CITY OF LETHBRIDGE

TECHNICAL BRIEFING – CURBSIDE DIVERSION OPTIONS

Juliane Ruck
Waste and Recycling Specialist
City of Lethbridge

Report issued: October 13, 2011

910- 4th Avenue South
LETTHBRIDGE, ALBERTA T1J 0P6
www.city.lethbridge.ab.ca

Contents

Tables

Figures

Appendix

1 Purpose

The purpose of this report is to provide Council members with a brief summary of considerations that should be taken into account when establishing a residential curbside diversion program in Lethbridge. The report will provide an overview of the following:

- Present existing diversion efforts and waste characteristics in Lethbridge,
- Overview of potential environmental impacts of most significant waste streams,
- Summary of recyclable diversion implications,
- Summary of organic diversion implications,
- Outline of anticipated stakeholder engagement and education processes, and
- Summary of implementation timelines and budget requirements.

2 Background

Across Canada, diversion efforts have had different drivers. Commonly, municipalities are faced with a critical shortage of landfill space and/ or residents have growing concerns about the best management of natural resources. In April 1989, the Canadian Council of Ministers of the Environment - agreed that targets and schedules for waste minimization be established including a fifty percent (50%) reduction in waste generation by the year 2000 (FCM, 2004). Provincial regulations have followed this first initiative. Alberta Environment, for example, established a waste disposal target of 500 kg/ resident.

During the last couple of years, municipalities throughout Canada have developed waste reduction targets and goals. Table 1 provides a brief overview of goals set by western Canadian municipalities:

Table 1: Overview diversion goals by western Canadian municipalities

Community	Residential Waste Diversion Goal
Calgary	80% waste diverted from landfills by 2020
Red Deer	10% reduction from 2009 levels by 2015 20% reduction from 2009 levels by 2020 40% reduction from 2009 levels by 2035
Edmonton	90% diversion from the landfill by 2013
City of St. Albert	Reduce from 195kg to 125kg/cap/yr (35%) by 2020
City of Kamloops	50% reduction (0.3 tonnes per capita) by 2020 85% reduction (0.1 tonnes per capita) by 2050
Metro Vancouver	80% waste diversion target by 2020

2.1 Preliminary Groundwork

Lethbridge residents and City Council have expressed interest in investigating curbside diversion efforts to conserve natural resources (Integrated Community Sustainability Plan, 2010). According to "Solid Waste as a Resource" (FCM 2004), it is important to understand the community's needs and priorities to set appropriate community and waste reduction goals. The 2010 "Integrated Community Sustainability Plan" identifies Lethbridge's economic, social and environmental visions. The community waste reduction goals should be aligned with the overall sustainability goals.

Waste and Recycling Services presented in 2008 the City of Lethbridge Comprehensive Waste Diversion/ Waste Prevention Master Plan. The Master Plan outlines strategies on how to achieve greater waste diversion within the community. Additionally, Waste and Recycling Services proposed in the 2012-2014 Business Plan to set waste diversion and waste disposal targets.

2.2 Current Waste Diversion Efforts in Lethbridge

The City of Lethbridge generates approximately 110,000 tonnes of municipal waste annually. On average, 23% of the waste is generated by residents, 58 % by the ICI (Industrial, Commercial and Institutional) sector and 19% by the Construction and Demolition sector.

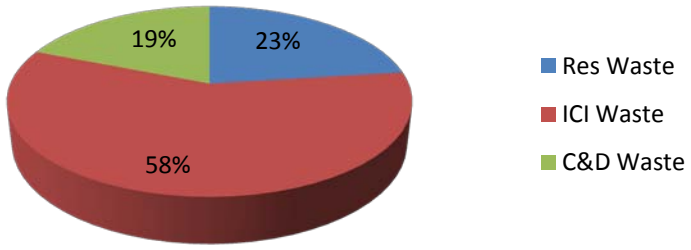


Figure 1: Breakdown of Lethbridge Waste Sources (Sonnevera, 2008)

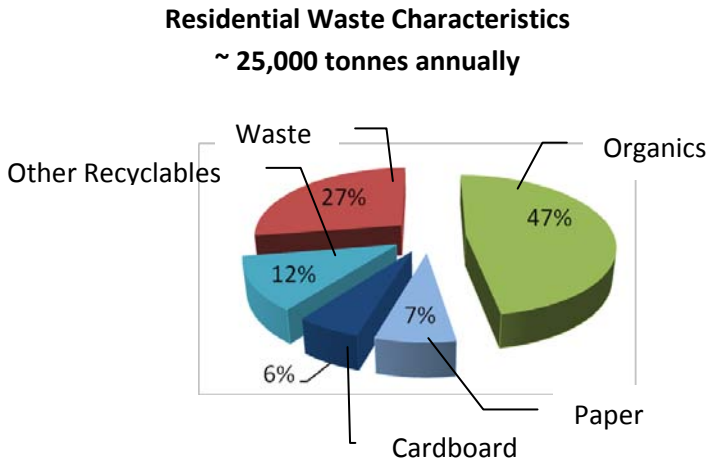
In addition to waste generated by Lethbridge residents, businesses and the construction industry, the Waste and Recycling Centre (WRC) has some regional customers that utilize the disposal facility. The following table provides a brief overview of typical quantities of waste from different sources disposed of at the WRC:

Table 2: Typical annual landfill disposal tonnages

Customer	Tonnage
City of Lethbridge Residential Waste	28,000
Lethbridge ICI Waste	60,000
Lethbridge C&D Waste	24,000
Sub-Total	**112,000**
Other Municipal Waste	10,000
Other ICI Waste	6,000

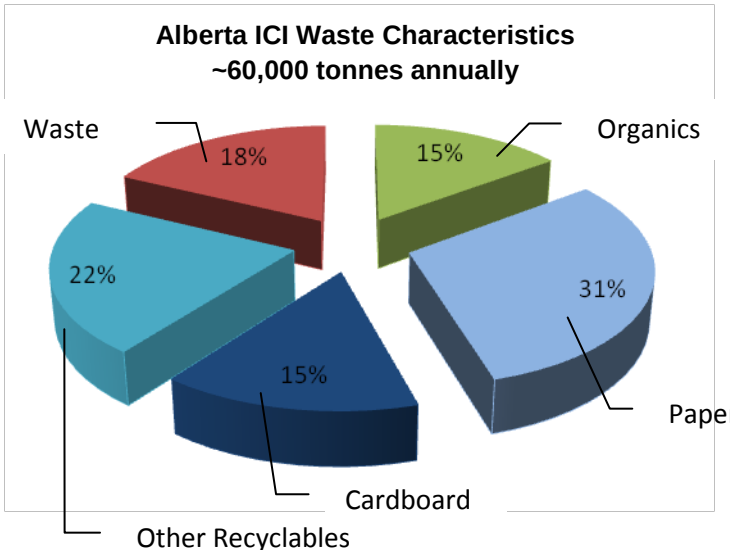
Customer	Tonnage
Sub-Total	16,000
HCS	20,000
Total	148,000

During recent waste audits, the City started to characterize the waste from the residential and ICI sector in more detail. Results show that organics, cardboard and paper are 60% of the residential waste and 61% of the ICI waste stream. Figure 2, 3 and 4 show 2010/2011 residential waste audit results and ICI and C&D waste characteristics based on a consultant's report.



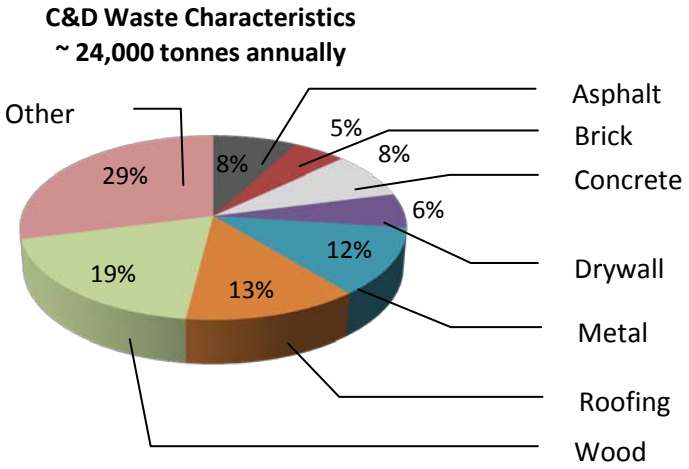
	Tonnage	Percentage
Organics	11,750	47%
Paper	1,750	7%
Cardboard	1,500	6%
Other Recyclables	3000	12%
Waste	6,750	27%
Total	**25,000**	**100%**

Figure 2: Residential (City of Lethbridge 2010/2011 data)



	Tonnage	Percentage
Organics	9,200	15%
Paper	19,000	31%
Cardboard	9,200	15%
Other Recyclables	13,600	22%
Waste	11,000	18%
Total	**62,000**	**100%**

Figure 3: Lethbridge ICI waste characteristics (Sonnevera, 2008)



	Tonnage	Percentage
Asphalt	1,900	8%
Brick	1,200	5%
Concrete	1,900	8%
Drywall	1,500	6%
Metal	2,900	12%
Roofing	3,100	13%
Wood	4,500	19%
Other	7,000	29%
Total	**24,000**	**100%**

Figure 4: Average Alberta C&D Composition (Sonnevera, 2008)

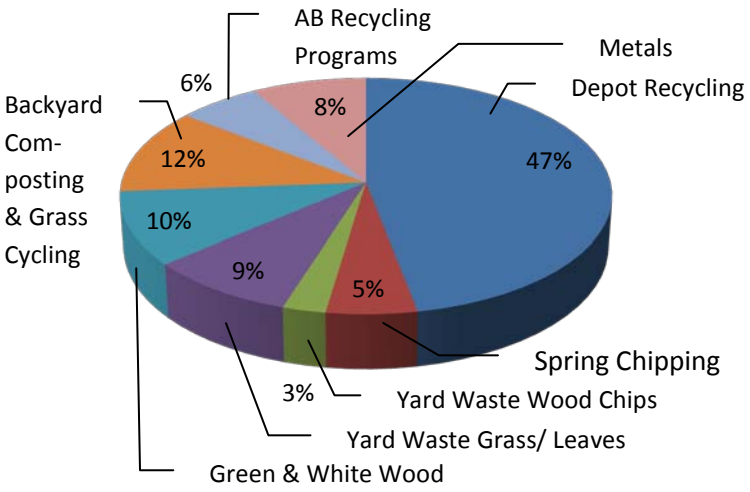
The City is the sole provider of residential waste collection. Residential dwellings are serviced weekly by fully automated or semi-automated curbside service. The City also services an estimated 15% of the commercial sector. The remainder of the commercial sector is serviced by private contractors.

Currently, residential waste diversion activities in Lethbridge include:

- Recycling drop-off depots,
- HHW, paint, and e-waste collection at the Waste and Recycling Centre,
- A Yard Waste drop-off site,
- Brush chipping,
- Fall leaf collection,
- Promotion of backyard composting, and
- Christmas tree recycling.

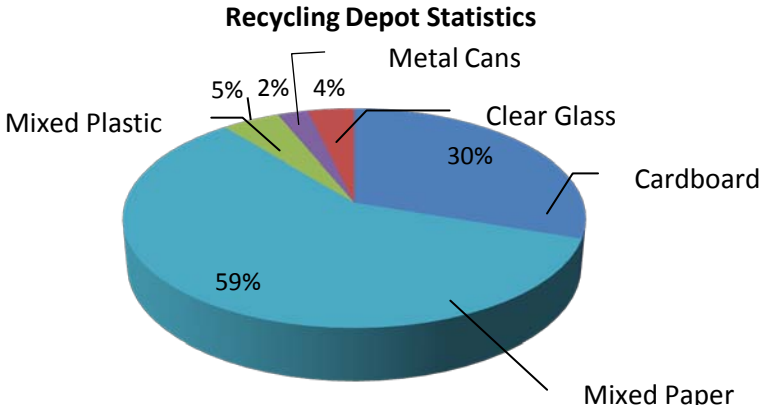
The residential customer pays $3.60 per month for the suite of waste diversion programs.

In 2010, approximately 20% of residential waste was diverted from the landfill. The following chart provides an overview of the residential diversion programs and the percentage of diversion contribution.



	Tonnage	Percentage
Depot Recycling	3375	47%
Spring Chipping	385	5%
Yard Waste Wood Chips	185	3%
Yard Waste Grass/ Leaves	635	9%
Green and White Wood	725	10%
Backyard Composting and Grass Cycling	840	12%
AB Recycling Programs (Tires, E-waste, Oil, HHW and Paint)	435	6%
Metals	600	8%
Total	**7180**	**100%**

Figure 5: City of Lethbridge Residential Diversion 2010



	Tonnage	Percentage
Cardboard	1020	30%
Mixed Paper	2000	59%
Plastic	150	5%
Clear Glass	120	4%
Metal Cans	85	2%
Total	**3375**	**100%**

Figure 6: City of Lethbridge 2010 Recycling Depot Statistics

The ICI sector is mainly serviced by private contractors and therefore data regarding their diversion efforts is limited.

2.3 Potential Environmental Impacts of Current Landfill Practices

If waste is not recycled or reused it gets disposed of in landfills. The following issues related to landfill operations are known to have impacts on the environment:

Item	Impact
• **Greenhouse gases**	• Methane, a strong greenhouse gas, is generated when organic material like paper, cardboard, wood, food waste and leaf and yard waste is decomposed under anaerobic (without oxygen) conditions in the landfill. • The more organics are disposed of in the landfill the more methane will be generated over time. • Greenhouse gas emissions are seen to have a great impact on climate change and are regulated by Alberta Environment and Environment Canada. • The current disposal site generated 71,000 tonnes CO_2 equivalents in 2010. • The greenhouse gas emissions are reported annually to Alberta Environment and Environment Canada. Currently, facilities that emit over 100,000 tonnes CO_2 equivalents per year are required to reduce their greenhouse gases. It is anticipated that this threshold will be lowered in the future.
• **Leachate**	• Leachate is generated by rainwater infiltrating through the waste and disposal of moisture rich organic waste. Water infiltrates through the landfill and dissolved salts, metals and other waste components. The contaminated water is reaching the bottom of the landfill as leachate. • Leachate generation can be decreased by diversion of wet organic waste materials and the installation of engineered landfill caps to prevent surface water infiltration.
• **Physical space**	• Landfills are regulated and are generally approved to reach a particular height, depth and width. • Once landfills have reached capacity there is a need to expand the site or site a new landfill. • Landfill sites have long term monitoring requirements and obligations for the owner. The owner is responsible to fulfill those requirements until the site becomes inactive with no leachate and gas generation.

2.4 Collection System Design Options

There are a wide range of diversion program and infrastructure options for municipal waste. Generally, higher level of collection services result in higher participation rates and more diversion. Figure 7 shows common diversion collection systems applicable for organics and recyclables and associated service level and cost ranges.

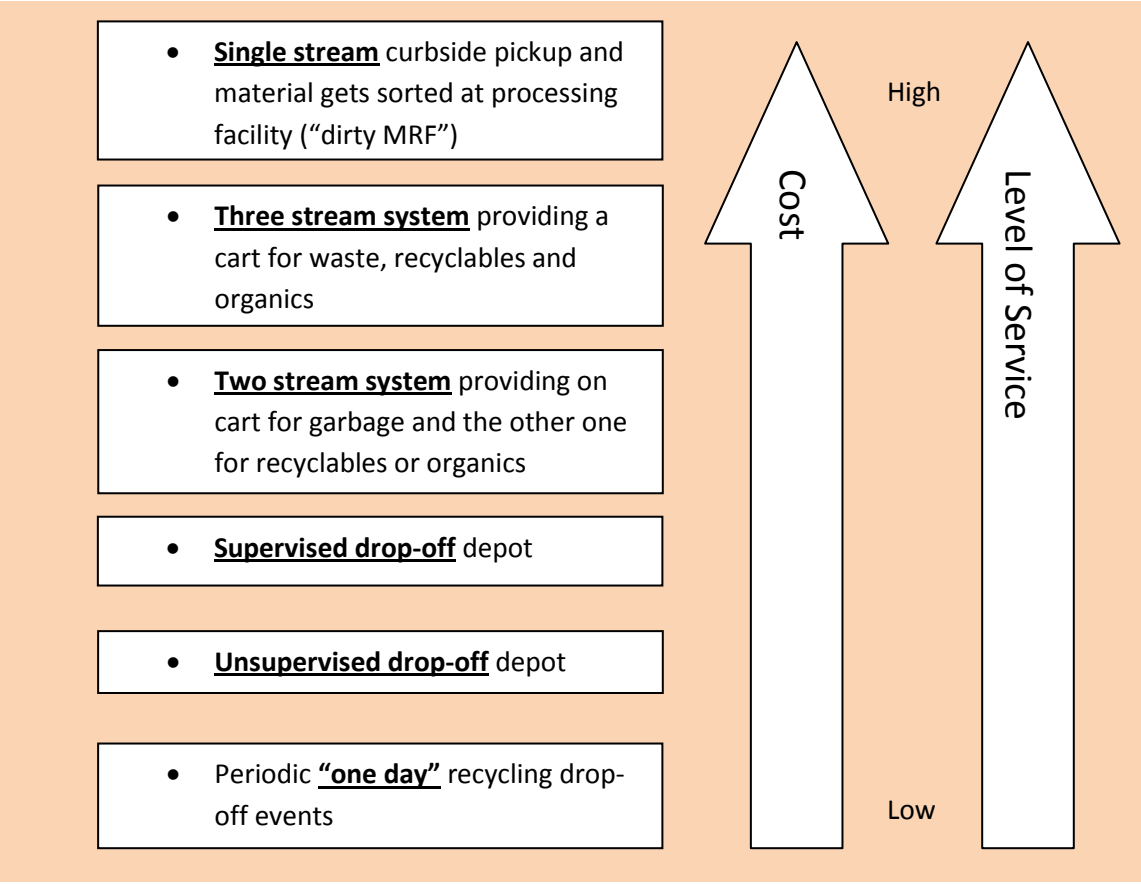


Figure 7: Collection system overview

One of the best known examples of residential recycling is the "blue box" program. Traditionally, newspaper, glass, metal containers and, in some cases, plastic soft drink bottles are collected from residents at the curb.

Recycling depots have been established where collection and processing costs make curbside programs impractical.

Also, more attention is being paid to organic wastes (food and yard wastes), which account for approximately 50% of the residential waste stream. Some municipalities encourage home owners to compost their organic wastes by providing them with low-cost composters. Others collect organics at the curb or have established yard waste drop-off locations. Generally, systems have to be designed to meet the community's needs, waste stream and available diversion infrastructure.

3 System Design

Recyclables management and organic diversion are the two major components of any waste diversion system. Both components have similarities and differences. Prior to implementation of either system, the following issues have to be looked at:

- Material characteristics (mass, density, components, seasonality etc.),
- Available and applicable processing systems, and
- Collection.

3.1 Recyclables

Recycling is a process where materials that are destined for disposal are collected, processed and remanufactured or reused. A well run recycling program can divert a significant percentage of waste and help control cost by generating revenue through the sale of recyclable materials. Finding markets for the materials and maintaining a high quality material stream can be challenging.

3.1.1 Recyclables in the Residential Waste Stream

According to waste audit results, recyclables, including paper, cardboard, plastics, plastic film, tin cans, and glass compromise about 25 % of the residential garbage and 68% of commercial garbage. Of these recyclables, more than half is paper and cardboard.

There are several systems to manage recyclables. Systems vary from simple drop-off depots to single stream curbside pick-up systems. Drop-off programs generally require thorough education and promotion to achieve participation rates similar to those of curbside collection. In a drop-off system the material is separated by the resident at the depot and collected as single commodities. The materials can often be processed at the material recovery facility (MRF) without any additional sorting. This source separated system is currently present in Lethbridge. The local MRF is operated by BFI Canada.

Single stream curbside systems commonly require more sophisticated MRFs and processing to achieve marketable products.

3.1.2 Review of available and applicable systems

Collectable recyclables are normally delivered to a MRF. A MRF is designed to receive, sort, process, and store the material in a way to meet recyclable market specifications.

There are two types of MRFs: dirty and clean. A “dirty” MRF receives mixed waste material that requires intense sorting activities to separate recyclables from the mixed waste (see Figure 8). A “dirty MRF” increases the likelihood of contaminates in the recyclables captured. Most affected by contamination are paper products. According to the Container Recycling Institute (2009) a recent analysis shows that mixed waste collection cost more in total (collection, processing and recycling) compared to a source separated system. Therefore, a “dirty” MRF will not be considered and described in this report.

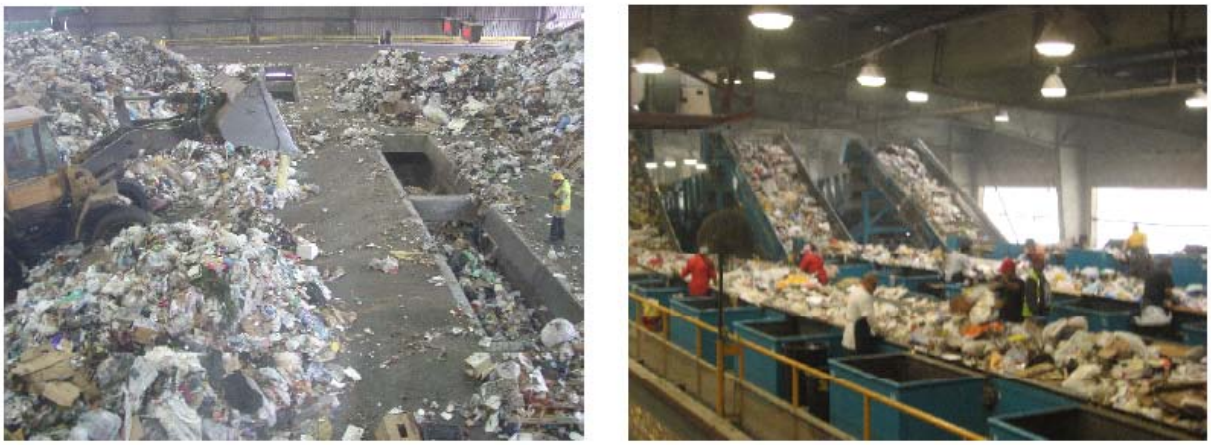


Figure 8: Dirty MRF (http://incineratorfreemecklenburg.files.wordpress.com/2011/02/learn-the-facts-about-the-proposed-reventure-dirty-mrf.pdf accessed on August 19, 2011)

A “clean” MRF is a facility that accepts source separated or commingled recyclable materials. A “clean” MRF reduces the potential for material contamination and provides high quality, marketable products.

When building and designing a MRF the following considerations have to be made:

Issue	Comment:
Location	Large piece of clear, uncontaminated land in an industrial area close to the source of the material production
Building layout and equipment	Accommodate efficient and safe material processing, movement and storage
External access/ delivery	Sufficient space to handle all incoming loads, including buffer capacity and storage

MRFs vary in size and configuration and are commonly designed to meet the communities waste stream needs.

Currently, 20% (7,180 tonnes) of residential material is diverted from the landfill. This diversion rate is calculated by dividing the tonnage of material diverted (7,180 tonnes) through the tonnage of total material generated (waste plus diverted material equals 28,600 tonnes plus 7,180 tonnes). Of that, 10% (3,375 tonnes) of recyclables are diverted from the residential waste stream in Lethbridge through the depot system. When planning waste management systems, the current material quantities and characteristics as well as future quantities and characteristics play an important role. The following table gives on overview of recyclable material generated in Lethbridge, and the assumed participation and capture rate to calculate the diversion potential for residential and ICI waste in 2012 and by 2026. It was assumed that new programs would help to increase participation and capture rates.

Table 3: Diversion potential recyclables simulation for 2012

	Total Material generated 2012	Percent in Material Generated	Total Recyclables Generated 2012	Participation Rate	Capture Rate	Diverted tonnage in 2012	Overall Diversion Potential 2012
Residential	36,500*	35%	12,600	60%	60%	4,400	12% of residential material
ICI	71,000**	70%	50,000	45%	45%	10,000	14% of ICI material

*Total material generated equals total waste (28,600 t) plus total diverted (7,180 t) plus 2% growth

** Total material generated equals total waste (60,000 t) plus total recyclables assumed (10,000 t) plus 2% growth

Table 4: Diversion potential recyclables simulation for 2026

	Total Material generated 2026	Percent in Material Generated	Total Recyclables Generated 2026	Participation Rate	Capture Rate	Diverted tonnage in 2026	Overall Diversion Potential 2026
Residential	59,000	35%	20,500	75%	75%	12,400	21% of residential material
ICI	82,000	70%	57,700	65%	65%	26,000	32% of ICI material

Results show that a medium sized MRF with approximately 150 tonnes per day (50,000 tonnes per year) throughput would be sufficient for the Lethbridge residential and ICI sector and would have capacity to service surrounding municipalities.

The following table gives an overview of different MRF sizes, building space and capital and operational cost.

Table 5: MRF Cost Overview adopted from Material Recovery Facility Handbook Tennessee (2003) – Large facilities (100 ton/day) excluded because not applicable for Lethbridge area

MRF	< 10 tons/day	<100 ton/day
Characteristics	• Small sized facility • Manual labour instead of sorting equipment • <15,000 square feet/ 1400 m^2	• Medium sized facility • More automated equipment • >20,000 square feet/ 1900 m^2
Capital Cost (Construction and equipment, no land purchasing)	$700,000 - $1,700,000	$2,500,000-$5,000,000
Operating Cost	$570,000	$1,870,000
Annual Cost[1]	$640,000-$740,000	$2,120,000-$2,370,000
Cost per ton	$180-$205/ton	$65-$75/ton

During the next project stage, the above cost will have to be validated by a consultant and put into a 2011 Canadian economy context.

BFI Canada currently operates a low tech medium sized MRF with a daily throughput of approximately 30 tons recyclables plus approximately 15 tons per day of redeemable beverage containers (Total annual throughput ~ 15,000 tons). Material arrives at the MRF source separated, is received at the tipping floor and pushed with a loader onto the conveyor, screened and baled. All sorting is manually.

MRF operating cost become significantly lower if > 30,000 tonnes are processed annually (FCM, 2004).

[1] Capital cost annualized over 10 years.

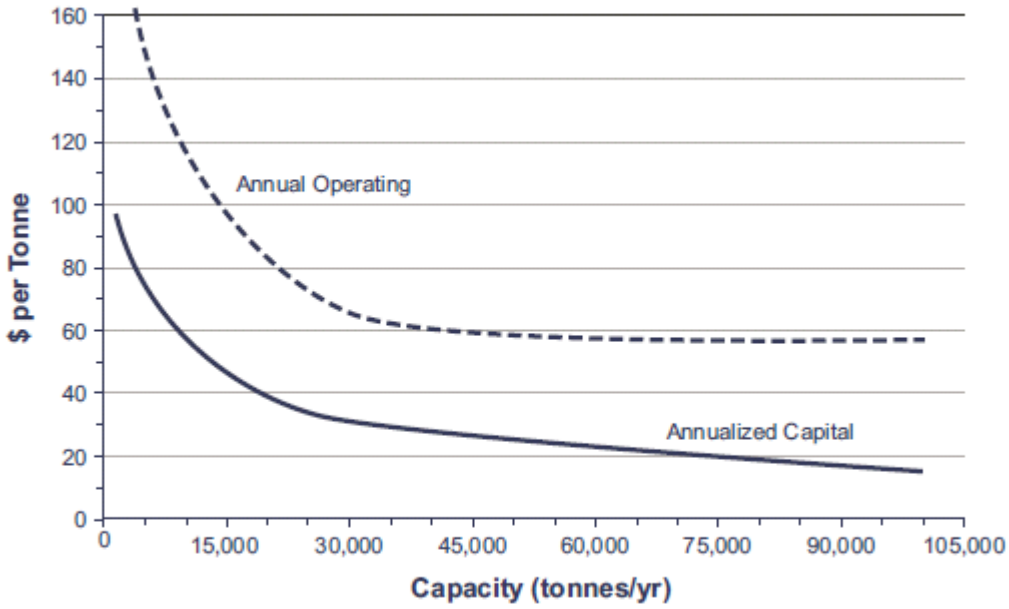


Figure 9: MRF Annualized Capital and Operating Cost Curves (FCM, 2004)

Capital and operational cost are closely linked to the MRF's degree of automation and throughput. MRF sorting systems may be completely automated, strictly manual or, more commonly, a combination of the two. The following factors affect the decision to use manual or mechanical sorting methods:

- Volume and types of materials handled,
- Economics of purchasing,
- Operating,
- Maintaining the equipment versus the cost of hiring additional employees, and
- Market requirements concerning the degree of acceptable contamination.

Manual sorting systems generally consist of flat conveyor belts where workers remove recyclables (or contaminants in a negative sort) by hand from the belt as they pass by. After sorting, the materials are baled and prepared for shipment to the brokers or markets.

Figure 10: Example of a manual sorting MRF (source: http://greenopolis.com/files/images/wm_philly_recycling01_0.jpg)

Automation can increase speed of operation, reduce costs and improve recovery. A list of common sorting equipment in automated facilities is included in Appendix A.

Some municipalities use a local transfer station to bail and transfer the recyclables to a regional facility for processing.

3.1.3 Collection

To develop a unified, efficient recycling program the following questions have to be answered:

- What materials will be collected?
- Which method shall be used to collect the recyclables?
- How will the collection system operate and how often will the material be collected?
- What type of facility is needed to process the material?

The following table gives an overview of curbside recycling systems and shows advantages and disadvantages.

System	Advantages	Disadvantages
Single-stream Recyclable Collection • Collection of all fiber and container recyclables, fully commingled, in a single vehicle compartment	• No need for specialized collection vehicles (i.e., opportunity to use existing fleet); • Convenient for the householder, usually resulting in increased material recovery; • Efficient and cost effective collection system • Fully-automated truck fleet suitable with high pick-up efficiencies	• Processing facility must be capable of segregating all materials • High capital and processing cost of the facility. • Higher potential for cross-contamination • Higher residue rates (~15%)
Two stream collection • Curbside material is separated into two streams of recyclables, commingled fibres (cardboard, boxboard, paper) and commingled containers (glass, plastic, metal)	• Cleaner, more marketable materials, • Require separation at the MRF • Fewer processing requirements (e.g., sorting); • Fibre stream can be compacted in single collection truck to maximize the load • Processing residue ~6%	• Requires various levels of intermediate processing capability, • Higher levels of non-recyclable materials at the processing facility because contaminants are not removed at the collection stage • The compaction of commingled containers must be limited to avoid crushing glass containers, because

System	Advantages	Disadvantages
		anything less than two inches is usually not recovered. • Use of fully automated equipment not possible • Higher education efforts
Multi-stream collection • Sorting recyclables into more than two streams at the curb	• Processing requirements and costs decrease. • Appropriate system for small programs with no local processing capability. • Advantages similar to those of the twostream • Quality of the material streams is high since the driver/sorter is leaveing nonrecyclables at the curb. • Less than 3% residue	• Collection efficiency decreases because of sorting activities at curbside, • Collection more costly • Hand pitch because of separation at the curb which will cause lower pick-up efficiencies

Material set-out requirements

Many communities provide curbside pick-up of recyclables kept separated from other waste. Recyclables are placed in carts, blue boxes or blue bags. Programs that use carts and boxes have been very successful. Although using carts and boxes means higher initial cost, many communities experience that the visibility of the program and related higher participation rates make the investment worth it.

Today, many communities provide a combination of drop-off and curbside collection systems. Drop-off facilities offer the opportunity to collect materials that cannot be easily handled as part of a curb side collection or at the processing facility (e.g. glass, large quantities of cardboard or Styrofoam). Table 6 gives an overview of western Canadian municipalities, their existing recycling system and reasoning why to run a curbside and depot system at the same time.

Table 6: Summary of Example Recycling Management Systems in Western Canada

Municipality	Centralized Recycling Depot system	Recycling curbside system	Why depots kept in place?
City of Red Deer	Yes	Yes	Extra large quantities and home businesses can use depots.
County of Strathcona	Yes	Yes	Provide depot service for rural residents, multi-family residents and businesses Large quantities (e.g. Christmas time)
City of St. Albert	Yes	Yes	Use depots for waste and recycle events Business users

Municipality	Centralized Recycling Depot system	Recycling curbside system	Why depots kept in place?
Calgary	Yes	Yes	Provide service for multi-family and small business Survey showed that 40% of users are single family households Use in peak periods or for excessive material
Saskatoon	Yes	Implementation 2012	Provide depot service to multi-family customers and businesses Combine depot with curbside to provide highest level of convenience for residents Depot can be used for extra large quantities of material
Regina	Yes	Implementation 2013	Provide depot service for businesses and multi-family customers
Kamloops	Yes	Yes	Depots provide capacity for multi-family and small businesses Will downsize from 4 to 2 central depots when multi-family curbside recycling implemented
Regional District of Okanagan	Yes	Yes	Depots provide additional capacity for single family households Depots are the only service provided to multi-residential dwellings and small businesses Depots handle glass which is considered a contaminant in the curbside system

When recyclables are set out at the curb, special requirements need to be fulfilled. The following table gives an overview of set-out containers, their disadvantages and advantages.

Containment	Advantage	Disadvantage
Bags	• Bags require less storage space in the home than containers, • Easy to collect by the driver.	• Hand pitch is the preferred pick-up with higher labour costs • Reyclables need to be debagged before processing; • If bags are opaque, the driver cannot spot contaminants; • If recyclable, the bags will require processing; • Bags require a permanent distribution system. • Can cause litter issues in windy conditions

Containment	Advantage	Disadvantage
Containers/ boxes Blue, green, grey, and black boxes are more common in Canada than bags. Some programs provide two boxes (one for containers, one for fibres)	• Attractive colours enhance participation and may significantly affect program success; • Large flat surface for program message delivery; • Re-use of container	• Containers must be emptied and returned to the curb • Hand pitch is the preferred pick-up with higher labour costs • Container size, weight, and volume capacity must be large enough to handle several materials, yet small and light enough for transport to the curb; • Multiple containers; • Drainage holes – container should allow for some liquid accumulation during in-house use,but permit rainwater drainage outside; • Durability – able to withstand temperature extremes, rough handling, household chemicals; • Lid/ cap will be required in windy weather conditions • Can cause litter issues in windy conditions
Rollout Containers/ Bins	• Can be stored outside. • Hold more materials, • Allowing recycling of a larger number of materials and greater diversion. • Visibility can enhance participation and may significantly affect program success • Use of an RFID tag which gives flexibility for monitoring weight of material collected for each household	• Tendency to have higher contamination levels, if fully-automated service and containers are not checked by the driver before dumping in the vehicle; • Rollout carts are expensive; • Larger size of rollout carts is often not appreciated by householders with limited storage space.

Consideration will have to be given to whether the curbside collection will be delivered by City resources or by contracted services.

When automated or semi-automated collection systems are used, the carts must be specifically designed to fit the truck mounted loading mechanism. Due to the high volume of recyclables bigger carts are recommended. Also, redeemable beverage containers should not be included in the recycling stream to prevent scavenging.

Frequencies of collection and type of collection equipment

Most municipalities collect recyclables, organics and waste in a three stream collection system. There are several variations on how to collect the three streams and it often depends on local parameters. The material can be collected in a combination of separate fleets or by trucks that have two separate collection compartments, called split-bodied trucks. Split-bodied trucks are only suitable for manual or semi-automated collection.

Additionally, the following considerations have to be given:

- Vehicles with separate compartments (co-collection of recyclables) for each material will result in cleaner, more marketable materials (requiring less processing) than recyclable material that is commingled. However, only semi-automated trucks would be suitable and higher labour cost and lower efficiencies are to be anticipated.
- Vehicles that avoid compaction generally result in more marketable materials than those that compact but cause lower hauling efficiencies.
- Glass breakage can become a contamination issue at the MRF and some municipalities exclude glass from their recycling stream.
- If the decision is made to use trucks for refuse and recyclables collection they must be well cleaned between uses to avoid contamination.
- Vehicles that collect fully commingled recyclable streams have greater collection efficiencies than those that collect materials in separate compartments.

Numerous types of collection vehicles and operational features are available. Trends in the collection vehicle industry include increased use of computer-aided equipment and controls as well as the use of compactor trucks.

When selecting collection equipment the following design considerations have to be given:

- Amount of material to be handled per pick-up
- Loading speed of the crew and the collection method used (automated, semi-automated)
- Weight of the full container
- Road width and weight limits
- Interference from overhead obstructions such as telephone and power lines when loading
- Truck capacity should be related to the quantity of the material collected on each route
- Travel time to processing site
- Relative cost of labour and capital
- Safety of collection crew
- Storage limitations
- Customer expectations
- Seasonal variations

Pick-up frequencies can be weekly to bi-weekly depending on customer needs, material generation and financial implications. When organics and recyclables are collected, little material is left for the garbage truck to collect. As part of the system design, bi-weekly garbage pick-up should be considered. The cost savings for a bi-weekly garbage pick-up can offset some of the costs for recyclable and organic pick-up.

All recyclable diversion options and cost implications have to be carefully analyzed. Waste and Recycling Services suggests hiring a consultant experienced in conducting feasibility assessments of recyclable processing systems. The consultant would investigate the following items further and provide a system recommendation:

- Recyclable commodities collected,
- Preferred collection equipment and frequency,
- Process facility availability and requirements,
- Processing methods, frequency, equipment, and staffing needs,
- Processing location and regulatory requirements, and
- Capital and operational cost estimates of selected system.

Cost

According to preliminary estimates, Waste and Recycling Services anticipates the following capital and operational cost for fully automated residential recyclables curbside collection:

Weekly Curbside Recycling Collection:

Capital: $4,300,000
Operating: $3,400,000

Bi-weekly Curbside Recycling Collection:

Capital: $3,300,000
Operating: $2,700,000

More detailed cost estimates are provided in Appendix B.

3.2 Organics

3.2.1 Organics in the Residential Waste

Compostable organics, including food waste, yard waste and soiled paper, compromise currently about 47% of the residential garbage (11,700 tonnes) and 15% (9,200 tonnes) of commercial garbage. Depending on the seasons, yard waste can compromise a significant amount of the organics waste stream. Figure 11 provides a conceptual illustration of the seasonal variations.

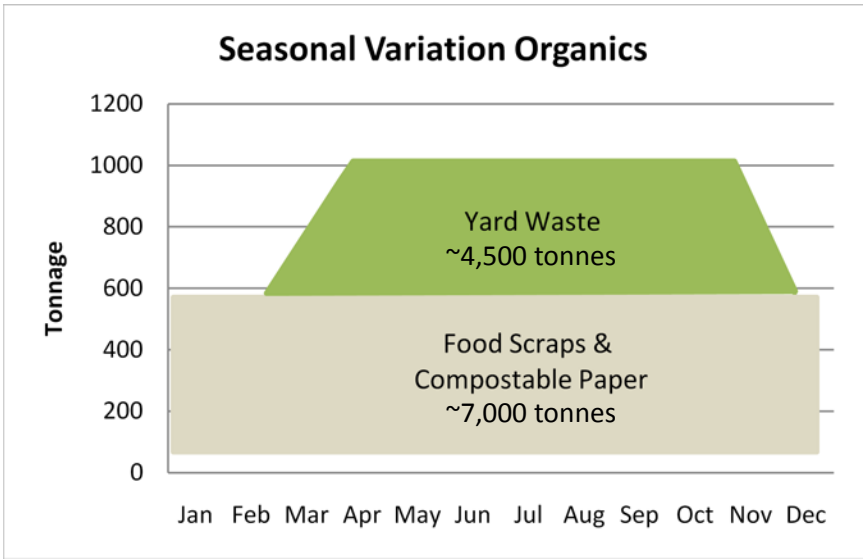


Figure 11: Seasonal Variations Residential Organics (Generated based on City of Lethbridge Data)

There are two ways to manage organic waste. One is aerobic digestion (composting), a process where microbes break down organic material in an oxygen rich environment. The other process is called anaerobic digestion where microbes break down the material in absence of oxygen and the addition of water. Methane is a bio-byproduct of this process and can be used as an energy source. Anaerobic digestion works well at scales of 10,000-20,000 tonnes annually (Municipal Solid Waste Options, 2006) but has significant capital and operational cost and will not be considered as part of this report.

3.2.2 Review of available and applicable aerobic (composting) systems

Composting can be undertaken with a variety of systems, which vary significantly in design, cost, and time to create a finished product as well as skill necessary to operate the facility. Table 7 provides an overview of applicable composting systems, relative operating and capital cost to serve 80,000 residents, time to reach a usable end product and manageable annual tonnage (Municipal Solid Waste Options, 2006).

Table 7: Composting technology overview for applicable systems that could service 80,000 people (MWIN & RCA, 2006)

Technology	Annual Throughput & Cost/ton	Capital Cost Range	Operational Cost Range	Time to Reach End-Product
Windrow Turning and passive aeration 	12,000 t **$24-50/t**	$1 -2 Mil	$200k -400k	3-18 months
Enclosed channels Mechanical turning, passive aeration 	12,000 t **$50-83/t**	$2-4 Mil	$400k -600k	2-6 months
Container/ tunnels Mechanical turning, active aeration 	12,000 t **$83-116/t**	$4-6Mil	$600k -800k	2-6 months

The above estimates would have to be verified by a consultant for the Lethbridge context during the next project stage.

With the current organic programs, the City of Lethbridge diverts 7.7% of organics from the residential waste stream. This diversion rate is calculated by dividing the tonnage of organic material diverted (2,770 tonnes) through the tonnage of total material generated (waste plus diverted material equals

28,600 tonnes plus 7,180 tonnes). When planning waste management systems, the current material quantities and characteristics as well as future quantities and characteristics play an important role. The following table shows total organic material generated and assumed capture and participation rates to calculate the potential diversion for 2012 and 2026.

Table 8: Diversion potential Organics Simulated for 2012 (Food scrapes, soiled paper and Yard Waste)

	Total Material generated 2012	Percent in Material Generated	Total Organics Generated 2012	Participation Rate	Capture Rate	Diverted tonnage in 2012	Overall Diversion Potential 2012
Residential	36,500*	45%	15,000	45%	45%	3,000	9% of residential material
ICI	71,000**	15%	11,000	40%	40%	1,800	2.4% of ICI material

*Total material generated equals total waste (28,600 t) plus total diverted (7,180 t) plus 2% growth

** Total material generated equals total waste (60,000 t) plus total recyclables assumed (10,000 t) plus 2% growth

Table 9: Diversion potential Organics Simulated for 2026 (Food scrapes, soiled paper and Yard Waste)

	Total Material generated 2026	Percent in Material Generated	Total Organics Generated 2026	Participation Rate	Capture Rate	Diverted tonnage in 2026	Overall Diversion Potential 2026
Residential	59,000	45%	26,000	65%	65%	11,000	20% of residential material
ICI	82,000	15%	13,000	60%	60%	4,500	5% of ICI material

Traditionally, organics curbside collection focuses on food scrapes and soiled paper. Management options for yard waste include seasonal drop-of depots or cart size subscriptions. In a subscription program, residents have the option to subscribe to a bigger cart to accommodate additional yard waste material.

Residential growth and garbage generation projections show that the total tonnes of residential garbage will continue to increase if the above assumed diversion rates are not exceeded.

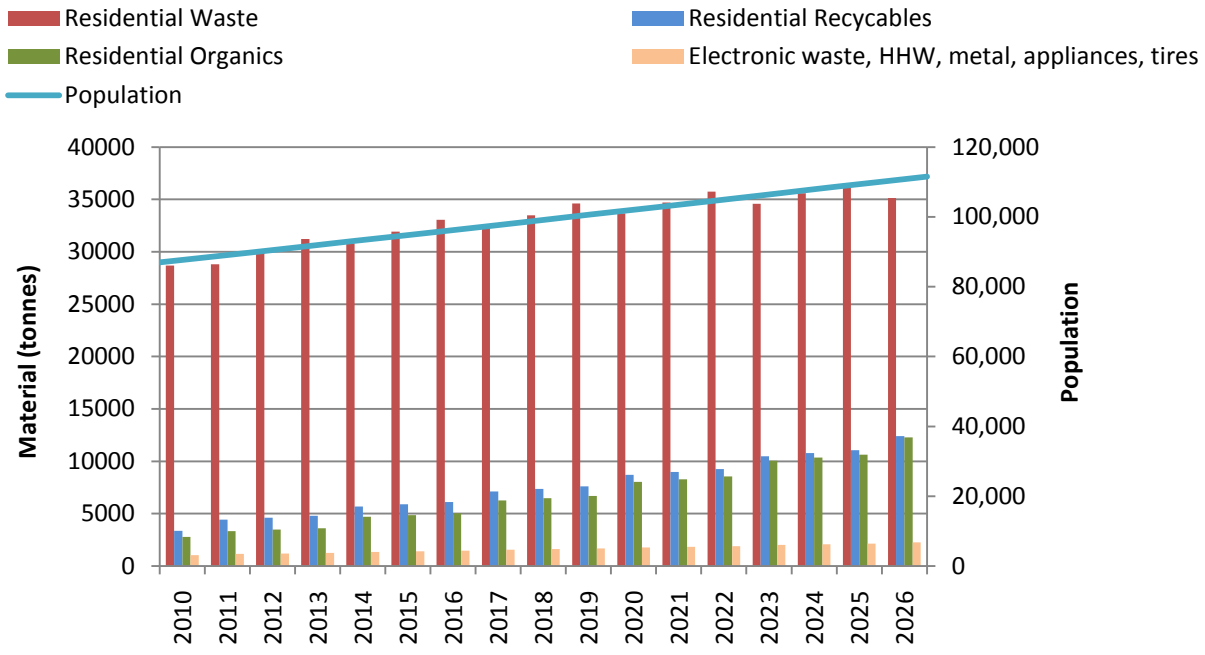


Figure 12: Modeled residential diversion efforts over 15 years

Appendix C provides a summary of different diversion incentives and their rated potential to increase diversion in Lethbridge (Sonnevera, 2008).

3.2.3 Collection

Source separated organics collection means the organics are separated at the source where they are generated and collected in a separate container. Mixed waste collection refers to the collection of municipal waste and the mechanical removal of recyclables and organics. Mixed waste composting, like operated at City of Edmonton facilities, is generally expensive and does not achieve a high quality and marketable compost product. Therefore, it is recommended to not explore this option further.

Efficient, sanitary, and customer-responsive collection are important features for organic waste material collection. The following needs to be considered when designing a collection system:

- Material set-out requirements,
- Frequencies of collection and type of collection equipment, and
- Cost.

Material set-out requirements

The handling of household scraps can cause odor and attract rodents within the residential dwelling, business building or cart. A key component in designing systems to handle food scraps is providing containers that allow participants to manage the material without the unpleasant side effects. Often, a small kitchen container and a wheeled cart are provided.

For sanitary reasons, plastic bags can be used as liners in the kitchen bin. However, plastic bags pose a serious contamination issue for the compost processing operation and are often not recommended to be used at all.

Yard waste can include a high amount of branches which would cause difficulties during the collection and composting process. Branch disposal alternatives will have to be provided to residents.

When automated or semi-automated collection systems are used, the carts must be specifically designed to fit the truck mounted loading mechanism. Due to the high moisture content, organics are normally heavier than regular garbage and automated collection is recommended.

Consideration will have to be given to whether the curbside collection will be delivered by City resources or by contracted services.

Frequencies of collection and type of collection equipment

Numerous types of collection vehicles and operational features are available. Trends in the collection vehicle industry include increased use of computer-aided equipment and controls as well as the use of compactor trucks.

When selecting collection equipment the following design considerations have to be given:

- Amount of material to be handled per pick-up
- Loading speed of the crew and the collection method used (automated, semi-automated)
- Weight of the full container
- Road width and weight limits
- Interference from overhead obstructions such as telephone and power lines when loading
- Truck capacity should be related to the quantity of the material collected on each route
- Travel time to processing site
- Relative cost of labour and capital
- Safety of collection crew
- Storage limitations
- Customer expectations
- Seasonal variations

Most municipalities collect recyclables, organics and waste in a three stream collection system. There are several variations on how to collect the three streams and it often depends on local parameters. The material can be collected in a combination of separate fleets or by trucks that have two separate collection compartments, called split-bodied trucks. Split-bodied trucks are only suitable for semi-automated collection.

Pick-up frequencies can be weekly to bi-weekly depending on customer needs, waste generation and financial implications. When organics and recyclables are collected, little material is left for the garbage

truck to collect. As part of the system design, bi-weekly pick-up should be considered. The cost savings for a bi-weekly pick-up can offset some of the other system cost.

All organic diversion options and cost implications have to be carefully analyzed. Waste and Recycling Services is suggesting hiring a consultant experienced in conducting feasibility assessments of organic processing systems. The consultant would investigate the following items further and provide a system recommendation:

- Processing system options (windrow, use of digester at waste water treatment plant, external facility)
- Overall system processing methods, frequency, equipment, and staffing needs.
- Processing location and regulatory requirements.
- Markets or use for compost.
- Capital and operational cost estimates of selected system.
- Collection challenges , i.e. “YUCK” factor

Cost

According to preliminary estimates, Waste and Recycling Services anticipates the following capital and operational cost for fully automated residential organics curbside collection:

Weekly Curbside Organics Collection:		***Bi-weekly Curbside Organics Collection:***	
Capital:	$4,300,000	Capital:	$3,300,000
Operating:	$2,700,000	Operating:	$2,000,000

More detailed cost estimates are provided in Appendix B.

4 Implementation Steps

4.1 Stakeholder Consultation

Stakeholders are people who are likely to be affected by the project, who have influence over it, or who have an interest in whether it succeeds or fails. The opinions and influence of stakeholders can determine the outcomes of a project. Consulting with stakeholders from the outset is essential in order to secure their support.

Waste and Recycling Services recommends asking residents and other stakeholders about their opinion regarding diversion options. Open houses, surveys, facebook pages or interviews are some consultation tools that could be used. Benefits of a stakeholder consultation process include:

- The opportunity to discover residents ideas and perspectives,
- Become aware of public concerns,
- Increase the projects transparency and accountability to the public,
- Elevate support for the City of Lethbridge's goals, and
- Increase sustainability of the decisions being made.

Additionally, a stakeholder consultation process is a great opportunity to reinforce recycling education and to gain diversion momentum within the community.

4.1.1 Develop Stakeholder Engagement/ Consultation Plan

Before a stakeholder consultation plan is developed, the decision has to be made to engage the public and at what level. According to Corporate Communications, questions that have to be considered when starting the engagement process are:

- Does this project directly affect residents' quality of life?
- How much say can the public have in the project? Is the area of the project highly technical or heavily regulated, minimizing their contribution?
- Who has the final decision (e.g. City Council)? What information would help their decision making process?
- Is there enough time to consult the community?
- Is community engagement a government regulated, necessary part of the project?

Corporate Communications developed the "Interact, Inform, Engage" document that provides some guidance regarding the development of a public stakeholder consultation plan. The document is still in the development stage but could be trialed as part of the curbside diversion initiative. Figure 13 shows the scale of public participation to be chosen from.

		Desired outcome	Commitment to residents	Techniques	City Of Lethbridge Examples
	**Inform**	Inform residents of programs, service changes, and Council decision in a fair and balanced way. Listen to any feedback.	You will be informed in a timely and accurate manner. We will hear your comments	Website News Release Public Service Announce-ment	City Website Twitter
	**Inquire**	Seek opinions and perspectives.	Your opinion will be heard. We will take the time to listen and learn from your feedback.	Open House Surveys Polling	Recycling Depot Survey
	**Interact**	Gather information and discuss issues, hearing about others points of view and recognizing resident concerns.	You will be connected with and your opinions will be reflected, where possible, in the project.	Workshops City Circles Idea Fairs	Plan Your City (MDP) • City Circles • Idea Fairs
	**Engage**	Work with stakeholders throughout the decision making process to facilitate understaning.	You will be active participants in the process.	Citizen Advisory Committees	Plan Your City (MDP) • Community Advisory Committee
	**Empower** **	Entrust residents to make the final decision.	You will get to decide.	Ballots Elections Plebiscites	City of Lethbridge Municipal Election

Figure 13: Scale of Public Participation (City of Lethbridge, 2011)

The stakeholder process should not only investigate stakeholders' agreement or disagreement with the proposed system. It should also identify barriers to participate, strategies to overcome barriers, diversion incentives and education tools that are suitable to communicate and keep the different stakeholder groups engaged. The following table provides a possible overview of project phases, the purpose of the consultation process, the goals and the methodology.

Table 10: Residential Diversion Public Consultation Strategy Possible Outline

PHASE	PURPOSE/ GOAL	MESSAGE	Level of Public Participation	METHOD	SUCCESS MEASURES
PHASE 1 Design	To engage the public and have them participate and provide input	• We are looking at curbside diversion of organics and recyclables and would like to get input about: Cart size, bi-weekly or weekly service, materials accepted, education considerations for advice on how to store materials at home • Communicate project stages	Engage	Survey, focus groups	High % of population participating and providing input through traditional and non-traditional methods. Good demographic representation.
PHASE 2 Pilot	To keep public informed	• Outcomes of design consultation and implementation of pilot	Inform	Update information on the website, newspaper, radio, new media	Positive feedback on pilot.
	Collect feedback from residents participating in Pilot	• What to place in cart/ what not • Collect feedback what works and what does not (segregation of materials, cart placement, pick-up frequency, education material etc)	Inform, collect feedback	Open houses, flyers, webpage, hotline, survey	
PHASE 3 City wide Implemen-tation	Inform and educate public about new program	• Educate about What to place in cart/ what not, pick-up frequencies, trouble hotline, cart placement, when cart will arrive	Inform	Update information on the website, newspaper, radio, new media , launch event	High % of population participating in program.

According to Corporate Communications the following steps will have to be taken to develop a stakeholder consultation plan:

- Project Definition
- Purpose
- Goals
- Identify stakeholders
- Tactic/Methodology
- Risk Assessment
- Communications strategy
- Resources
- Timeline
- Budget
- Roles and Responsibilities
- Evaluation

Waste and Recycling Services suggests using a consultant that will assist in the public stakeholder consultation process building on the experiences gained through the public stakeholder component of the Landfill Masterplan Project. A consultant will bring third party credibility, external knowledge and expertise, see the project through fresh eyes and add staffing capacity.

4.1.2 Develop Education Campaign to overcome barriers and increase participation

A strong education campaign is key to a successful integrated resource and waste management strategy. Residents need to understand their role in the strategy and be comfortable with participation requirements.

When developing the education campaign the following steps should be taken (FCM, 2004):

Step	Comment
1. Set Goals/objectives	• Objectives state the specific outcomes of the strategy that need to be accomplished. They include performance measurements and how they fit with other community goals.
2. Identify target audience(s)	• Different audiences require different education strategies, reflecting different information needs, level of awareness, and goals and objectives.
3. Create meaningful, precise messages	• A core message is the most significant idea that has to be communicated. It needs to be simple, consistent and focused.
4. Communication tactics and tools	• Advertising, hosting special events, generating free publicity, and speaking with the public one-on-one are communication opportunities. Using different media can ensure access to a greater portion of the target audience.

Step	Comment
5. Develop a campaign timetable	• Communications should begin about three months prior to the program launch with a stepped-up communication package released two weeks before the launch, and again during the launch. After the program implementation, communication is needed as a reminder or troubleshooter.
6. Estimate budget	• Costs can be affected by: Awareness of target audiences, desired communication tools, chosen promotional materials, frequency and type of distribution, use of in-house/ external resources, use of free resources and volunteers, and range and type of external media used.
7. Develop evaluation criteria and conduct evaluation	• Pre- and post-campaign surveys, pre- and post-program setout counts, and pre- and post-program waste audits are tools possible to use when evaluating the success of the program and education strategy.

4.2 Pilot

Based on background research, stakeholder consultation outcomes and financial and technical considerations a preferred curbside system would be chosen. Through a pilot program the chosen system is tested. A pilot will give City Administration and Council the opportunity to reevaluate the functionality of the system.

It is important to analyze operational, processing and communication aspects of the program before the final service plan is prepared. To account for seasonal variations for collection, processing and material tonnages Waste and Recycling Services recommends a Pilot duration of 12 months. Ideally, a pilot would start in the spring months to give residents and equipment operators' good conditions to get to know the new system before the winter months.

A pilot study may address a number of issues, for example:

- Evaluation of communication to residents on participation in the program.
- Understanding of collection logistics and issues.
- Evaluation of processing facility.
- Identify and evaluate adverse effects (illegal dumping, scavenging, material contamination) caused by the program and the effectiveness of actions to reduce them (e.g. customer education).
- Create risk mitigation strategy.
- Create community acceptance of the program changes.
- Evaluate storage containers, i.e. carts, bags, boxes.
- Test implementation strategies.

The following data could be collected through the Pilot to verify the above identified questions (based on City of Honolulu, 2008):

Item:	
Routes	• Monitor bin setout, bin contents, bin contamination levels • Monitor pick-up efficiencies • Amount of material to be handled
Equipment	• Seasonal challenges • Technical challenges
Processing sites	• Material tonnage, composition and level of contamination • Efficiency of unloading material and processing
Participants	• Feedback through surveys, hotline, webpage, open houses and focus groups
Customer complains	• Nuisance complaints through material storage, collection and processing
Impact on drop-off depots	• Tonnage received at depots in pilot area
Cost	• Collection, maintenance, and processing cost • Revenues from material sell

Waste and Recycling Services suggest to pilot curbside pick-up within the four existing garbage pick-up zones. In each zone 150 residential dwellings would participate. Additionally, multi-family dwellings will be included in the pilot. Waste and Recycling Services suggests to pilot five condo and five apartment buildings.

Preliminary estimates show, that during a 12 month pilot existing resources can be used. The additional cost would be equipment purchases, consultant cost and processing. The overall Pilot would cost:

Pilot Curbside Recycling	$550,000
Pilot Organics Curbside	$470,000
Total	**$1,000,000**

Funding for the pilot and potential program implementation would have to be identified by the City of Lethbridge as part of the capital and operational budget.

Prior to the pilot it should be clearly communicated to the residents if they will be able to continue to receive a similar diversion service once the pilot is completed or not. Municipalities have experienced difficulties in removing pilot services and going back to “business as usual”.

4.2.1 Program Cost Structure

Across Canada, Waste and Recycling cost recovery models vary significantly. Stewardship programs in Ontario for example provide funds towards municipalities for recyclable diversion. Other waste and recycling operations, like in Edmonton, are partially tax supported. However, the most effective way to manage revenues and costs is to set up a separate cost centre for waste management services, making resource and waste management services financially independent and self financing (FCM, 2004).

Waste and Recycling Services at the City of Lethbridge is currently a utility which is self financed.
As part of the implementation of a curbside diversion program the current rate structure and by-law would require changes.

4.2.2 Timeline

The following program effort is expected, some tasks will be carried out simultaneously and some follow one another.

Milestones:	Time effort
Council Strategic Direction	Milestone
Organics Diversion Assessment	5 months
Recyclables Diversion Assessment	5 months
Stakeholder Consultation	4 months
Approval of Pilot	Milestone
Design of Pilot	5 months
Pilot	12 months
Evaluation of Pilot	2 months

5 Recommendations

Waste and Recycling makes the following key recommendations for the implementation of curbside diversion in the City of Lethbridge:

- Involve the community from the beginning. This ensures higher community buy-in and support for the selected system resulting in higher compliance and participation;
- Consider opportunities to target IC&I materials to help reduce costs, increase volumes and achieve economies of scale at the processing sites;
- Consider innovative, low-tech solutions;
- Establish a strong promotion and education campaign that begins before the launch of the program and considers the integration of social marketing techniques;
- Engage experts/ consultants at major decision points; and
- Include considerations for organics management.

References:

APWA, "Organics Recycling – Going Behound Yard Waste Seminar", 2010

City of Calgary, Waste and Recycling Services, "Recycling Summary Report 2004/2005", 2005

City of Lethbridge, "Interact, Inform, Engage", 2011

City of Lethbridge, "Waste Audit Results 2010/2011", on file generated 2011

Container Recycling Institute, "Understanding economic and environmental impacts of single stream collection systems", 2009

Department of Environmental Services City and County of Honolulu, "Curbside Recycling Pilot Program Evaluation", 2008

Dubanowitz, Alexander J., "Design of a Materials Recovery Facility (MRF) For Processing the Recyclable Materials ofNew York City's Municipal Solid Waste", Columbia University, 2000

Eco Conservation Institute, "BEST PRACTICES IN FOOD SCRAP PROGRAMS Seminar", 2011

Eco Conservation Institute, "Pay as you Throw Seminar", 2010

Federation of Canadian Municipalities, "Solid Waste as a Resource", 2004

Municipal Waste Integration Network and Recycling Council of Alberta, "Municipal Solid Waste Options Integrating Organics Management and Residual treatment/ Disposal", 2006

Recycling Marketing Cooperation for Tennessee, "Material Recovery Facility Handbook", 2003

Sonnevera, "City of Lethbridge Comprehensive Waste Diversion/ Waste Prevention Master Plan", 2008

SWANA, "Collection of Recycling Material Seminar", 2011

SWANA, "Processing of Recycling Material Seminar", 2011

US EPA, "Composting Food Scrapes and Soiled Paper", 2010

US EPA, "Decision-Makers Guide To Solid Waste Management – Vol III", 1995

City of Kamloops Sustainable Kamloops Plan Information Package on Solid Waste accessed September 5, 2011: http://64.114.94.71/docs/solidwaste.pdf

City of Calgary Recycling accessed Spetember 5, 2011: http://www.calgary.ca/UEP/WRS/Pages/Recycling-information/City-of-Calgary-Recycling.aspx

City of Red Deer Environmental Master Plan accessed September 5, 2011: http://letstalkreddeer.ca/

City of Edmonton Recycling Facts, accessed September 5, 2011: http://www.edmonton.ca/for_residents/Environment/City_recycle_factsheet(web).pdf

City of St. Alberta Environmental Masterplan, accessed September 5, 2011: http://www.stalbert.ca/uploads/files/EMP_document-layout_updated-Jan-091.pdf

City of Vancouver Integrated Solid Waste and Resource Management Plan, accessed September 5, 2011 http://www.metrovancouver.org/services/solidwaste/planning/Pages/default.aspx

COMPOSTING OF MUNICIPAL SOLID WASTES accessed September 7, 2011: http://www.accessengineeringlibrary.com/mghpdf/007145019x_ar017.pdf

APPENDIX A

SORTING EQUIPMENT IN AUTOMATED MRF FACILITIES

SORTING EQUIPMENT IN AUTOMATED MRF FACILITIES

Equipment	Application
A trommel, or rotating drum screen	• Sorts materials by size. • Outside of trommel consists of a screen with small holes that grow larger along the length of the screen. Small containers like aluminum and tin cans fall through the smaller screen holes, plastic bottles and milk jugs pass through the larger holes.
Discs	• Sorts materials by size. • Discs are rotating and staggered from one shaft to the next • Between shafts and discs openings where smaller materials fall through
Vibrating screens	• Shakes as materials pass over its surface. • Particles that are smaller than the holes fall through the screen; larger pieces move across the screen
Density sorting	• Material is subjected to an air stream • Air stream velocity is set so that lighter materials such as plastic or aluminum cans are blown away from heavier materials such as glass containers
Magnets	• Removing ferrous metals or using eddy current separators to create an electrical current in aluminum materials that propels the aluminum away from other materials
Infrared detectors	• Identify different plastic grades

APPENDIX B

COST OVERVIEW COMPARISON

Scenarios	Captital	Operational (2011)	Monthly residential rate component
Weekly Garbage	$0.00	$3,100,000.00	$8.61 30,000 customers
Bi-weekly garbage	$0.00	$2,200,000.00	$6.11 30,000 customers
Weekly Curbside Recycling	$4,300,000.00	$3,400,000.00 Carts to be amortized over 10 years, trucks over 6 at 6%	$8.33 34,000 Customers
Bi-weekly Curbside Recycling	$3,300,000.00	$2,700,000.00 Carts to be amortized over 10 years, trucks over 6 at 6%	$6.62 34,000 Customers
Weekly Curbside Organics	$4,300,000.00	$2,700,000.00 Carts to be amortized over 10 years, trucks over 6 at 6%	$6.62 34,000 Customers
Bi-weekly Curbside Organics	$3,300,000.00	$2,000,000.00 Carts to be amortized over 10 years, trucks over 6 at 6%	$4.90 34,000 Customers

APPENDIX C

SUMMARY OF DIVERSION INCENTIVES AND THEIR RATED POTENTIAL TO INCREASE DIVERSION IN LETHBRIDGE

Residential (Sonnevera, 2008)

Option – Residential Sector	Possible stages of option	Capital Cost	Operating Cost	Residential diversion potential
Grass Cycling/ Xeriscaping	Education supported by user-pay garbage	$0	<$100,000	0-10%
	Education supported by user-pay garbage and organics collection	$0	<$100,000	0-15%
	Supporting education but behavior driven by bans	$0	<$100,000	0-25%
Green Procurement Education	Education and City Leadership	$0	<$100,000	0-5%
Reuse Promotion - EXISTING	Promote awareness of Opportunities	$0	$0	0-2%
User Pay Program (garbage)	Increase cost differential between cart sizes. Education campaign to announce changes.	850,000	<$100,000	5%-10%
	Large cost differential between sizes of garbage carts. Lower cost for curbside organics.	$200,000	<$100,000	10%-17%
Disposal Bans	Prohibit organics and recyclables from landfill. Requires aggressive advanced marketing.	$0	<$100,000	10%-75%
Incentives	Introduce contest for high performers to receive special recognition, such as decals on their bin.	< $100,000/ yr	<$100,000	1%-5%
	Build on visual recognition (special bin) with financial incentive (high performing residents receive credit back)	< $100,000/ yr	<$100,000	5%-10%
Mandatory Recycling	Residents are required to participate in recycling/ composting. Requires aggressive advanced marketing.	$0	<$100,000	10%-75%
Curbside Organics/ Recycling Collection	Recycling and organics collected through existing drop-off programs.	$220,000	$730,000	0%

SUMMARY OF DIVERSION INCENTIVES AND THEIR RATED POTENTIAL TO INCREASE DIVERSION IN LETHBRIDGE

Option – Residential Sector	Possible stages of option	Capital Cost	Operating Cost	Residential diversion potential
	Introduce curbside collection of recyclables and organics.	$6 – 8 Mil	$5-6 Mil	10%-30%
	Introduce curbside collection of recyclables and organics prior to bans.	$6 – 8 Mil	$5-6 Mil	20%-40%
Bi-weekly Garbage Collection	Reduce garbage collection bi-weekly, alternating with recyclables and/ or organics. Lead into change with aggressive education campaign.	$0	$0	0-20%
	Reduce garbage collection to bi-weekly, alternating with recyclables and/ or organics.	$0 (cost recycling & organics above)	$0 (cost recycling & organics above)	0-20%
Mast Composter/ Recycler Program	Introduce community Master Composter Courses.	$0	$100,000	1-10%
Permanent centralized recycling Facility – EXISTING	Establish a permanent facility for drop-off of a wide range of materials, including recyclables, yard waste, bulky items, HHW, tires, and e-waste.	$250,000 - $3,500,000	$150,000 - $750,000	1-10%
Community-Based Social Marketing	Integrate community-based social marketing techniques into all programming	$0	$150,000 – $600,000	Impacts each program
Multi-Family Programming	Develop targeted promotional program for multi-family buildings	$500,000-600,000	$300,000	1-10%

Industrial, Commercial and Institutional (Sonnevera, 2008)

Option – ICI Sector		Capital Cost	Operating Cost	ICI diversion potential
Waste Audit and Waste Reduction Plan Requirements	City requires businesses to conduct waste audits and develop waste reduction plans.	$0	$100,000-$200,000	5%-25%
City establishes a Green Procurement Program	City adopts green procurement policy and practices	$0	<100,000	1%-2%
Promoting Green Procurement Within the ICI Sector	Education to encourage green procurement within ICI sector.	$0	$100,000-$200,000	0%-5%
Waste Reduction Certification Program	Businesses can receive certification if they achieve specified waste reduction/ diversion targets	$0	<100,000	5%-10%
Waste Diversion Assistance Program	City offers technical and information assistance to companies that want to implement waste diversion program.	$0	<$100,000	5%-25%
Mandatory Recycling and/ or Source Separation Requirements	Businesses must participate in recycling and/ or must divert designated materials through a recycling program.	$0	$200,000 – $300,000	25%-75%
Mandatory Diversion at Special Events	Organizer of Special events to offer waste diversion services during event.	$0	<$100,000	1%-2%
ICI Yard Waste Program	City or private sector develops commercial yard waste facility.	$175,000	$100,000 - $500,000	0%-2%
Food Waste Collection Program	City or private sector provides food waste collection to businesses.	$0-$10,000,000	$100,000 – $1 Mil	5%-10%
Differential Tipping Fees	Higher tipping fees are applied to loads of waste containing designated recyclables and compostable materials.	$0	$100,000-$200,000	10%-50%

SUMMARY OF DIVERSION INCENTIVES AND THEIR RATED POTENTIAL TO INCREASE DIVERSION IN LETHBRIDGE

Option – ICI Sector		Capital Cost	Operating Cost	ICI diversion potential
Landfill Bans	Designated materials are banned from entering the landfill.	$0	$100,000-200,000	25%-75%
Haulers Submit Annual Waste and Recycling Reports	Haulers required to submit waste and recycling reports as part of business operating permit.	$0	<$25,000	0%
Waste Diversion Promotional Programs	Target waste diversion programs developed for specific ICI sectors, such as schools and office buildings.	$0	$100,000 - $500,000	5%-25%

Construction and Demolition (Sonnevera, 2008)

Option – C&D Sector		Capital Cost	Operating Cost	C&D diversion potential
Incentives for Green Design	Buildings or developments with green design receive incentives, such as reduced permitting fees.	$0	<$100,000	5%-10%
Green Building Certification Program	Promote programs that promote energy/ water conservation and waste reduction/ diversion.	$0	<$50,000	1%-5%
Government Leadership	C&D waste reduction mandated on City projects.	$0	<$100,000	1%-5%
Contract Waste Diversion Requirements	Contract specifications written to require waste diversion.	$0	<$100,000	1%-15%
Builder/ Developer/ Industry Stakeholder Involvement	C&D stakeholders are invited to participate in discussions on waste diversion challenges and opportunities.	$0	<$50,000	0%-5%
Waste Diversion Assistance Program	City offers technical and information assistance to companies that want to implement waste diversion programs.	$0	<$100,000	5%-15%
Increased Tipping Fees	Landfill tipping fees increase across the board.	$0	<$50,000	10%-25%
Differential/ Variable Tipping Fees	Source-separated loads receive lower tipping fees than mixed loads.	$0	<$100,000	20%-50%
Landfill Bans	Designated materials are banned from entering the landfill.	$0	$100,000 - $200,000	25%-75%
Waste Diversion/ Disposal/ Material Recovery Plan requirements on all C&D Projects	Management Plan that identifies materials and destinations required as part of permitting process (align with provincial program).	$0	$100,000	10%-40%
Refundable Deposit Program	Deposit accompanies permit application –	$0	$100,000 -	25%-50%

SUMMARY OF DIVERSION INCENTIVES AND THEIR RATED POTENTIAL TO INCREASE DIVERSION IN LETHBRIDGE

Option – C&D Sector		Capital Cost	Operating Cost	C&D diversion potential
Tied to Building Permit	refund based on diversion performance (align with provincial program).		$200,000	
Market Development for Recyclable Materials	City works with businesses/ industry to develop/ stipulate markets.	$0	<$100,000	5%-10%
Infrastructure Development	Establish/ support collection/ transfer/ processing facilities and transfer stations	$100,000 - $200,000	<$100,000	10%-25%