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 943,000
Total Operating Costs per Household per Month	**$ 6.98**	**$ 6.98**	**$ 5.76**	**$ 6.98**	**$ 5.76**	**$ 6.98**	**$ 5.76**	**$ 5.76**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 386,400	$ 365,700	$ 510,000	$ 269,100	$ 470,000	$ 241,500	$ 510,000	$ 470,000
Disposal Cost per Household per Month	**$ 2.36**	**$ 2.23**	**$ 3.11**	**$ 1.64**	**$ 2.87**	**$ 1.47**	**$ 3.11**	**$ 2.87**
Recycling Depot/Centre Costs								
Recycling Depot/Centre Costs per Household per Month[9]	**$ 5.60**	**$ 5.60**		**$ 5.60**		**$ 5.60**		
Total Fleet Costs per Household per Month	**$ 9.07**	**$ 9.07**	**$ 7.84**	**$ 9.07**	**$ 7.84**	**$ 9.07**	**$ 7.84**	**$ 7.84**
Total Fleet and Cart Costs per Household per Month	**$ 9.07**	**$ 9.85**	**$ 8.63**	**$ 9.85**	**$ 8.63**	**$ 9.85**	**$ 8.63**	**$ 8.63**
Total Disposal Costs per Household per Month	**$ 2.36**	**$ 2.23**	**$ 3.11**	**$ 1.64**	**$ 2.87**	**$ 1.47**	**$ 3.11**	**$ 2.87**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.02**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$9.07**	**$16.91**		**$16.91**		**$24.75**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$9.07**	**$17.69**		**$17.69**		**$26.32**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$11.42**	**$23.04**		**$22.20**		**$33.77**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$15.44**	**$27.06**		**$26.22**		**$37.79**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly from waste projection modelling for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

Table G.9 Cost Analysis for Regionalization Options in the Partnership - 2035 Tonnage and Households

Regionalization between Okotoks, Turner Valley, Black Diamond, Nanton, and Foothills County
Regional Solid Waste Management Plan
GHD Limited, December 2019

	Option 1	Option 2		Option 3		Option 4		
	Garbage	Garbage	Recycling	Garbage	Organics	Garbage	Recycling	Organics
Number of Households in Collection Program[1]	14,500	14,500	14,500	14,500	14,500	14,500	14,500	14,500
kg/house weekly (one collection day/home)[2]	7.9	7.4	4.8	5.5	6.6	5.0	4.8	6.6
Tonnes total projected (2020)	6,000	5,600	3,600	4,100	5,000	3,800	3,600	5,000
kg of material on collection week	114,550	107,300	69,600	79,750	95,700	72,500	69,600	95,700
Overall Weekly Route Setup (Based on Total Tonnage to Collect)								
kg / truck load (capacity)	9,000	9,000	4,000	9,000	9,000	9,000	4,000	9,000
Number of collection days per week[3]	4	4	4	4	4	4	4	4
Target number of homes collected per day (# HH / # days)[4]	3,625	3,625	3,625	3,625	3,625	3,625	3,625	3,625
Average number of HH per day per truck (best practice)	850	850	850	850	850	850	850	850
Average number homes before truck is FULL	1,139	1,216	833	1,636	1,364	1,800	833	1,364
Average number of routes per day (4 days/week)	3	3	4	2	3	2	4	3
Number of trucks needed for best practice collection performance	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Number of trucks needed	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Major Costs Influencing Overall Collection Costs - Capital Costs								
Capital Fleet								
Number of Trucks needed, including spare	6	6	6	6	6	6	6	6
Cost per Truck	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000	$ 355,000
Upfront Total Fleet Capital	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000	$ 2,130,000
Annual Total Fleet Capital Cost (assume loan over 7 years at 3%)[3]	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879	$ 341,879
Total Fleet Capital Cost per Household per Month	**$ 1.96**	**$ 1.96**	**$ 1.96**	**$ 1.96**	**$ 1.96**	**$ 1.96**	**$ 1.96**	**$ 1.96**
Cart Costs								
Total Number of carts[5]	0	1,200	6,240	1,200	8,240	1,200	6,240	8,240
Cost per Cart[3]	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80	$ 80
Total Cart Capital Cost	$ -	$ 96,000	$ 499,200	$ 96,000	$ 659,200	$ 96,000	$ 499,200	$ 659,200
Annual Total Cart Cost (assume loan over 10 years at 3%)	$ -	$ 11,254	$ 58,521	$ 11,254	$ 77,278	$ 11,254	$ 58,521	$ 77,278
Total Cart Capital Cost per Household per Month (10 year life)	**$ -**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**	**$ 0.78**
Major Costs Influencing Overall Collection Costs - Operating Costs								
Number of Trucks in Operation	5	5	5	5	5	5	5	5
Number of Staff Per Truck	1	1	1	1	1	1	1	1
Number of Staff Needed	5	5	5	5	5	5	5	5
Truck Driver Salary and Benefits[3]	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000	$ 90,000
Total Fleet Labour Costs	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000	$ 450,000
Estimated Annual Maintenance and Fuel Costs per Truck[6]	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Annual Truck Maintenance and Fuel Cost	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000	$ 275,000
Storage costs for Trucks[7]	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000	$ 168,000
Administration Costs[8]	$ 250,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 250,000	$ 50,000	$ 50,000
Total Operating Costs per Collection Service	$ 1,143,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 1,143,000	$ 943,000	$ 943,000
Total Operating Costs per Household per Month	**$ 6.57**	**$ 6.57**	**$ 5.42**	**$ 6.57**	**$ 5.42**	**$ 6.57**	**$ 5.42**	**$ 5.42**
Major Costs Influencing Overall Disposal Costs								
Disposal Cost Per Tonne for Waste Stream[9]	$ 69	$ 69	$ 150	$ 69	$ 100	$ 69	$ 150	$ 100
Annual Disposal Costs for Waste Stream (2020 Tonnage)	$ 414,000	$ 386,400	$ 540,000	$ 282,900	$ 500,000	$ 262,200	$ 540,000	$ 500,000
Disposal Cost per Household per Month	**$ 2.38**	**$ 2.22**	**$ 3.10**	**$ 1.63**	**$ 2.87**	**$ 1.51**	**$ 3.10**	**$ 2.87**
Average Recycling Depot/Centre Costs per Household per Month								
Recycling Depot/Centre Costs per Household per Month[9]	**$ 4.02**	**$ 4.02**		**$ 4.02**		**$ 4.02**		
Total Fleet Costs per Household per Month	**$ 8.53**	**$ 8.53**	**$ 7.38**	**$ 8.53**	**$ 7.38**	**$ 8.53**	**$ 7.38**	**$ 7.38**
Total Fleet and Cart Costs per Household per Month	**$ 8.53**	**$ 9.32**	**$ 8.17**	**$ 9.32**	**$ 8.17**	**$ 9.32**	**$ 8.17**	**$ 8.17**
Total Disposal Costs per Household per Month	**$ 2.38**	**$ 2.22**	**$ 3.10**	**$ 1.63**	**$ 2.87**	**$ 1.51**	**$ 3.10**	**$ 2.87**
Total Recycling Depot/Centre Costs per Household per Month	**$ 4.02**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ 4.02**	**$ -**	**$ -**
Total Option Costs - Fleet Ownership & Operation	**$8.53**	**$15.92**		**$15.92**		**$23.30**		
Total Option Costs - Fleet Ownership & Operation incl. Cost of Carts	**$8.53**	**$16.70**		**$16.70**		**$24.87**		
Total Option Costs - Fleet Ownership & Operation, Carts, and Disposal	**$10.91**	**$22.02**		**$21.20**		**$32.35**		
Total Option Costs - Fleet Own & Op, Carts, Disposal, and Recycle Centre	**$14.93**	**$26.04**		**$25.22**		**$36.37**		

Notes:

(1) Number of households in 2020 based estimates from each of the members: includes households from Okotoks (8,600), Nanton (900), Turner Valley (1,100), Black Diamond (1,040), and select communities in Foothills County (420 households in Aldersyde, Blackie, Cayley, Silvertip). Household growth rates for each Partner applied for future years.

(2) Tonnes collected weekly from waste projection modelling for the Region.

(3) Value/cost chosen during Workshop 2 on July 4th based on the TAG's experience. Note that cart size is not considered in the model.

(4) Note that Turner Valley currently uses blue bins for residual garbage collection, so there is the need under a regionalized system to purchase black bins for this Town if a recycling program is initiated. The blue bins would then be repurposed as recycling collection bins, reducing the number of bins required to begin regionalized recycling collection.

(5) Cost based on experience in Okotoks.

(6) Storage costs for trucks is based on current costs of $14,000 per month in Okotoks for storing a maximum of 5 trucks. For additional streams requiring trucks, the cost is added. Cost savings may be realized if other FRSC members have the ability to store regional trucks for lower costs.

(7) Reduced cost assumed for additional streams due to efficiencies in administration and public education.

(8) Recycling cost of $150/tonne based on TAG member experience, organics processing cost of $100/tonne based on TAG experience, garbage disposal at LRRC cost of $69/tonne determined from average of 2018 disposal costs per tonne for each FRSC member using fees and tonnage provided by the LRRC.

(9) Recycling depot/centre costs determined as weighted average cost for the recycling centres in Okotoks, Nanton, and Turner Valley (raw financial data provided), with the costs shared across total households in Okotoks, Nanton, Turner Valley, Black Diamond, and Foothills County, plus a conservative 25%. Costs assumed constant into the future.

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

André Joseph
andre.joseph@ghd.com
403.538.7484

Sarah Wilmot

www.ghd.com