Alberta Municipal Benchmarking Initiative - Wastewater

(April 2017)

Table of Contents

1 Introduction and Background

1.1 Introduction

Today's municipalities are challenged by an ever-increasing demand to deliver a greater variety and a higher level of public services while maintaining low taxes and user fees.

To meet this challenge, municipal governments are continually looking for new ways to improve performance, operationally and fiscally.

In the spring of 2012, a number of municipalities in Alberta expressed an interest in benchmarking their service delivery against leading practices as a way to improve service. At a workshop hosted by the Town of Banff in May 2012, participating municipalities discussed the benefits of benchmarking; developed a preliminary list of guiding principles; and identified considerations related to governance, scope, data collection, resources, and risks.

Subsequent to this workshop, the Town of Banff, on behalf of a group of 13 municipalities, successfully applied to the provincial government for a Regional Collaboration Grant to fund the development of a municipal service delivery benchmarking framework. With the support of the provincial government, the Alberta Municipal Benchmarking Initiative (ABMI) was launched in 2013.

1.2 Background

The Alberta Municipal Benchmarking Initiative is a collaboration of small and large-municipalities. Their objective is to develop and implement a framework that will enable a continuous, multi-year benchmarking process for participating municipalities. The initiative includes identifying and gathering comparable metrics and preparing benchmarking reports to prompt questions, start discussions, identify and share leading practices, and ultimately improve the municipal services provided to Albertans.

The service areas to be considered as part of this initiative are for efficiency and effectiveness performance measures are:

1. Drinking Water Supply (complete)
2. Wastewater Collection, Treatment and Disposal (complete)
3. Fire Protection (complete)
4. Roadway Operations and Maintenance
5. Snow and Ice Management
6. Residential Solid Waste Management (c0mplete)
7. Police Protection, RCMP and Self-Run (complete)
8. Transit
9. Parks Provision and Maintenance
10. Recreation, Facility Booking and Maintenance

A method for collecting data to ensure it is comparable between communities and a database to hold the data and produce performance measure reports has been developed. The foundation of this method is a "User Manual" for each service area, containing:

- Definitions for cost and service data, and
- Definitions for the calculations of performance measures for both efficiency and effectiveness.

To ensure an "apples to apples" comparison, participating municipalities are involved in the creation of the user manual.

1.3 Participating Municipalities

The municipalities currently participating in the Wastewater section of the Project are the cities of Airdrie, Lethbridge, Medicine Hat, and the towns of Banff, Canmore, and Okotoks.

1.4 Governance Structure

To guide and drive the project, a model has been developed consisting of:

- A governance committee consisting of six municipal leaders
- A working committee with representatives from each of the participating municipalities
- A finance group with representatives from each of the participating municipalities
- A subject matter expert (SME) Group for each service area with representatives from each of the participating municipalities

Governance Committee - The governance committee was created to provide overall guidance and oversight, and to ensure that the work conducted is in the best interest of the group of municipalities as a whole as opposed to an individual municipality. The committee is: Robert Earl (Chair), Town of Banff, Paul Schulz, City of Airdrie, Lisa de Soto, Town of Canmore, Corey Wight, City of Lethbridge and two vacant positions.

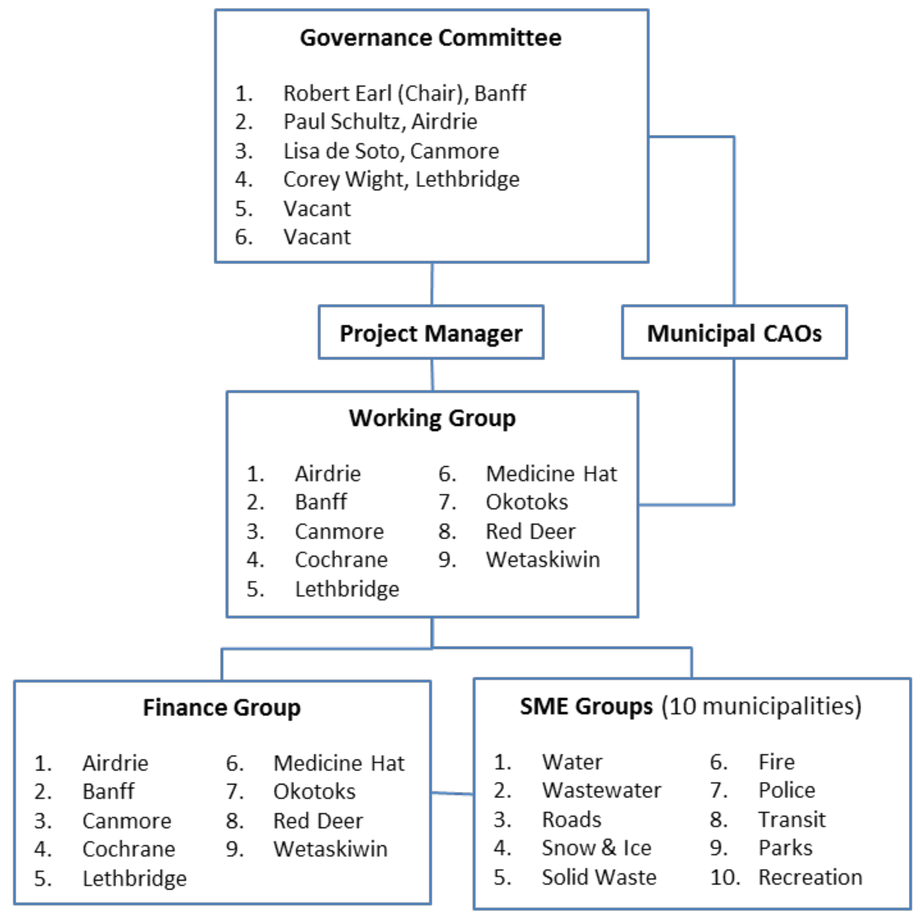
Working Committee - Each of the participating municipalities is represented on the working committee. Its members' primary role is liaising between the project manager and the respective municipality. They oversee the completion of activities within the municipality, support the identification of SMEs needed for the development of the Database User Manual, and assist with the gathering of relevant data.

Finance Group – The primary role and responsibility of the Finance Group is to collect and enter data for a calculation to allocate overhead to each service area, collect and enter data for amortization of assets in each service area, and assist service area SMEs on collection of cost data for each service area. The Finance Group also ensures all data is accurate by confirming the financial data to the municipality's non-consolidated financial statements.

Subject Matter Expert Group (SME) – The primary role and responsibility of the SME groups is to provide subject matter expertise in the development of the service definitions, performance measures, and collection of data for the benchmarking pilot project.

The CAOs' Role – In addition to the governance committee, the CAOs from each of the participating municipalities were asked to confirm their commitment to this pilot project, to be the executive sponsor for their respective municipality, to champion this pilot project within their municipality, and ensure that all participating municipalities are informed of the activities and outcomes.

Governance Structure



1.5 Benefits of Benchmarking

The anticipated benefits from this benchmarking project are:

- Helps tell the municipal "performance story"
- A sound business practice used in government and private sectors
- Sets the stage for sharing knowledge and best practices among the municipal sector
- Understanding of trends within each municipality
- Identification of opportunities for change to improve efficiency or effectiveness of municipal services
- Formation of objective evidence that shows the differentiation between municipalities and provides information for Municipal CAOs to address questions from Council, staff, and the community on service efficiency and effectiveness
- Encouragement of continuous improvement initiatives and a better understanding of the drivers that impact performance results
- Encourages continuous improvement, and
- Awareness of the value of collaboration between municipalities.
- Supports results-based accountability

1.6 Definitions

Efficiency – Efficiency is a measure of productivity based on dividing the quantity of output (measured in units of deliverables) by the quantity of resources input (usually measured in person hours or dollars).

Effectiveness – Effectiveness is a measure of the value or performance of a service relative to a goal, expressed as the actual change in the service. An effectiveness measure compares the output of a service to its intended contribution to a higher level goal.

Wastewater

Alberta Municipal Benchmarking Initiative

2 Wastewater

2.1 System Description

2.1.1 Municipal Wastewater Services

Municipal wastewater systems consist of collection and treatment systems. The collection system utilizes a network of sanitary sewer pipe and lift (pump) stations to convey sewage from municipal residents and businesses to a wastewater treatment plant (WWTP).

Wastewater treatment processes are designed to achieve improvements in the quality of the sewage prior to being discharged into a receiving body of water. The WWTPs described in this report are required, through an Approval to Operate, to provide treatment that meets the Alberta provincial standard. For municipalities in National Parks, such as the Town of Banff, the requirement is to meet a more stringent standard; Parks Canada Leadership Target.

Wastewater Composition
Various treatment processes affect;

- **Suspended Solids**, physical particles that settle under gravity and have the potential to clog bodies of water.

- **Biodegradable Organics,** a potential source of "food" for microorganisms, which, when combined with the oxygen in the receiving body of water, enables them to flourish and multiply. That demand for oxygen by microorganisms directly competes with the resident aquatic species' requirement for oxygen. Organic pollution can create situations where fish struggle to survive.

- **Pathogenic Bacteria**, disease-causing organisms are of particular concern when the receiving body of water is used for drinking by other municipalities.

- **Nutrients**, generally refers to nitrates and phosphates. These nutrients can lead to high concentrations of algae, which, in turn, leads to increased organic loading.

Treatment
The WWTP process generally includes three levels of treatment; primary, secondary and tertiary.

- **Primary (mechanical)** is designed to remove large, floating or suspended solids from raw sewage. It includes screening to remove solid objects and sedimentation by gravity. Sometimes chemicals can be used to accelerate the sedimentation process.

- **Secondary (biological)** further removes dissolved organic matter. Microbes, through biological activity, consume the organic matter as food and convert it to

CO_2, water and energy for their own survival. This is followed by secondary sedimentation in settling tanks.

- **Tertiary** treatment provides enhanced treatment prior to discharge into a receiving body of water. This can be achieved by employing a number of different technologies or processes; biological nutrient removal (BNR), biological aerated filters (BAF), filtration and disinfection either through treatments such as ultraviolet (UV) exposure, chlorination or ozone exposure.

- **Biological Nutrient Removal (BNR)** is a process used for removal of the nutrients nitrogen and phosphorus from wastewater before it is discharged into surface or ground water. BNR is comprised of two processes: biological nitrogen removal and enhanced biological phosphorus removal (EBPR). Removal of these nutrients leads to lower concentrations of algae in a receiving body of water.

- **Biological Aerated Filters (BAF)** is a process to remove nitrogen (ammonia) as well as organic matter. Wastewater flows upwards through tanks (called cells) that are filled with media. The media within the filter cells is tightly packed and provides a surface for microorganisms to attach to and grow on. The microorganisms consume organic material. The upward flow of wastewater through the tightly packed media also provides filtering, eliminating the need for a separate clarification step in the treatment process. Air is added to the bottom of the cell to provide oxygen for the microorganisms. The BAF system typically employs multiple filter cells that are rotated in and out of service as needed to accommodate varying wastewater flow rates and concentrations of organic materials in the flow.

- **Ultraviolet (UV)** is a safe, clean, easy-to-maintain method of disinfecting wastewater of bacteria. UV disinfection uses ultraviolet light, just like sunlight, to kill micro-organisms that may be in the water. It is a proven technology that has no significant drawbacks. In some applications, its initial cost is a bit more than chlorination, but because of its low operating cost, it quickly pays for itself. It is environmentally friendly and essentially trouble-free.

Disposal

Biosolids that have been removed from the collected wastewater by various treatment processes in the WWTPs are typically further processed, either in-house or contracted out, to create a beneficial re-use products such as compost or fertilizers.

2.1.2 Factors Influencing Wastewater Services

Treatment Standards: Municipal WWTPs must meet Provincial or Parks Canada standards for the water returned to the natural waterways. WWTPs are operated to do best treatment possible at all times. This means they often produce exceptional results exceeding the Provincial standards. Exceeding the standards also leaves some buffer when conditions change unexpectedly.

Age of Infrastructure: Age and condition of the wastewater collection system and the WWTP have a significant influence on the efficiency and effectiveness of municipal wastewater systems.

Treatment Plants: The number, size and complexity of wastewater collection systems and treatment plants is also a significant influencing factor.

Weather Conditions: Severe and frequent weather events put additional load on wastewater systems.

Urban Density: The more spread out the municipality, the greater the collection cost per user.

Urban Growth: High growth municipalities have newer infrastructure which comes with higher amortization (depreciation) costs.

2.1.3 Wastewater System Narrative Data (See Section 3 for definitions of each column heading)

The Narrative Data shows differences and similarities between municipalities for this service area.

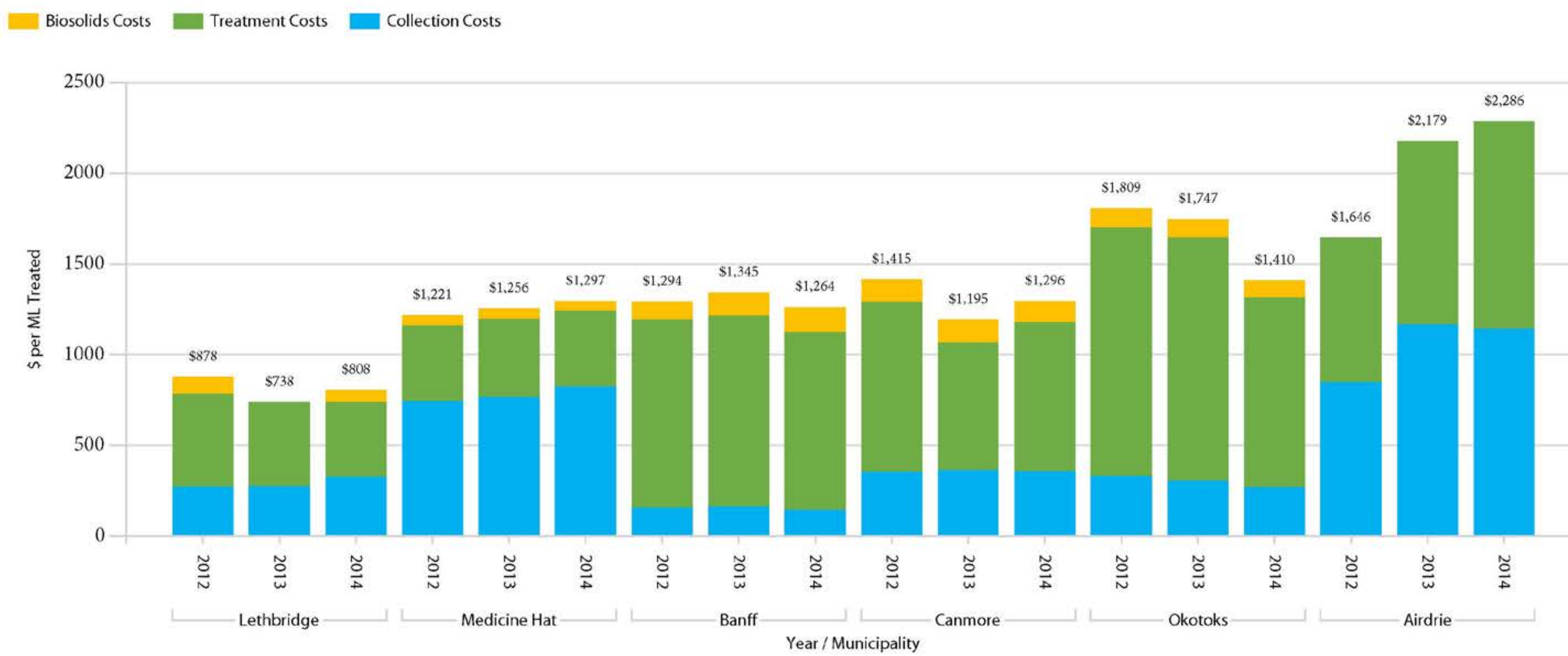
Municipality	Collection	Treatment	Biosolids Processing	Treatment Plant Rating	Treatment Process	UV Disinfection
Airdrie	Self-Run	Purchased	N/A	N/A	N/A	N/A
Banff	Self-Run	3rd Party Operator (Self-Run 2015+)	In-house	IV	BNR	Yes
Canmore	3rd Party Operator	3rd Party Operator	Purchased	III	BAF	Yes
Lethbridge	Self-Run	Self-Run	Purchased	IV	BNR	Yes
Medicine Hat	Self-Run	Self-Run	Purchased	IV	BNR	Yes
Okotoks	3rd Party	3rd Party	Purchased	IV	BNR	Yes

NOTES:

1. The City of Airdrie is solely a collection system and has a contract with the City of Calgary for wastewater treatment. The City of Calgary is a regional provider for water supply and wastewater treatment. From a description of the Calgary wastewater system on the city website, "We return the water to the Bow River. Our water meets the high standards set by Alberta Environmental Protection."
2. All municipalities meet Provincial Standards for treated wastewater released to natural waterways except for Banff that meets the more stringent National Parks target.
3. All municipalities discharge treated water into rivers, except for the City of Airdrie which has a contract with the City of Calgary to provide treatment services.
4. Parks Canada standards for discharged treated water lead to higher treatment costs, e. g. Banff has an additional filtration step at the end of the treatment process to collect and control phosphorus. This requires additional capital and operational costs.

2.2 Total Wastewater System Costs 1 ($/ML) – Efficiency

This chart shows the total cost of collecting wastewater from residences and commercial/industrial customers, treatment of the wastewater to provincial standards, and processing biosolids separated from the wastewater stream for re-use. For comparability, the total cost is normalized to cost per million litres (mega-litre, ML) and shown for each of the three processes. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.2.1 Total Wastewater Data (See Section 3 for definitions of each column heading)

Municipality	Year	Collection Costs ($)	Treatment Costs ($)	Biosolids Costs ($)	Total Costs ($)	Wastewater Treated (ML)	Cost per ML ($)
Airdrie	2012	$4,066,976	$3,793,186	$0	$7,860,162	4,776	$1,646
	2013	$5,794,293	$4,998,835	$0	$10,793,128	4,953	$2,179
	2014	$6,372,841	$6,362,586	$0	$12,735,427	5,570	$2,286
Banff	2012	$490,820	$3,178,808	$306,231	$3,975,860	3,072	$1,294
	2013	$504,688	$3,230,244	$395,957	$4,130,889	3,072	$1,345
	2014	$457,044	$3,099,914	$429,981	$3,986,940	3,155	$1,264
Canmore	2012	$1,085,345	$2,868,761	$379,392	$4,333,499	3,063	$1,415
	2013	$1,143,314	$2,224,323	$392,426	$3,760,063	3,147	$1,195
	2014	$1,105,072	$2,543,173	$356,507	$4,004,753	3,090	$1,296
Lethbridge	2012	$3,539,549	$6,615,653	$1,222,092	$11,377,294	12,961	$878
	2013	$3,792,984	$6,358,889	$0	$10,151,872	13,755	$738
	2014	$4,766,765	$6,059,958	$1,000,552	$11,827,275	14,633	$808
Medicine Hat	2012	$6,856,010	$3,854,789	$523,411	$11,234,210	9,203	$1,221
	2013	$7,066,507	$3,954,913	$528,235	$11,549,655	9,196	$1,256
	2014	$7,588,985	$3,855,581	$506,208	$11,950,775	9,213	$1,297
Okotoks	2012	$726,152	$2,983,010	$240,000	$3,949,162	2,183	$1,809
	2013	$733,134	$3,186,622	$240,000	$4,159,757	2,381	$1,747
	2014	$701,353	$2,706,928	$240,000	$3,648,282	2,588	$1,410

NOTES:

1. Airdrie operates solely a collection system and has a contract with the City of Calgary for treatment of Airdrie wastewater. Airdrie has no control over meeting provincial standards for water released or the handling of biosolids as it is considered part of the City of Calgary process and not that of the City of Airdrie. From a description of the Calgary wastewater system on the City website;
   - "We (Calgary) return the water to the Bow River. Our water meets the high standards set by Alberta Environmental Protection."
   - Our (Calgary) Calgro program provides biosolids to Calgary farmlands for the growth of crops such as alfalfa, canola, oats, wheat and barley. Our labs monitor the quality of the Calgro program's biosolids to make sure we meet Alberta Environment's standards."

2. Lethbridge has no costs for biosolids in 2013. Lethbridge stores a multi-year stockpile of biosolids on site. Because of this practice, the volume of solids disposed in any given year is not directly related to the amount produced in that year. The cost budgeted for the 2013 biosolids disposal program is included in 2012 and 2014.

2.2.2 Lessons Learned

1. For municipalities that operate a municipally owned WWTP, total costs of wastewater systems range from about $800/ML to $1,800/ML. While this is a small sample size, and clear conclusions are limited by this, the data shows that in general, larger systems lead to lower costs/ML.

   The average total wastewater cost/ML for this group is $1,265, while the range is $738 (Lethbridge) to $1,809 (Okotoks). It appears that as volume handled in the wastewater system increases, costs/ML decreases. Banff, Canmore and Okotoks process an average 2861ML at an average cost of $1,419/ML. Lethbridge, Medicine Hat handle an average of 11,494 ML at a cost of $1,033/ML.

   For municipalities that operate a municipally owned WWTP, Fixed costs are a large part of operating the wastewater treatment system. As volume handled increases, the fixed costs are spread out over this larger volume lowering the cost/ML

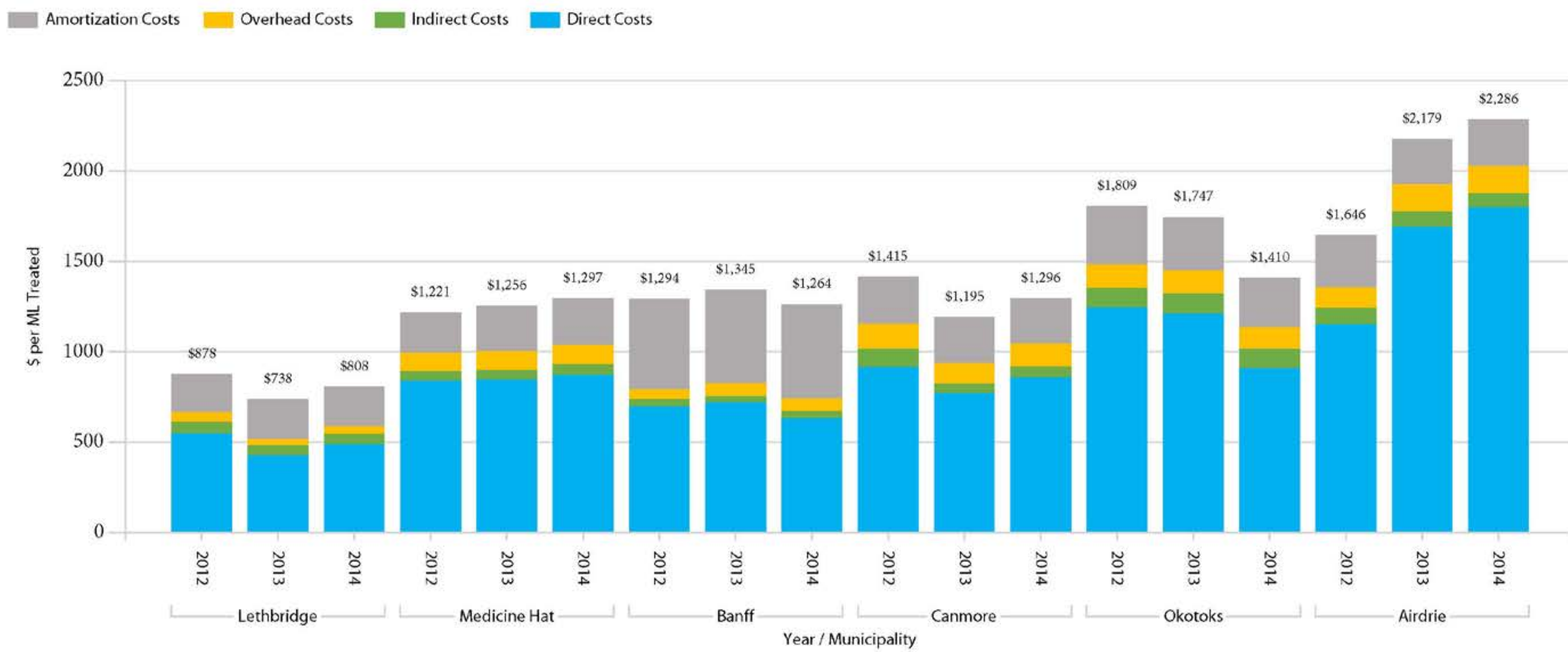
2. In most instances, treatment costs form the majority of total wastewater costs, with collection costs forming the next largest portion

3. As municipalities grow, the fixed costs related to treatment are gradually spread over larger volumes treated until capacity needs to be increased.

4. For municipalities that operate a municipally owned WWTP, Ð differences in total costs per ML treated between similar sized communities are in part due to the split of staffing and other costs between the water and wastewater services by the individual municipalities. Through this process it has become clear that some participating municipalities approximate the split in labour and materials between water and wastewater services. This approximation will make a direct comparison challenging. For example within the study period, Okotoks shifted from 45% water and 55% wastewater to 50% water and 50% wastewater.

2.3 Total Wastewater System Costs 2 ($/ML) – Efficiency

This chart shows total cost collecting wastewater, treatment and processing of separated biosolids per ML collected by cost type; direct costs are those for day-to-day operation of the service, indirect costs are for management of the service, overhead cost is a calculated allocation of total overhead to this service, amortization is the depreciation cost of all assets used to deliver the service. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.3.1 Total Wastewater Data (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Wastewater Treated (ML)	Cost Per ML ($)
Airdrie	2012	$5,500,608	$438,903	$535,977	$1,384,674	$7,860,162	4,776	$1,646
	2013	$8,379,997	$425,498	$737,913	$1,249,720	$10,793,128	4,953	$2,179
	2014	$10,031,718	$417,164	$851,015	$1,435,530	$12,735,427	5,570	$2,286
Banff	2012	$2,151,786	$115,935	$169,749	$1,538,390	$3,975,860	3,072	$1,294
	2013	$2,207,089	$118,089	$220,723	$1,584,988	$4,130,889	3,072	$1,345
	2014	$1,991,245	$135,414	$216,572	$1,643,709	$3,986,940	3,155	$1,264
Canmore	2012	$2,802,036	$314,108	$415,550	$801,805	$4,333,499	3,063	$1,415
	2013	$2,423,496	$173,255	$358,080	$805,232	$3,760,063	3,147	$1,195
	2014	$2,652,244	$182,517	$394,894	$775,098	$4,004,753	3,090	$1,296
Lethbridge	2012	$7,097,775	$852,465	$704,508	$2,722,546	$11,377,294	12,961	$878
	2013	$5,877,836	$762,774	$460,195	$3,051,067	$10,151,872	13,755	$738
	2014	$7,162,253	$823,558	$632,559	$3,208,905	$11,827,275	14,633	$808
Medicine Hat	2012	$7,750,036	$463,368	$934,156	$2,086,650	$11,234,210	9,203	$1,221
	2013	$7,800,775	$501,442	$941,593	$2,305,845	$11,549,655	9,196	$1,256
	2014	$8,037,581	$553,708	$974,455	$2,385,031	$11,950,775	9,213	$1,297
Okotoks	2012	$2,716,978	$237,646	$287,540	$706,998	$3,949,162	2,183	$1,809
	2013	$2,887,496	$257,758	$307,505	$706,998	$4,159,757	2,381	$1,747
	2014	$2,352,482	$283,470	$305,332	$706,998	$3,648,282	2,588	$1,410

2.3.2 Lessons Learned

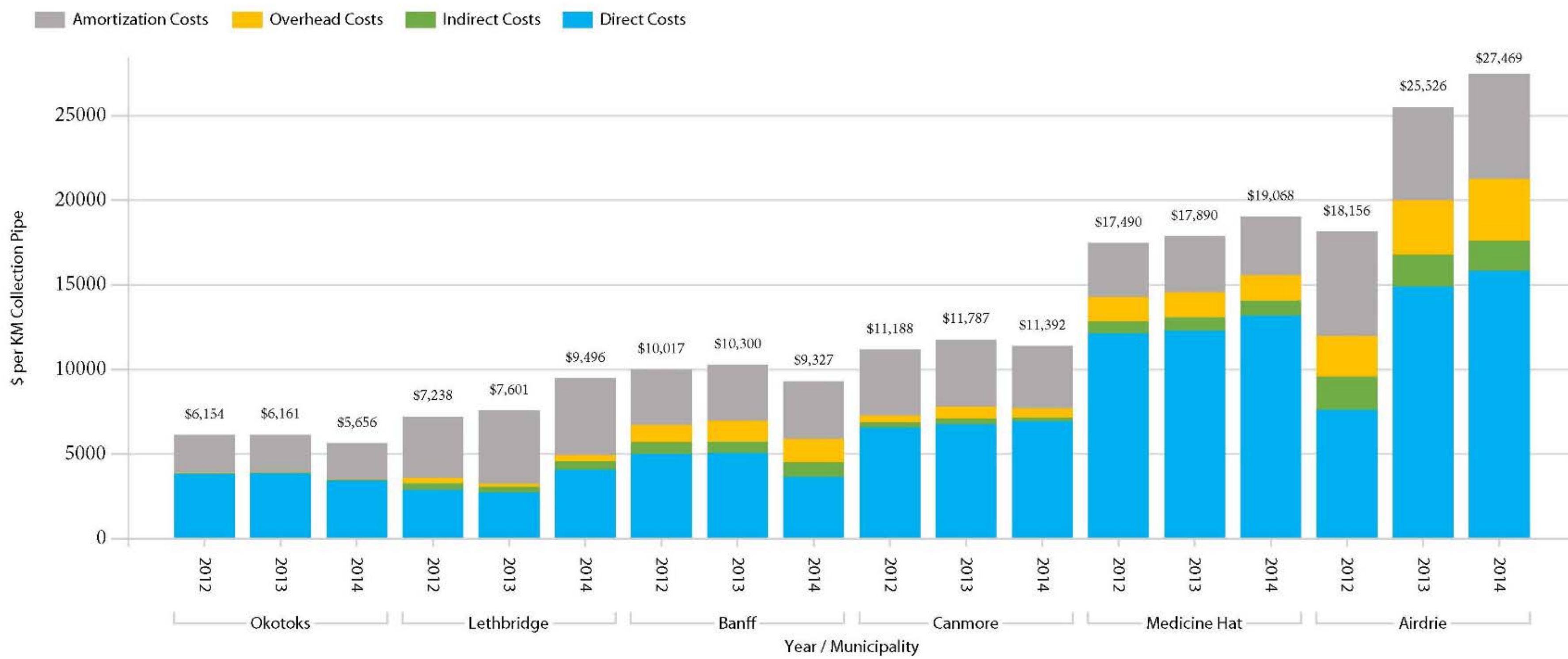
1. Direct costs form the majority of wastewater costs, followed by amortization costs, overhead and indirect.

2. Within a municipality, increasing volumes treated can lead to lower cost/ML treated. Lethbridge for example, saw dropping direct costs/ML through increasing volumes treated. This is derivative of the high fixed costs of treatment systems. Airdrie, which also saw increasing volumes over the study period due to population growth, did not see a drop in costs/ML as its treatment is provided by the City of Calgary at a fixed unit rate price.

3. Energy costs form a large portion of total wastewater costs. Okotoks for example negotiated a new long-term power contract resulting in a 25% -30% savings in power costs in 2014 substantially dropping their total cost/ML.

2.4 Collection Costs ($/KM collection pipe) – Efficiency

This chart shows the total cost of collecting wastewater per KM (kilometre) of collection pipe maintained by the municipality. The cost is shown by cost type; direct, indirect, overhead and amortization. Wastewater is collected though a network of underground sanitary pipes, using natural gravity feed and lift (pumping) stations to move the wastewater to a treatment plant. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.4.1 Collection Data (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Collection Pipe Maintained (KM)	Cost per KM ($)
Airdrie	2012	$1,707,422	$438,903	$535,977	$1,384,674	$4,066,976	224	$18,156
	2013	$3,381,162	$425,498	$737,913	$1,249,720	$5,794,293	227	$25,526
	2014	$3,669,132	$417,164	$851,015	$1,435,530	$6,372,841	232	$27,469
Banff	2012	$245,118	$34,443	$50,430	$160,830	$490,820	49	$10,017
	2013	$248,407	$32,609	$60,950	$162,722	$504,688	49	$10,300
	2014	$178,616	$42,680	$68,259	$167,489	$457,044	49	$9,327
Canmore	2012	$638,292	$29,487	$39,010	$378,555	$1,085,345	97	$11,189
	2013	$655,898	$33,202	$68,622	$385,592	$1,143,314	97	$11,787
	2014	$672,611	$23,520	$50,888	$358,053	$1,105,072	97	$11,392
Lethbridge	2012	$1,417,255	$190,661	$157,569	$1,774,064	$3,539,549	489	$7,238
	2013	$1,371,153	$156,893	$94,656	$2,170,282	$3,792,984	499	$7,601
	2014	$2,045,479	$251,939	$193,509	$2,275,838	$4,766,765	502	$9,496
Medicine Hat	2012	$4,755,996	$279,320	$563,113	$1,257,581	$6,856,010	392	$17,490
	2013	$4,853,634	$312,682	$587,145	$1,313,046	$7,066,507	395	$17,890
	2014	$5,253,654	$345,024	$607,198	$1,383,109	$7,588,985	398	$19,068
Okotoks	2012	$454,164	$2,708	$3,276	$266,004	$726,152	118	$6,154
	2013	$461,777	$2,441	$2,912	$266,004	$733,134	119	$6,161
	2014	$427,827	$3,622	$3,901	$266,004	$701,353	124	$5,656

2.4.2 Lessons Learned

1. Some of the differences in total costs per KM pipe maintained between similar sized communities are in part due to the approximate split of staffing and other costs between the water and wastewater services by the individual municipalities.
2. Topography, the amount of pumping required, affects collection costs)
    - For Banff, Canmore and Okotoks, wastewater flows by gravity to the treatment plant at the bottom of a valley. This means fewer lift stations and lower power used for pumping and so lower costs.

	Cost per KM Pipe ($)	Average Lift Stations (#)	Average Collection Power (kWh/ML)
Banff, Canmore, Okotoks	$9,109	7	52
All others	$16,659	15	126
Change, %	83%	114%	142%

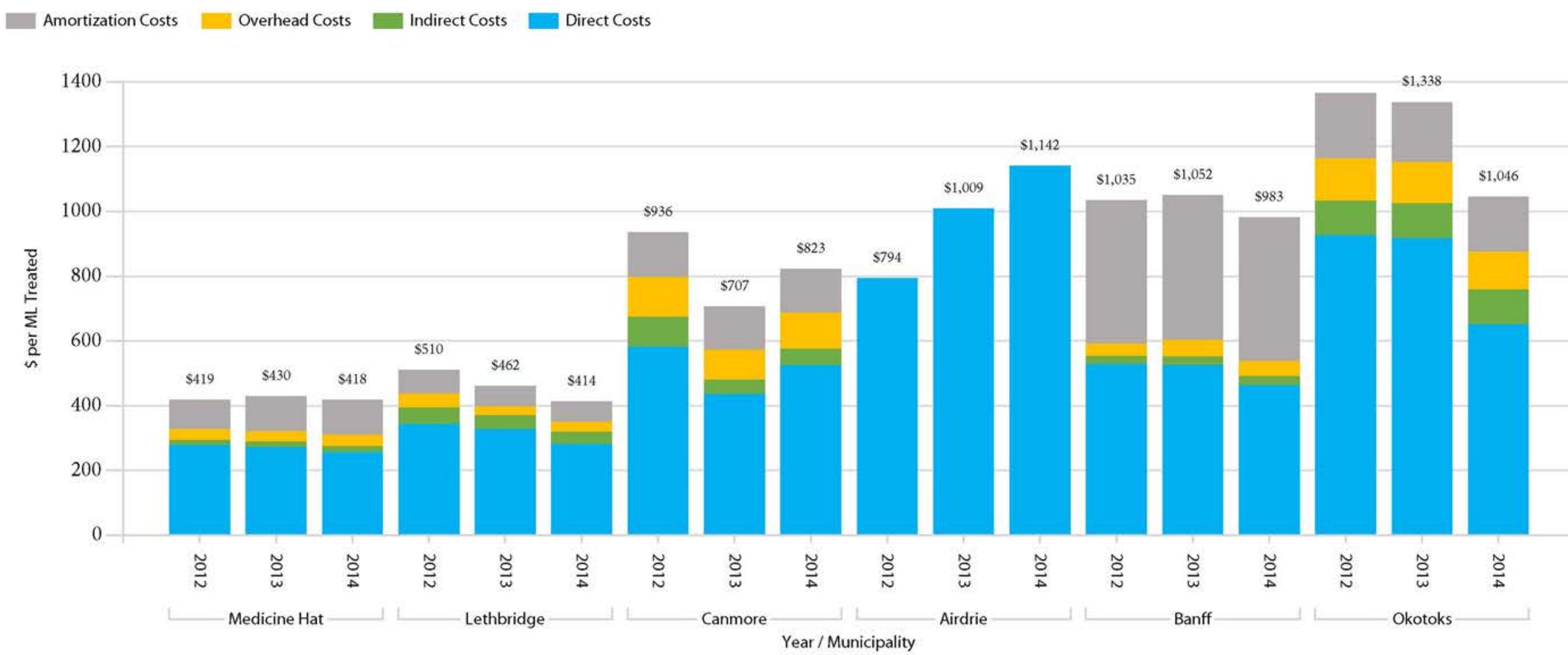
- Airdrie has the highest $/KM of pipe due to the cost of pumping the wastewater 11KM to Calgary, i.e. size of pumps required. This is shown in the power used for collection pumping; all except Airdrie average 63 kWh/ML while Airdrie uses an average of 218 kWh/ML.

  Distance to treatment plant was not measured as part of this initiative.

3. Densely developed areas require less pumping to get wastewater from the furthest customer tie-in to the treatment plant. However, Banff with the smallest footprint of developed area at 3.9 KM^2 and system size at 46KM of pipe maintained is not the lowest cost ($9,881/KM pipe). Topography has a larger effect. Okotoks has a lower cost, at $5,990/KM of pipe even though for Okotoks;
   - Developed area is four times larger at 19.2 KM^2
   - Size of the system, at about 120KM of pipe, is 2.6 times larger than Banff.

2.5 Treatment Costs ($/ML) – Efficiency

This chart shows the cost of treating wastewater to provincial standards per ML collected by cost type; direct, indirect, overhead and amortization. There are two outputs from treatment; water that is released to a natural waterway and biosolids that are processed into re-useable products. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.5.1 Treatment Data (See Section 3 for definitions of each column heading)

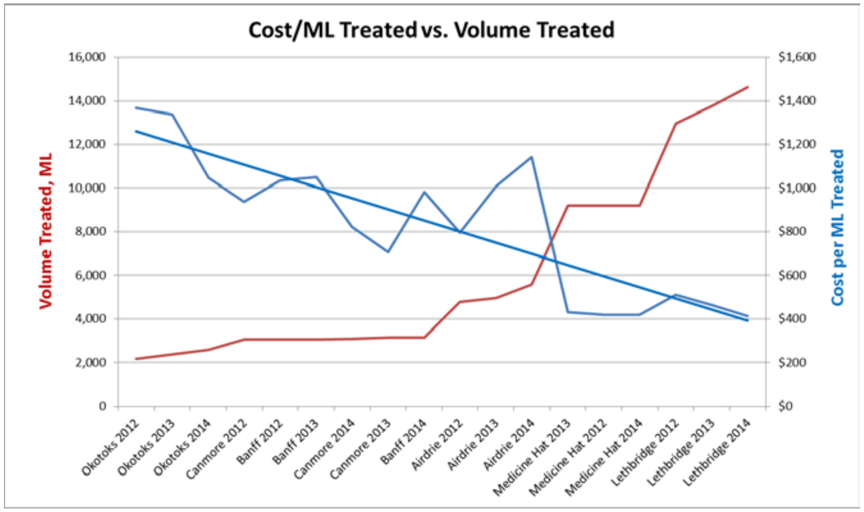
Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Wastewater Treated (ML)	Cost per ML ($)
Airdrie	2012	$3,793,186	$0	$0	$0	$3,793,186	4,776	$794
	2013	$4,998,835	$0	$0	$0	$4,998,835	4,953	$1,009
	2014	$6,362,586	$0	$0	$0	$6,362,586	5,570	$1,142
Banff	2012	$1,624,667	$79,742	$116,757	$1,357,642	$3,178,808	3,072	$1,035
	2013	$1,615,590	$83,195	$155,501	$1,375,958	$3,230,244	3,072	$1,052
	2014	$1,462,145	$90,118	$144,129	$1,403,522	$3,099,914	3,155	$983
Canmore	2012	$1,783,326	$285,062	$377,123	$423,250	$2,868,761	3,063	$937
	2013	$1,375,172	$140,053	$289,458	$419,640	$2,224,323	3,147	$707
	2014	$1,623,126	$158,997	$344,005	$417,045	$2,543,173	3,090	$823
Lethbridge	2012	$4,458,428	$661,804	$546,939	$948,482	$6,615,653	12,961	$510
	2013	$4,506,683	$605,881	$365,539	$880,785	$6,358,889	13,755	$462
	2014	$4,116,314	$571,568	$439,010	$933,067	$6,059,958	14,633	$414
Medicine Hat	2012	$2,557,259	$155,325	$313,137	$829,069	$3,854,789	9,203	$419
	2013	$2,506,074	$158,470	$297,570	$992,799	$3,954,913	9,196	$430
	2014	$2,367,076	$176,307	$310,277	$1,001,922	$3,855,581	9,213	$418
Okotoks	2012	$2,022,814	$234,938	$284,263	$440,994	$2,983,010	2,183	$1,366
	2013	$2,185,719	$255,317	$304,592	$440,994	$3,186,622	2,381	$1,338
	2014	$1,684,655	$279,848	$301,431	$440,994	$2,706,928	2,588	$1,046

2.5.2 Lessons Learned

1. Different technologies of treatment include differing costs.
    - Canmore treatment includes the extra cost for the chemical alum injected into the wastewater flow to remove phosphorus. Canmore uses BAF treatment technology. BAF removes only one nutrient from the wastewater, nitrogen. All others use the BNR technology that removes the nitrogen and the nutrient phosphorus. Canmore chose the BAF technology in order to minimize the footprint of the treatment plant.
    - Banff has the extra cost of a final filtering step needed to meet higher quality standards for treated water released within the national park. This increases operating and amortization costs.

- It was concluded peak capacity of the treatment plant, under or over, may have a larger impact than technology. Capacity data was not collected but it has been recommended for future consideration.

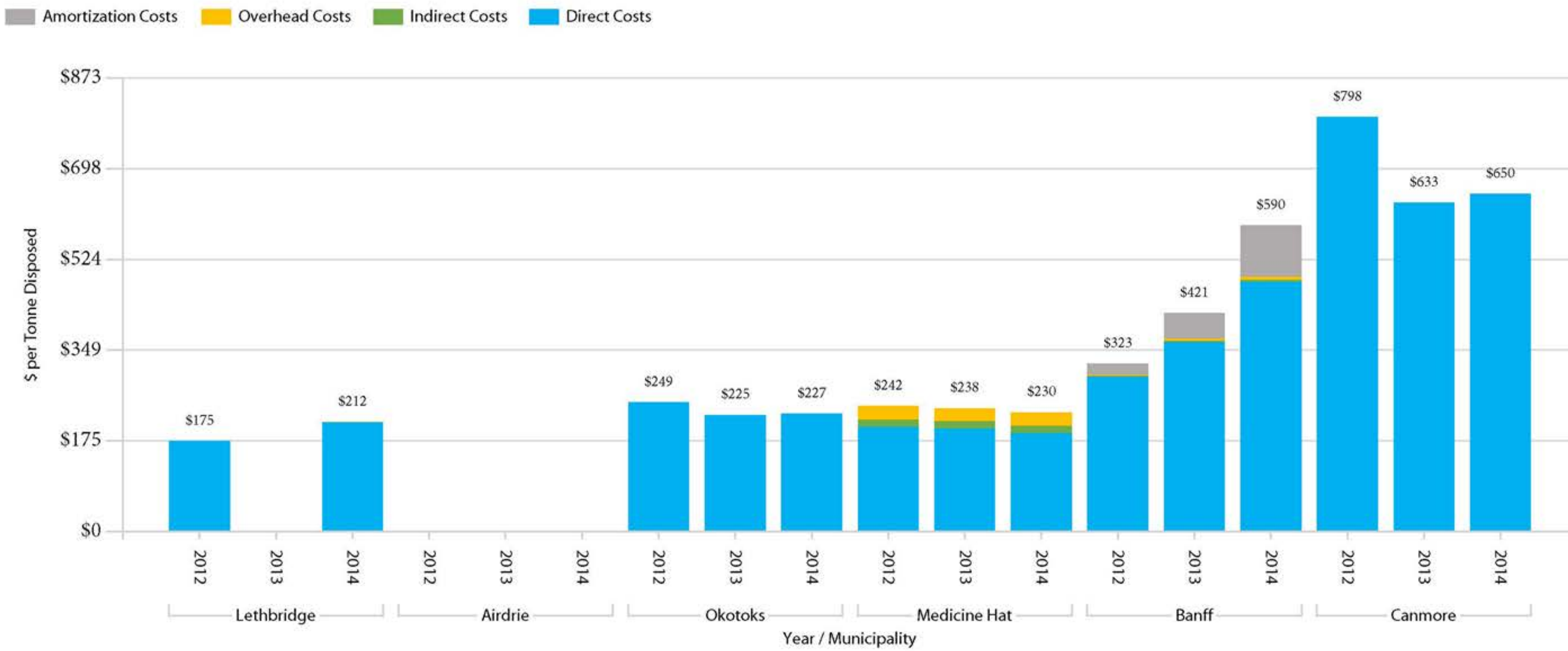
2. Economies of scale appear to affect treatment. As volume treated increases, cost/ML decreases (blue trend line). The high fixed costs of the treatment operation are spread out over larger volumes treated.



3. The concentration level of wastewater influent was not measured but has been recommended a measure for the future.

2.6 Biosolids Processing Cost ($/dry tonnes re-used) – Efficiency

This chart shows the cost of having biosolids removed and transported for processing into re-useable products per dry tonne re-used. The cost per dry tonne is shown by cost type; direct, indirect, overhead and amortization. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.6.1 Biosolids Data (See Section 3 for definitions of each column heading)

Municipality	Year	Direct Costs ($)	Indirect Costs ($)	Overhead Costs ($)	Amortization Costs ($)	Total Costs ($)	Dry Weight Re-used (tonnes)	Cost per Dry Tonne ($)
Airdrie	2012	$0	$0	$0	$0	$0	0	$0
	2013	$0	$0	$0	$0	$0	0	$0
	2014	$0	$0	$0	$0	$0	0	$0
Banff	2012	$282,001	$1,750	$2,562	$19,918	$306,231	948	$323
	2013	$343,092	$2,285	$4,272	$46,308	$395,957	942	$421
	2014	$350,484	$2,616	$4,183	$72,698	$429,981	729	$590
Canmore	2012	$381,678	$0	$0	$0	$381,678	479	$798
	2013	$392,426	$0	$0	$0	$392,426	620	$633
	2014	$356,507	$0	$0	$0	$356,507	548	$650
Lethbridge	2012	$1,222,092	$0	$0	$0	$1,222,092	6,983	$175
	2013	$0	$0	$0	$0	$0	0	$0
	2014	$1,000,460	$52	$40	$0	$1,000,552	4,731	$212
Medicine Hat	2012	$436,781	$28,723	$57,907	$0	$523,411	2,163	$242
	2013	$441,067	$30,290	$56,878	$0	$528,235	2,222	$238
	2014	$416,851	$32,377	$56,980	$0	$506,208	2,204	$230
Okotoks	2012	$240,000	$0	$0	$0	$240,000	964	$249
	2013	$240,000	$0	$0	$0	$240,000	1,068	$225
	2014	$240,000	$0	$0	$0	$240,000	1,056	$227

NOTES:

1. Airdrie purchases treatment in a contract with the City of Calgary. The biosolids component could not be separated out from the total treatment contract cost
2. Banff operates a municipally-owned biosolids processing facility to produce a re-use product, fertilizer that is sold to a world-wide distributor.
3. All other municipalities municipally-owned treatment facilities purchase removal of biosolids by a 3rd party contractor who process them into re-use products

2.6.2 Lessons Learned

1. Distance to the re-use site forms a large part of biosolids costs.
   - Canmore pays to have biosolids hauled 240KM to be processed into re-use products. This results in higher costs at an average of

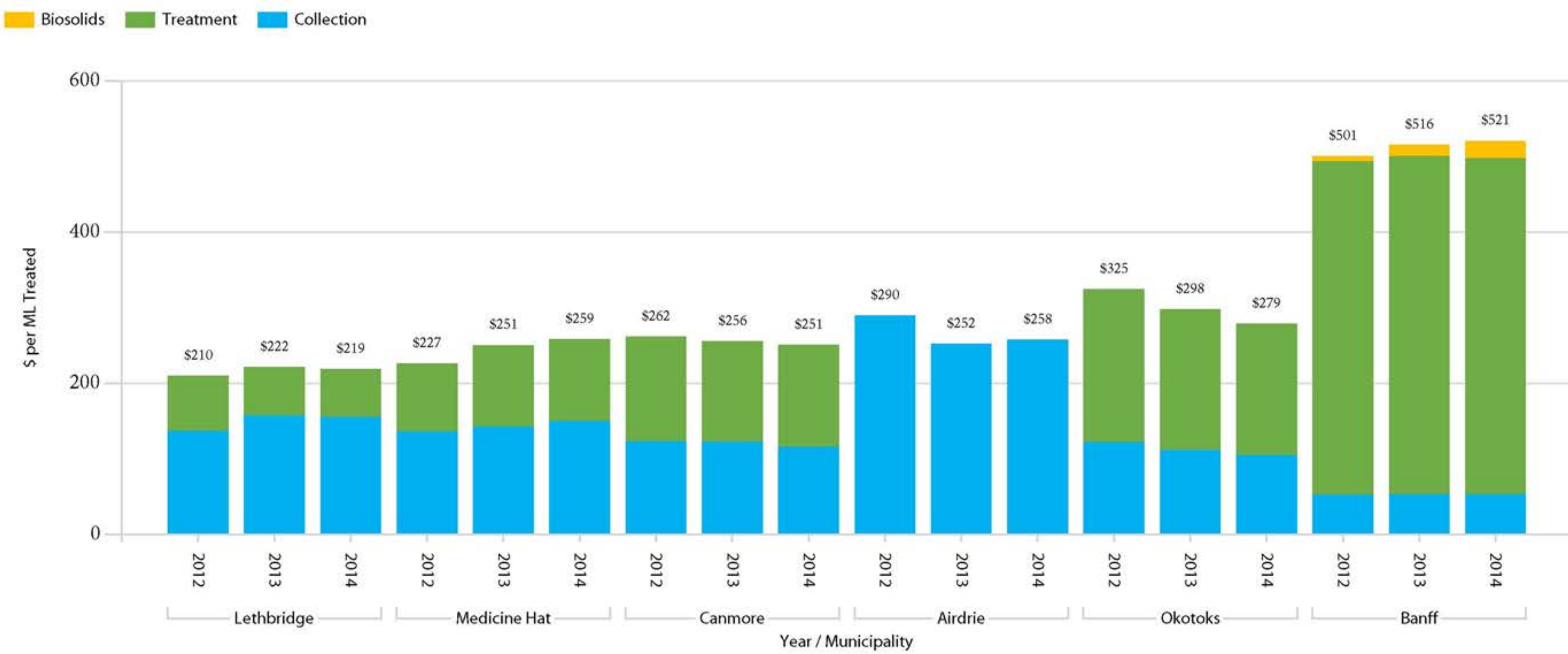
$694/dry tonne due to a combination of technology, haulage and tipping fees.

- The biosolids cost for Lethbridge, Medicine Hat and Okotoks, who pay local 3rd party contractors to take and process biosolids, is an average of $211 /dry tonne.

2. The biggest effect on cost of biosolids processing is distance to the re-use site then followed by the water content of the biosolids being shipped. Canmore ships biosolids with solids content as low as 12%, which results in an average cost of $694/dry tonne. Canmore is currently implementing a dewatering upgrade to increase solids content and reduce shipping costs.

2.7 Amortization Cost – Wastewater Assets ($/ML) – Efficiency

This chart shows the amortization (depreciation) cost of the assets used to deliver the service per ML collected and by process. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.7.1 Amortization – Wastewater Assets, Data (See Section 3 for definitions of each column heading)

Municipality	Year	Collection Amortization Costs ($)	Treatment Amortization Costs ($)	Biosolids Amortization Costs ($)	Total Amortization ($)	Wastewater Collected (ML)	Cost per ML ($)
Airdrie	2012	$1,384,674	$0	$0	$1,384,674	4,776	$290
	2013	$1,249,720	$0	$0	$1,249,720	4,953	$252
	2014	$1,435,530	$0	$0	$1,435,530	5,570	$258
Banff	2012	$160,830	$1,357,642	$19,918	$1,538,390	3,072	$501
	2013	$162,722	$1,375,958	$46,308	$1,584,988	3,072	$516
	2014	$167,489	$1,403,522	$72,698	$1,643,709	3,155	$521
Canmore	2012	$378,555	$423,250	$0	$801,805	3,063	$262
	2013	$385,592	$419,640	$0	$805,232	3,147	$256
	2014	$358,053	$417,045	$0	$775,098	3,090	$251
Lethbridge	2012	$1,774,064	$948,482	$0	$2,722,546	12,961	$210
	2013	$2,170,282	$880,785	$0	$3,051,067	13,755	$222
	2014	$2,275,838	$933,067	$0	$3,208,905	14,633	$219
Medicine Hat	2012	$1,257,581	$829,069	$0	$2,086,650	9,203	$227
	2013	$1,313,046	$992,799	$0	$2,305,845	9,196	$251
	2014	$1,383,109	$1,001,922	$0	$2,385,031	9,213	$259
Okotoks	2012	$266,004	$440,994	$0	$706,998	2,176	$325
	2013	$266,004	$440,994	$0	$706,998	2,372	$298
	2014	$266,004	$440,994	$0	$706,998	2,533	$279

NOTES:

1. Only Banff has in-house processing of biosolids. The processing facility assets add to amortization costs.
2. The Banff treatment plant operates at 50% capacity for almost half the year (winter) due to the seasonal effect of the visitor based commercial sector This dormant capacity adds to amortization costs

2.7.2 Lessons Learned

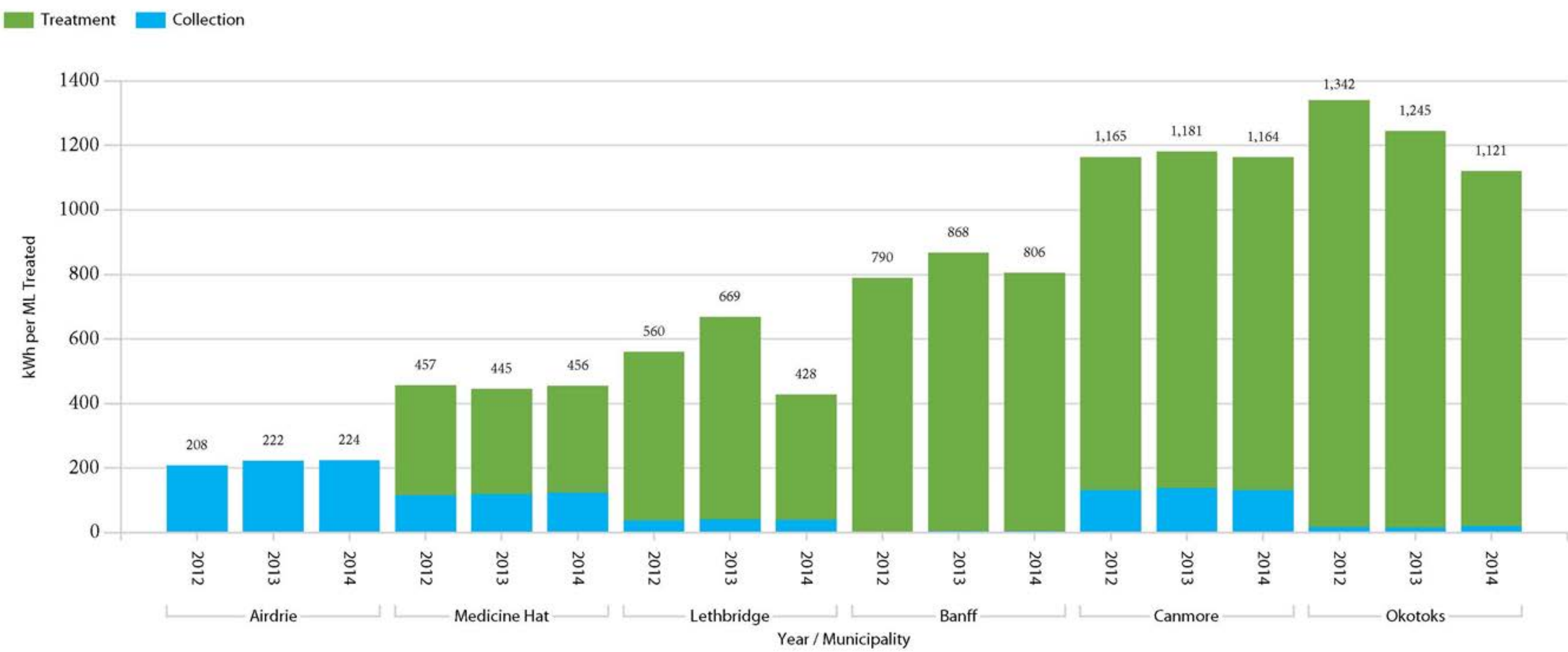
1. Older infrastructure has lower amortization cost but higher costs for repairs and maintenance.
    - Airdrie, with most collection pipe 10 years or less old, has average (2012 – 2014) collection amortization/KM pipe of $5,958, compared to, Banff with the oldest age of pipe at 29 years,

and an average (2012 – 2014) amortization cost of $3,340, about 44% lower than Airdrie.

2. In the communities studied, there is variation in amortization costs
    - The average amortization cost for Airdrie, Canmore, Lethbridge, Medicine Hat and Okotoks is an average of $257/ML with a range of $210/ML to $325/ML.
    - The one outlier is Banff with an average amortization cost of $513/ML. This was accounted for by Banff's treatment plant needing to handle peak visitor capacity and Banff's need to treat to a higher standard than the others. As demonstrated in the chart, Banff's collection amortization is below average, but treatment amortization cost/ML is the average of the others.

2.8 Power Consumed (kWh/ML collected) – Effectiveness

This chart shows the power consumed to operate the wastewater system per ML collected and by process. Power for collection is mostly for pumping wastewater to a treatment plant. Power for treatment is for the operation of the treatment process. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.8.1 Power Consumed, Data (See Section 3 for definitions of each column heading)

Municipality	Year	Power Collection (kWh)	Power Treatment (kWh)	Power Total (kWh)	Wastewater Collected (ML)	Collection (kWh/ML)	Treatment (kWh/ML)	Total (kWh/ML)
Airdrie	2012	994,427	0	994,427	4,776	208	0	208
	2013	1,101,880	0	1,101,880	4,953	222	0	222
	2014	1,248,344	0	1,248,344	5,570	224	0	224
Banff	2012	11,986	2,414,595	2,426,581	3,072	4	786	790
	2013	13,290	2,652,912	2,666,202	3,072	4	864	868
	2014	13,994	2,529,280	2,543,274	3,155	4	802	806
Canmore	2012	404,593	3,163,168	3,567,761	3,063	132	1,033	1,165
	2013	434,552	3,283,472	3,718,024	3,147	138	1,043	1,181
	2014	405,988	3,191,530	3,597,518	3,090	131	1,033	1,164
Lethbridge	2012	497,897	6,757,000	7,254,897	12,961	38	521	560
	2013	561,170	8,637,638	9,198,808	13,755	41	628	669
	2014	578,422	5,682,121	6,260,543	14,633	40	388	428
Medicine Hat	2012	1,072,761	3,136,160	4,208,921	9,203	117	341	457
	2013	1,091,684	3,001,600	4,093,284	9,196	119	326	445
	2014	1,141,540	3,055,040	4,196,580	9,213	124	332	456
Okotoks	2012	37,778	2,881,363	2,919,141	2,176	17	1,324	1,342
	2013	36,059	2,917,902	2,953,961	2,372	15	1,230	1,245
	2014	53,389	2,787,213	2,840,602	2,533	21	1,100	1,121

2.8.2 Lessons Learned

1. Distance from treatment plant affects power consumed. Airdrie pumps their effluent 11KM to Calgary for treatment. Airdrie's power consumed for collection averages 218 kWh/ML. For all others the average is 63 kWh/ML.

2. Topography also affects power consumed. Lethbridge and Medicine Hat have flat topography, on average 19 lift stations and use an average of 80 kWh/ML for collection. Banff and Okotoks have wastewater flowing to a treatment plant at the bottom of a valley. They have an average of 5 lift stations and use an average of 11 kWh/ML for collection.

3. The scale of the facility affects power usage/ML. Banff, Canmore and Okotoks have higher power usage per ML treated due to smaller volumes treated, higher treatment standards for Banff, and requirements for

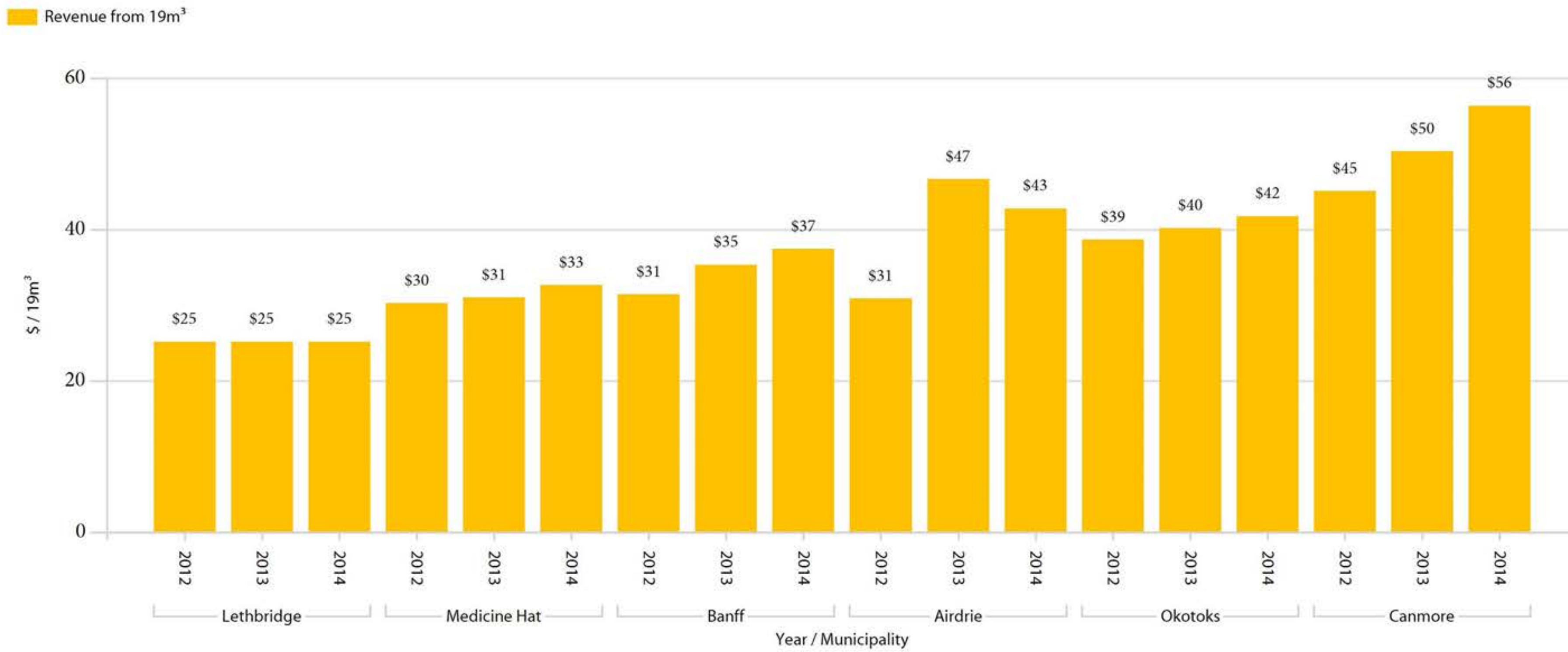
technology such as odour control due the proximity of the treatment plant to the developed area of the municipality.

	Average Treatment Power (kWh/ML)	Average Volume Treated (ML)
Banff, Canmore, Okotoks	1,024	2,853
Lethbridge, Medicine Hat	423	11,494

4. The technology used also affects power usage. Blowers in the treatment process are the largest draw on power, e.g. Banff is upgrading to new blowers and diffusers to reduce power consumption. Another technology effect is that Canmore has a small footprint BAF treatment plant. It has three stories that require extra vertical pumping vs. one story for BNR plants.

2.9 Residential Wastewater Bill ($/19m^3 per month)

This chart shows the bill a residence would receive each month for processing of 19 cubic metres of wastewater, the average amount produced by a residence. The bill is based on a base utility rate plus a consumption rate. Municipalities are in order from lowest to highest cost based on the average of 2012, 2013, 2014 results.



2.9.1 Residential Wastewater Bill, Data (See Section 3 for definitions of each column heading)

Municipality	Year	Base Utility Rate ($/month)	Consumption Utility Rate($ / m^3)	Monthly Residential Wastewater Bill ($/month)
Airdrie	2012	$12.27	$0.98	$30.89
	2013	$13.40	$1.75	$46.65
	2014	$17.36	$1.34	$42.82
Banff	2012	$6.76	$1.30	$31.46
	2013	$9.15	$1.38	$35.37
	2014	$9.71	$1.46	$37.45
Canmore	2012	$24.95	$1.06	$45.09
	2013	$27.95	$1.18	$50.37
	2014	$31.30	$1.32	$56.38
Lethbridge	2012	$7.90	$0.91	$25.19
	2013	$7.90	$0.91	$25.19
	2014	$7.90	$0.91	$25.19
Medicine Hat	2012	$30.27	$0.00	$30.27
	2013	$31.02	$0.00	$31.02
	2014	$32.67	$0.00	$32.67
Okotoks	2012	$6.38	$1.70	$38.68
	2013	$6.60	$1.77	$40.23
	2014	$6.83	$1.84	$41.79

2.10 Wastewater Service Data **(See Section 3 for definitions of each column heading)**

This data consolidates the information about wastewater services for each municipality.

Part 1

Municipality	Year	Wastewater Collected (ML)	Wastewater Treated (ML)	Water Discharged (ML)	Pipe Maintained (KM)	Lift Stations (#)	Biosolids Dry Content (%)	Utility Rate Base ($/month)	Utility Rate Consumption ($/cubic metre)
Airdrie	2012	4,776	4,776	0	224	6	0%	$12.27	$0.98
	2013	4,953	4,953	0	227	6	0%	$13.40	$1.75
	2014	5,570	5,570	0	232	6	0%	$17.36	$1.34
Banff	2012	3,072	3,072	3,095	49	5	20%	$6.76	$1.30
	2013	3,072	3,072	3,134	49	6	20%	$9.15	$1.38
	2014	3,155	3,155	3,290	49	6	19%	$9.71	$1.46
Canmore	2012	3,063	3,063	3,541	97	11	16%	$24.95	$1.06
	2013	3,147	3,147	3,210	97	11	20%	$27.95	$1.18
	2014	3,090	3,090	2,610	97	11	18%	$31.30	$1.32
Lethbridge	2012	12,961	12,961	12,961	489	22	6%	$7.90	$0.91
	2013	13,755	13,755	13,755	499	22	0%	$7.90	$0.91
	2014	14,633	14,633	14,633	502	22	7%	$7.90	$0.91
Medicine Hat	2012	9,203	9,203	8,169	392	16	20%	$30.27	$0.00
	2013	9,196	9,196	8,416	395	16	20%	$31.02	$0.00
	2014	9,213	9,213	8,089	398	16	20%	$32.67	$0.00
Okotoks	2012	2,176	2,183	2,183	118	3	20%	$6.38	$1.70
	2013	2,372	2,381	2,381	119	5	21%	$6.60	$1.77
	2014	2,533	2,588	2,588	124	7	21%	$6.83	$1.84

NOTES:

1. The blocked sewers per year were removed from the service data due the inability get a common definition for a blockage and the small number of annual occurrences.

Part 2

Municipality	Year	Energy Collection (kWh)	Energy Treatment (kWh)	Useful Life Collection Pipe (years)	Avg. Age Collection Pipe (years)	Remaining Life Collection Pipe (years)	Useful Life Treatment (years)	Avg. Age Treatment (years)	Remaining Life Treatment (years)	Lines Flushed (KM)
Airdrie	2012	994,427	0	50	16	34	0	0	0	98
	2013	1,101,880	0	50	17	33	0	0	0	35
	2014	1,248,344	0	50	17	33	0	0	0	100
Banff	2012	11,986	2,414,595	100	48	52	43	10	33	6
	2013	13,290	2,652,912	100	49	51	43	11	32	2
	2014	13,994	2,529,280	100	50	50	43	12	31	4
Canmore	2012	404,593	3,163,168	50	21	29	25	15	10	44
	2013	434,552	3,283,472	50	22	28	25	16	9	60
	2014	405,988	3,191,530	50	23	27	25	17	8	48
Lethbridge	2012	497,897	6,757,000	38	30	8	24	25	0	46
	2013	561,170	8,637,638	38	31	7	25	26	0	17
	2014	578,422	5,682,121	38	32	6	25	27	0	46
Medicine Hat	2012	1,072,761	3,136,160	46	40	6	45	35	10	68
	2013	1,091,684	3,001,600	46	41	5	45	36	9	54
	2014	1,141,540	3,055,040	46	42	4	45	37	8	44
Okotoks	2012	37,778	2,881,363	75	17	58	45	17	28	10
	2013	36,059	2,917,902	75	18	57	45	18	27	12
	2014	53,389	2,787,213	75	19	56	45	19	26	12

NOTES:

1. The Lethbridge treatment plant has a co-generation facility that can generate power from digester gas (methane) or from natural gas. The two CAT engines were out of service in 2013 to be overhauled. This resulted in more power purchased from the grid than the adjacent years when they were operational.

2. Infrastructure Age. For collection, the average age includes pipe maintained only; excludes other infrastructure such as lift stations. Treatment includes all assets.

3. Remaining Life is the difference between Useful Life and Average Age of the assets.

	Flushed per KM Pipe
LBG	7%
BNF	8%
OKT	9%
MHT	14%
ARD	34%
CMR	52%

2.10.1 Lessons Learned

1. There is a wide variation in the Lines Flushed as a % of length of collection pipe maintained. This chart is based on the three year average KM of pipe maintained and the three year average KM of pipe flushed.
    - Lethbridge is lowest at 7% because they only flush "hot spots" during pipe maintenance.
    - Canmore is highest at 52% because, in addition to regular pipe maintenance flushing, they have been conducting an Infiltration & Inflow study over the last few years that required flushing before camera work. Infiltration & Inflow is the volume of ground water that enters the collection pipe through cracks, which adds to the total volume to be treated.

Part 3 Water Quality (released to a natural water course)

Municipality	Year	Total Phosphorous (mg / L)	Ammonia (mg / L)	TSS (mg / L)	CBODs (mg / L)	Fecal Coliforms (CFU / 100ml)
	Provincial Limit Parks Canada Target	≤ 0.50 ≤ 0.15	≤ 10 ≤ 5	≤ 15 ≤ 5	≤ 20 ≤ 20	≤ 200 ≤ 20
Airdrie	2012	0.00	0.00	0.00	0	0
	2013	0.00	0.00	0.00	0	0
	2014	0.00	0.00	0.00	0	0
Banff	2012	0.22	0.28	2.40	2	10
	2013	0.44	1.16	3.30	3	10
	2014	0.11	0.50	2.50	2	10
Canmore	2012	0.45	3.70	6.50	7	1
	2013	0.49	4.40	7.90	7	94
	2014	0.53	4.20	7.60	8	166
Lethbridge	2012	0.31	0.60	4.00	2	18
	2013	0.51	0.90	8.00	3	23
	2014	0.39	0.90	7.00	3	28
Medicine Hat	2012	0.72	2.85	11.00	3	13
	2013	0.71	4.01	12.00	3	13
	2014	0.49	3.71	12.00	3	21
Okotoks	2012	0.14	0.55	2.52	2	13
	2013	0.15	0.69	2.86	2	16
	2014	0.13	0.71	2.70	2	13

NOTES:

1. Municipal treatment plants are operated to do the best treatment possible at all times. This means the plants often have results exceeding provincial standards. Exceeding the standards leaves a buffer when wastewater conditions change unexpectedly. This avoids violations of the standards.
2. The City of Airdrie does not treat wastewater and therefore does not report on this measure.

2.11 Lessons Learned, General

1. **Influent quality (concentration) to the WWTP**
   In the future, collect data to report on the influent quality at entry to the treatment plant. This would allow comparisons of amount (cost) of treatment across a variety of levels of concentration to meet Provincial standards. Influent with weak concentration may result from low population density and dilution from infiltration.
   - Does higher concentration influent (high solids, pathogens) require more treatment and increase cost?
   - Does higher concentration influent result from higher population density?

2. **Treatment Plant Capacity**
   Capacity data could be collected to determine the effect of under vs. over capacity on cost and effectiveness of treatment.

3. **Utility Rate Revenue**
   - Compare total revenue (residential + commercial/industrial) to the total cost for the wastewater service.
   - Review financing/reserve balances as percentage of annual budget or asset value.

4. **Topography**
   Currently there is no easy way to measure topography for benchmarking application. A few municipalities, e.g. Banff, Canmore and Okotoks have a treatment plant at the bottom of a valley. That means they have the advantage of gravity feed lowers collection pumping costs.

5. **Size of the collection system vs. cost/ML**
   Collect data on the distance from the furthest customer tie-in to the treatment plant.

6. **Temperature of influent entering treatment plant vs. cost/ML**
   Collect data to determine how variations in temperature lead to operational changes that affect costs. It was agreed that to minimize treatment changes and costs temperature of effluent should be consistent.

7. **Variations in flow of influent entering treatment plant vs. cost/ML**

Collect data to determine how variations in flow rates lead to operational changes that affect costs, e.g. Canmore/Banff have seasonal/weekly volume increases

from visitor populations and weather events (rain storms) can suddenly increase effluent flow due to infiltration of storm water into the pipes in the collection system. . It was agreed that to minimize treatment changes and costs flow of effluent should be consistent.

8. **Residential to non-residential split.**
   It may be useful to compare the percentage of municipal systems that service residential vs. non-residential properties in an effort to better understand the impact of residential growth on wastewater costs.

9. **Population density.**
   It may be useful to compare wastewater treatment costs to population density to better understand the impacts of compact communities.

Database Manual, Wastewater

Alberta Municipal Benchmarking Initiative

3 Database Manual, Wastewater

3.1 Municipal Wastewater Systems

Typical municipal wastewater systems consist of collection and treatment systems. The collection system utilizes a network of sanitary sewer pipe and lift (pump) stations to convey the sewage from municipal residents and businesses to a wastewater treatment plant (WWTP).

Wastewater treatment processes are designed to achieve improvements in the quality of the WWTP effluent prior to being discharged into a receiving body of water. The WWTPs described in this report are required, through an Approval to Operate, to provide treatment that meets the Alberta provincial standard. For municipalities in National Parks, such as the Town of Banff, the requirement is to meet a more stringent standard; Parks Canada Leadership Target.

Wastewater Composition

The various treatment processes may reduce;

- **Suspended Solids**, which are physical particles that settle under gravity and have the potential to clog bodies of water.
- **Biodegradable Organics** that are a potential source of "food" for microorganisms, which, when combined with the oxygen in the water, enables them to flourish and multiply. That demand for oxygen by the microorganisms thriving from the biological organics directly competes with the resident fish species' requirement for oxygen. Organic pollution can create dead zones where fish struggle to survive.
- **Pathogenic Bacteria**, which are disease-causing organisms and are of particular concern when the receiving body of water is used for drinking by other municipalities.
- **Nutrients**, which typically refers to nitrates and phosphates. These nutrients can lead to high concentrations of algae, which, in turn, lead to increased biodegradable organic loading.

Treatment

The WWTP's process entails three levels of treatment; primary, secondary and tertiary.

- **Primary (mechanical)** is designed to remove large, floating or suspended solids from raw sewage. It includes screening to remove solid objects and sedimentation by gravity. Sometimes chemicals can be used to accelerate the sedimentation process.

- **Secondary (biological)** further removes dissolved organic matter. Microbes, through biological activity, consume the organic matter as food and convert it to CO_2, water and energy for their own survival. This is followed by secondary sedimentation in settling tanks.

- **Tertiary** treatment provides enhanced treatment prior to discharge of the water component into a receiving body of water. This can be achieved by employing a number of different technologies or processes; biological nutrient removal (BNR), biological aerated filters (BAF), filtration and disinfection either through treatments such as ultraviolet (UV) exposure, chlorination or ozone.

Disposal

Biosolids that have been removed from the collected wastewater by various treatment processes in the WWTPs are typically further processed, either in-house or contracted out, to create a beneficial re-use product such as compost or a registered fertilizer, e.g. Banff N-Rich® fertilizer.

3.2 Data Definitions - Costs

All costs for Benchmarking are OPERATING COSTS ONLY. Capital costs are not to be included.

3.2.1 Collection Direct Costs ($/year)

All operating direct costs involved in the activities to collect wastewater in the sanitary pipe system and pump it to a treatment plant.

Includes costs to;

1. Pump wastewater from collection points through lift stations to the treatment plant
2. Inspect collection pipe and lift stations
3. Repairs and Maintenance of collection pipe and lift stations
4. Disposal, e.g. Grit and of the solids from cleaning lift stations

If treatment is purchased, for collection

Include costs to;

1. Pre-Treat wastewater to 3rd party requirements for treatment

Examples of direct operating costs for these activities are;

1. Materials used
2. Labour wages and benefits, and compulsory training for certified operators, including first-aid
3. Testing and reporting of water quality to the Province
4. Power; electrical
5. Energy; natural gas
6. Inspections and testing of equipment and buildings
7. Repairs and maintenance, e.g. parts and labour
8. 3rd party contract costs, e.g. specialized repairs, wastewater quality testing/reporting
9. Utility funded debt interest associated with wastewater collection asset capital improvements

3.2.2 Treatment Direct Costs ($/year)

All operating direct costs involved in the activities to treat wastewater to Provincial standards, or the contract cost to purchase treatment.

If you operate a Treatment Plant

Includes costs to;

1. Pre-Treat wastewater
2. Primary Treat wastewater
3. Pump wastewater within the Treatment Facility
4. Repairs and Maintenance of treatment facilities
5. Test wastewater for quality within the Treatment Facility
6. Handling and Disposal of grit

If treatment is purchased

Includes costs to;

1. Purchase treatment at the contract cost from a 3rd party supplier.

Excludes;

1. Maintenance of wastewater meters; 100% of this cost is applied to Drinking Water Supply recognizing one meter may be used to measure both water and wastewater volumes

Examples of direct operating costs for these activities are;

1. Materials used
2. Labour wages and benefits, and compulsory training for certified operators, including first-aid
3. Power; electrical
4. Energy; natural gas
5. Inspections and testing of equipment and buildings
6. Repairs and maintenance equipment and buildings, e.g. parts and labour
7. 3rd party contract costs, e.g. Treatment cost, specialized repairs
8. Utility funded debt interest associated with wastewater treatment asset capital improvements

3.2.3 Biosolids Handling Cost ($/year)

All operating direct costs involved in the activities to dispose of biosolids.

Includes costs to;

1. Dewater wet biosolids
2. Test biosolids
3. Transport biosolids

3.2.4 Biosolids Disposal Cost ($/year)

All operating direct costs involved in disposal of biosolids. Includes costs to;

1. Composting costs at municipally owned facility
2. Cost to have a 3rd party accept biosolids

3.2.5 Indirect Costs ($/year)

All operating costs involved in the activities to support wastewater collection, treatment and biosolids disposal. Includes costs to;

1. Administer customer accounts (meter reading, billing, and set-up of new accounts)
2. Design and Deliver wastewater public education programs
3. Manage the wastewater system operations, e.g. salaries/office operation costs for managers (may be a portion of the total cost, e.g. a public works manager who is responsible for both water and wastewater)

4. Training soft-skills (if not covered by HR budget) and other wastewater related training not separable between collection, treatment and disposal
5. Memberships not separable between collection, treatment and disposal
6. Planning, e.g. Utility Master Plans
7. Utility funded debt interest associated with asset capital improvements not separable between collection, treatment and disposal (applies to all)

Total indirect costs will be prorated (allocated) separately, in the Database, to collection, treatment and disposal separately based on the percentage the Direct Cost each represents of total Direct Costs of the wastewater system.

3.2.6 Amortization Costs – Collection Assets ($/year)

Amortization costs for collection capital assets.

Includes

1. Collection pipe, including force mains, maintained
2. Lift stations

3.2.7 Amortization Costs – Treatment Assets ($/year)

Amortization costs for treatment capital assets. If treatment services are purchased, amortization cost of lift station and pipeline to external treatment plant, if owned.

Includes

1. Treatment plant

3.2.8 Amortization Costs – Biosolids Disposal Assets ($/year)

Amortization costs for biosolids handling and disposal capital assets.

Includes

1. Assets to convert of biosolids into a usable product

3.2.9 Overhead Costs ($/year)

Overhead costs are all operating costs of activities necessary for the continued functioning of the municipality but not directly associated with the services being offered.
Includes
Costs, e.g. human resources, IT, security, engineering, planning, financial services, Council, Administration, tax funded debt interest.

NOTES:

1. Total Overhead Costs will be allocated to each Service Area using a calculation in the database. The calculation includes these factors; for Fleet – number and value of vehicles, for Facilities – area, sq. ft., and for All Other Overhead – Service Area Total Cost and number of FTEs.

2. Overhead allocation for the Wastewater Service Area will then be prorated (allocated) separately to the collection, treatment and disposal systems in the database based on the percentage the Direct Cost each represents of total Direct Costs of the Wastewater System.

3.2.10 Out of Scope Costs ($/year)

Out of Scope Costs are all operating costs for activities in the wastewater system not already captured collection, treatment and biosolids disposal system.

Includes

1. Storm water systems
2. Capital for infrastructure development/replacement

The total of these costs will be used by Finance to ensure all operating costs for the wastewater system are accounted for as recorded in the municipality's Annual Financial Statements.

3.3 Data Definitions - Service

3.3.1 Collected Volume (ML/year)

Volume, in ML, of wastewater collected.

3.3.2 Treated Volume (ML/year)

Volume, in ML, of wastewater collected. When wastewater treatment is purchased from a 3rd party, include the volume collected as the volume treated (the volume sent to the 3rd party for treatment).

3.3.3 Treated Water Discharged (ML/year)

Volume, in ML, of water discharged.

3.3.4 Collection Pipe (KM)

Length, in KM, of all maintained pipe used to collect wastewater.

Includes

1. Length of all connecting mains/pipes

Excludes

1. Length of pipe in the municipal Right-of-Way, e.g. service pipe from the customer property line to mains
2. Length of service connections from the customer's property line to dwelling

3.3.5 Lift Stations

Number of lift stations needed to pump wastewater to the treatment facility.

3.3.6 Biosolids, Dry Solids Content (%)

Percentage of dry solids waste in the wet biosolids produced.

Process/Calculation

1. Wet weight of biosolids sample
2. Dry weight of biosolids sample; sample dried at 103C to 105C to eliminate all moisture
3. Percentage of dry biosolids = Dry weight ÷ Wet weight X 100%

3.3.7 Biosolids Disposed, Dry Weight (Tonnes)

Dry weight of Biosolids Disposed = wet weight of biosolids produced from the treatment system (for conversion to usable product) X percentage of dry biosolids.

3.3.8 Energy Consumed – Collection (kWh)

Power (electrical) consumed by the collection of wastewater from all customers.

3.3.9 Energy Consumed – Treatment (kWh)

Power (electrical) consumed by the treatment and disposal of wastewater collected from all customers.

3.3.10 Infrastructure Age – Collection (years)

Average age of the collection pipe maintained only included in the entire wastewater system; based on the year of installation and excludes other assets such as lift stations.

3.3.11 Infrastructure Age – Treatment (years)

Average age of the treatment plant and biosolids assets included in the wastewater system, based on the year of installation.

3.3.12 Useful Life – Collection Pipe (years)

Useful life, for amortization purposes, assigned to the collection pipe maintained only in the entire wastewater system.

3.3.13 Useful Life – Treatment Plants (years)

Useful life, for amortization purposes, assigned to the treatment plant assets.

3.3.14 Lines Flushed (KM)

Length, in KM, of collection pipe lines flushed per year.

3.3.15 Area of Facilities (sq. ft.)

Direct

The total area of the facilities used by the Wastewater Department, e.g. Treatment Plant and associated buildings (owned and maintained by the municipality) floor space area + office space dedicated to wastewater.

Indirect

The total area of the facilities used by the indirect support to the Wastewater Department, e.g. office space dedicated to indirect wastewater people.

3.4 Benchmark Performance Measures (PM) Calculations

All calculations are made in the database system based on finalized data input from municipalities.

Efficiency

1. Total Wastewater System Cost – 1 ($/ML)

$$\frac{Collection\ Total\ Cost + Treatment\ Total\ Cost\ + Disposal\ Total\ Cost}{ML\ of\ Wastewater\ Treated}$$

2. Total Wastewater System Cost – 2 ($/ML)

$$\frac{Total\ Direct\ Costs + Total\ Indiect\ Costs\ + Total\ Allocated\ Overhead\ Cost + Total\ Amorization\ Costs}{ML\ of\ Wastewater\ Treated}$$

3. Collection Total Cost ($/KM pipe maintained)

$$\frac{Collection\ Direct\ Costs\ + Prorated\ Indirect\ Costs + Prorated\ Overhead\ Costs + Amortization\ of\ Collection\ Assets}{KM\ of\ Collection\ Pipe\ Maintained}$$

4. Treatment Total Cost ($/ML)

$$\frac{Treatment\ Direct\ Costs + Prorated\ Indirect\ Costs + Prorated\ Overhead\ Costs + Amortization\ of\ Treatment\ Assets}{ML\ of\ Wastewater\ Treated}$$

5. Biosolids Cost Total Cost ($/dry tonne re-used)

$$\frac{Handling\ Direct\ Costs + Disposal\ Direct\ Costs + Prorated\ Indirect\ Costs + Prorated\ Overhead\ Costs + \ Amortization\ of\ Disposal\ Assets}{Dry\ Tonnes\ of\ Biosolids\ Re - used}$$

6. Amortization – Wastewater Assets ($/ML)

$$\frac{Amortization\ of\ Collection\ Assets + Amortization\ of\ Treatment\ Assets + Amortization\ of\ Biosolids\ Assets}{ML\ of\ Wastewater\ Collected}$$

7. Residential Wastewater Bill (for 19 m^3/month)

$$\frac{(Base\ cost\ per\ month + Concumption\ cost\ for\ 19\ m3)}{Month}$$

Effectiveness

8. Power Consumed (kWh/ML)

$$\frac{Power\ Consumed\ for\ Collection + \ Power\ Consumed\ for\ Treatment}{ML\ of\ Wastewater\ Treated}$$