



Comparison of Recycling Depot Costs

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1 Introduction

Measuring program costs and effectiveness is fundamental to making informed decisions related to program changes, investments, and transition planning. In the Fall of 2019, CIF consultants conducted a review of blue box depot operations in Ontario municipalities that operate depots as their primary method of collecting Blue Box recyclable materials. The purpose of the assessment was to undertake an analysis of the costs to operate and maintain municipal blue box recycling services in a depot environment. This document provides a summary of the analysis, including labour, operating, maintenance and capital costs.

2 Sampled Municipalities

Depot costs reported through the annual Resource Productivity and Recovery Authority (RPRA) datacall process vary significantly. This variance is, in part, due the broad range of depot operations across Ontario and the under-reporting of actual depot operating costs. In this study, depot costs from six different depot-based municipalities representing the most common types of depot set ups were examined in detail to identify predictive full operating costs for similar operations in Ontario. The populations for the municipalities ranged from about 700 people to 5,000. The types of collection systems examined included:

- 8 cubic yard overhead bins;
- 40 cubic yard open and closed top roll off bins;
- 50 cubic yard open top roll off bins; and
- compactor bins.

The collection systems using eight-yard bins are typically found on ground level sites and are serviced by Front End Loader (FEL) trucks. These ground level depots also use twenty yard roll off bins, with or without separate compartments, as a common alternative. Larger roll off bins (such as 40 or 50 yard bins) are almost exclusively used in 'sawtooth' set ups because the height of the side wall makes it difficult for residents to access from the ground. Compactors are typically found at sites servicing higher volumes of material (i.e., > 500 tonnes/year).

Table 1 provides a summary of the characteristics of the municipalities sampled. A municipality code indicating the system's primary bin type has been used in place of the municipality's name. The depot costs are reviewed in Section 3. Section 3.1 provides an overview of the costs for the sampled municipality as a whole. Section 3.2 to 3.4 breakout the labour, operating and maintenance, and capital costs for the individual depot sites.

Table 1: Summary of Depot Characteristics

Municipality Code	Number of Depot Sites Sampled	Type and Number Collection Bins Used	Waste Streams	Annual Tonnes
A-8YD*	6 Depots (of 16)	<ul style="list-style-type: none"> • 43 Fibres 8 YD Front End Load bins • 40 Containers 8 YD Front End Load bins • 1 Fibres Compactor 	2	743
B-8YD	5 Depots (of 5)	<ul style="list-style-type: none"> • 29 Cardboard 8 YD Front End load bins • 22 Commingle 8 YD Front End load bins 	2	146
C-40YD	5 Depots (of 5)	<ul style="list-style-type: none"> • 6 Fibres 40 YD roll-off • 7 Containers 40 YD roll-off • 1 Fibres 20 YD roll-off • 1 Fibres compactor • 1 Container compactor • 2 Fibres / Containers Split Bin 	2	332
D-40YD	1 Depot (of 1)	<ul style="list-style-type: none"> • 3 open-top 40 YD roll off containers (1 active plus 2 spares) 	1	74
E-40YD_COM	7 Depots (of 7)	<ul style="list-style-type: none"> • 14 40-yard roll off bins (1 for fibres and 1 for containers at each location) • 8 compactors 	2	464
F-50YD	5 Depots (of 5)	<ul style="list-style-type: none"> • 5 Fibres 50 YD Roll off • 5 Containers 50 YD Roll off • 1 Fibres 40 YD Compactor Bin • 1 Containers 40 YD Compactor Bin • 1 Fibres Stationary Compactor • 1 Containers Stationary Compactor 	2	429

* YD = Cubic Yard

3 Review of Depot Costs

3.1 Overview

Table 2 below provides a summary of the aggregated depot costs for each municipality sampled. Note that haulage costs are not included in this analysis because they can vary significantly depending on the distance to the processing or transfer site. The costs are provided on a per tonne and a per household basis (the households include seasonal households). As the subsequent sections will show, costs for specific depots vary considerably. Not surprisingly, tonnage managed is a key driver of costs because of the ability to amortize fixed overhead and capital costs more effectively over greater tonnages. Based on the cost analysis, the approximate total annual cost by collection system (represented by bin type commonly used) are:

- 8 Cubic Yard - \$674/tonne
- 40 Cubic Yard - \$850/tonne
- 40 Cubic Yard with compactors - \$462/tonne
- 50 Cubic Yard - \$540/tonne

Table 2: Depot Cost Summary

Municipality Code	Labour		O&M		Capital		Total Annual	
	Per Tonne	Per H. Hold	Per Tonne	Per H. Hold	Per Tonne	Per H. Hold	Per Tonne	Per H. Hold
A-8YD	\$263	NA	\$114	NA	\$38*	NA	\$415*	NA
B-8YD	\$254	\$14	\$30	\$2	\$389	\$22	\$674	\$38
C-40YD	\$310	\$30	\$205	\$20	\$302	\$29	\$816	\$78
D-40YD	\$350	\$35	\$34	\$3	\$496	\$50	\$880	\$89
E-40YD_COM	\$106	\$10	\$232	\$21	\$124	\$11	\$462	\$43
F-50YD	\$371	\$38	\$59	\$6	\$111	\$11	\$540	\$56

* Capital costs for this municipality consist of amortized replacement cost of bins only. Other capital costs were unavailable.

The following figures present the various on-site depot cost components (i.e., labour, O&M, capital and total) plotted against the number of households serviced for each municipality sampled¹. The general trend is that the 'per household' cost decreases for each cost category as the number of households served increases, although the range varies. The exception to this was the total O&M costs, which increased proportionally per household as the number of households increased. There are many factors that may influence the cost per household of the depot, including:

- The number of staff on site;
- Hours of operation;
- Size of the site and the amount of area required to be maintained;
- Whether a site is a stand-alone recycling depot or part of a larger waste management site (e.g., landfill site);
- Age of the site;

¹ The number of households serviced for Municipality A-4YD is not available. Costs were obtained for six of the municipal depots, which is not all of the depots operated by the municipality. Estimates for households served by individual depot locations are not available.

- The number and type of structures (e.g., depot attendant booth or office, etc) or roadway surface (e.g., paved or gravel); etc.

The effects of these considerations on costs have not been explored as part of this study.

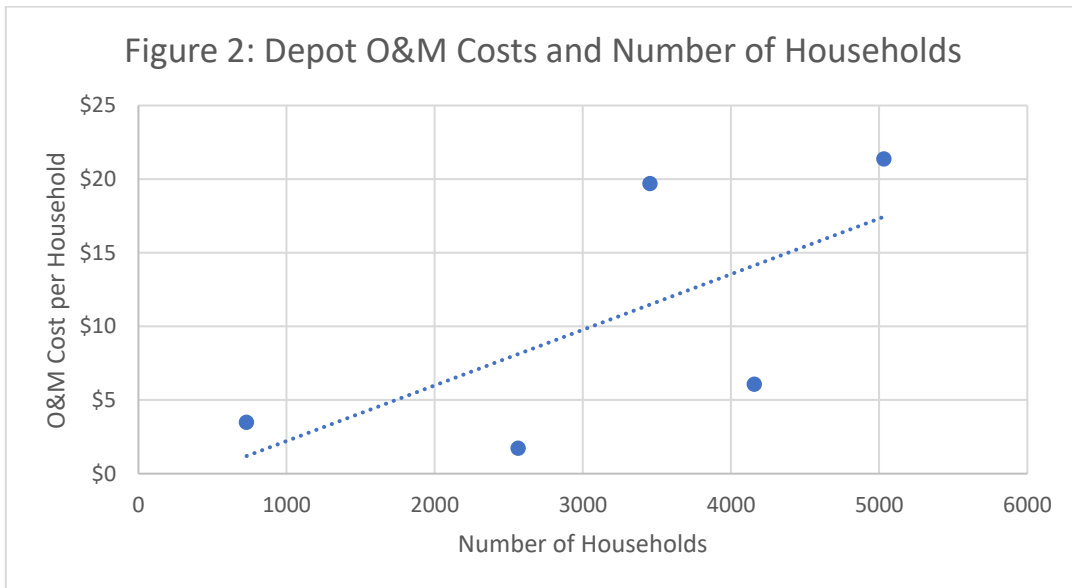
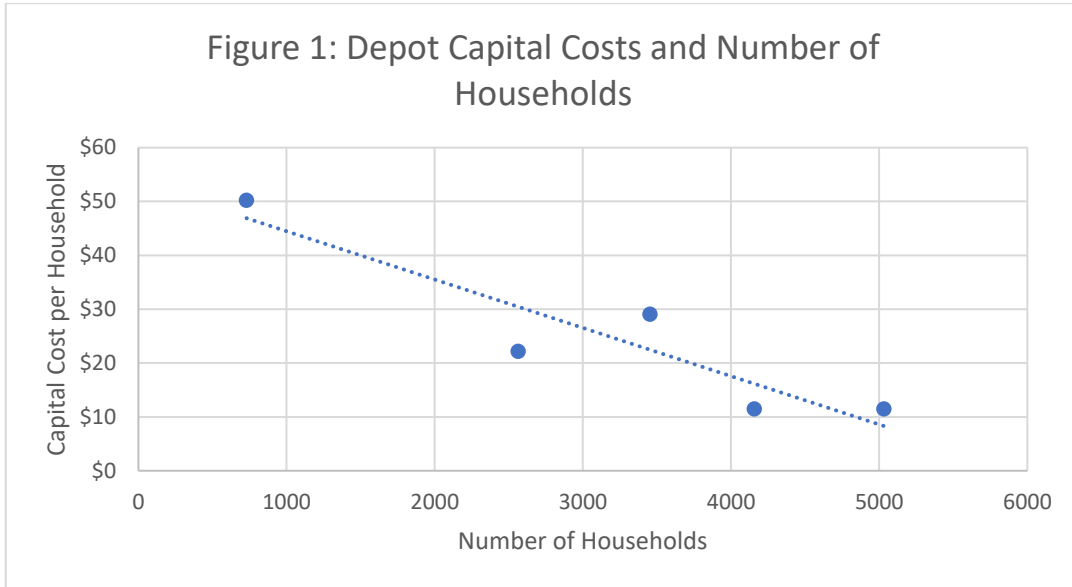


Figure 3: Depot Labour Costs and Number of Households

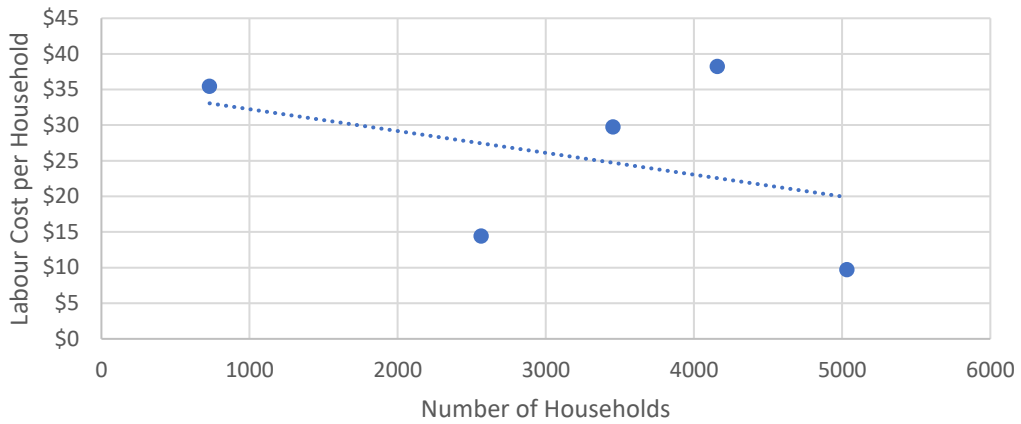


Figure 4: Total Depot Cost and Number of Households

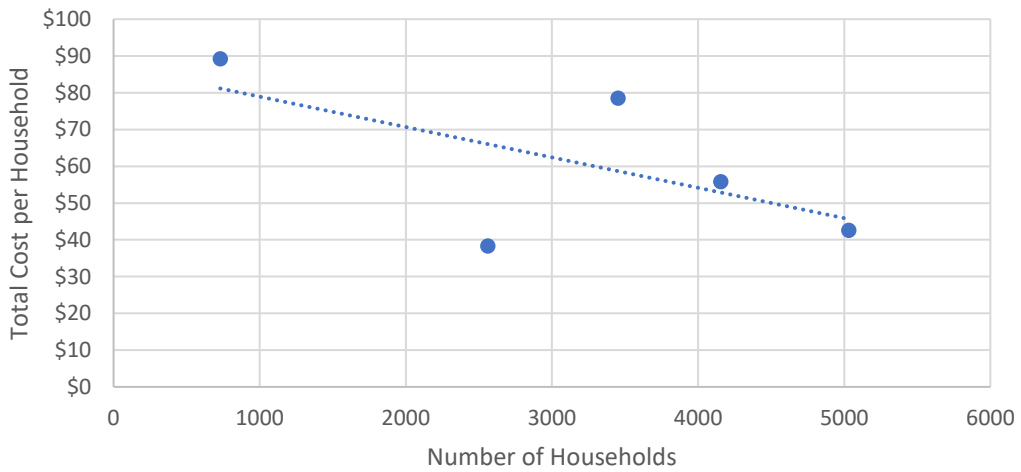
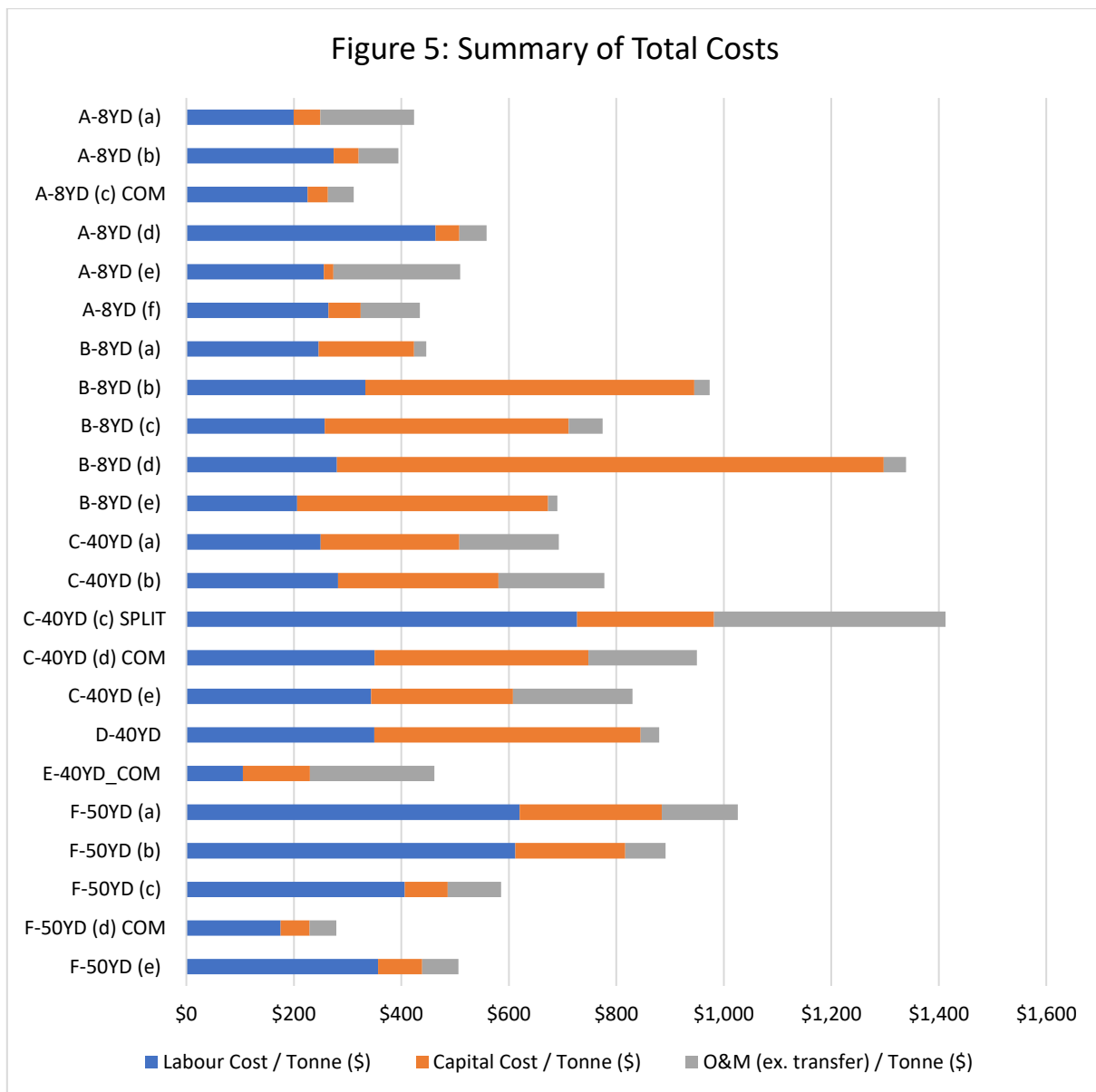


Figure 5 provides a summary of the total costs per tonne for each individual depot location. Key observations include:

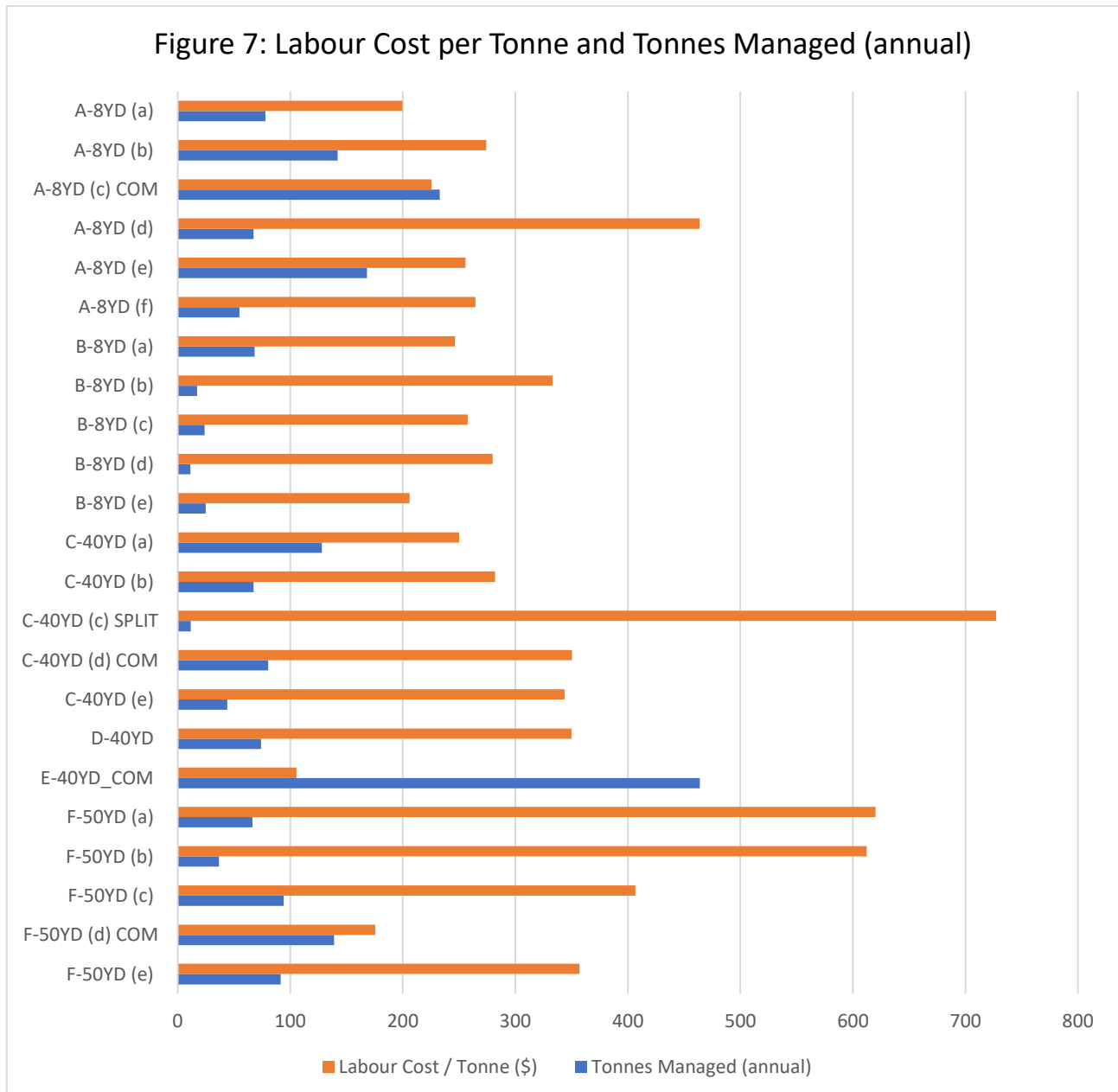
- The costs range from \$279 per tonne to \$1,413 per tonne, with an average of \$702 per tonne.
- As observed in the Datacall, there is a wide fluctuation in costs per tonne, even among depots using similar types of collection bins.
- Sites with higher tonnage that use compactors and/or overhead compactor bins seem to be able to operate at a lower cost per tonne.
- While the capital costs that were available for Municipality A-8YD have been included in this chart, they account only for replacement cost of bins and do not represent the full capital cost of the depot set-up.



3.2 Labour Costs

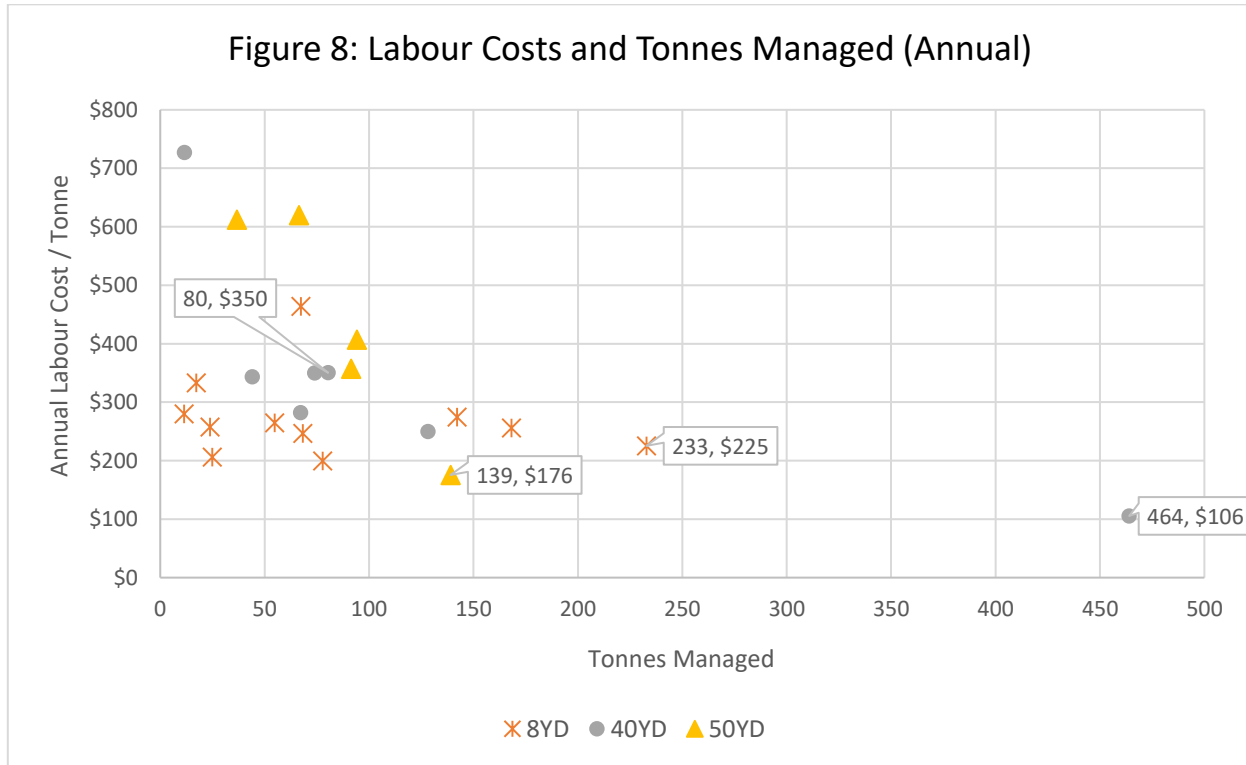
The average annual labour cost was \$330 per tonne, although this varied significantly across the sites. The site costs ranged from a low of \$106 per tonne up to \$727 per tonne. However, most costs were generally below \$407 per tonne. Comments on the cost anomalies include:

- The cost of \$727 for the Site “C-40YD (c) SPLIT” is significantly larger than the costs for other locations within this municipality. This may be due, however, to the low tonnage received at the site compared to the others.
- Similarly, site “A-8YD (d)” and sites (a) and (b) for municipality “F-50YD” each have relatively lower tonnage compared to other sites for that municipality, which may have driven the cost per tonne up.



The figure below presents the annual per tonne labour costs for bin types on the same graph. Sites using compactors are indicated by the use of callouts. The graph clearly depicts the trend of decreasing per tonne labour costs as tonnage increases. Based on the graph, reasonably achievable per tonne labour costs, in general, can be divided into two tonnage-based ranges, regardless of system types:

- 100 tonnes per year or less: ceiling of \$400 per tonne.
- 100 tonnes per year or more: ceiling of \$300 per tonne.



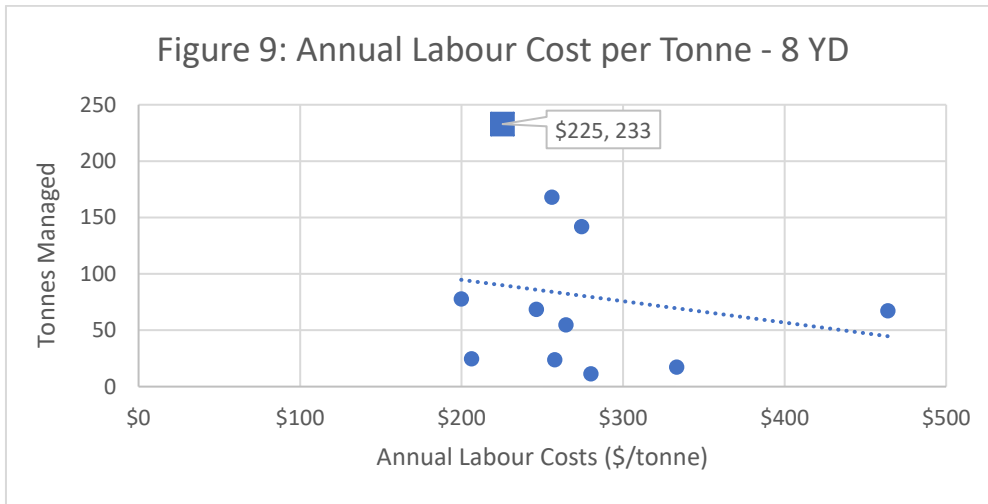
* The marker with callout indicates use of a compactor at that site.

When labour costs relative to collection systems are considered, the following observations are noted:

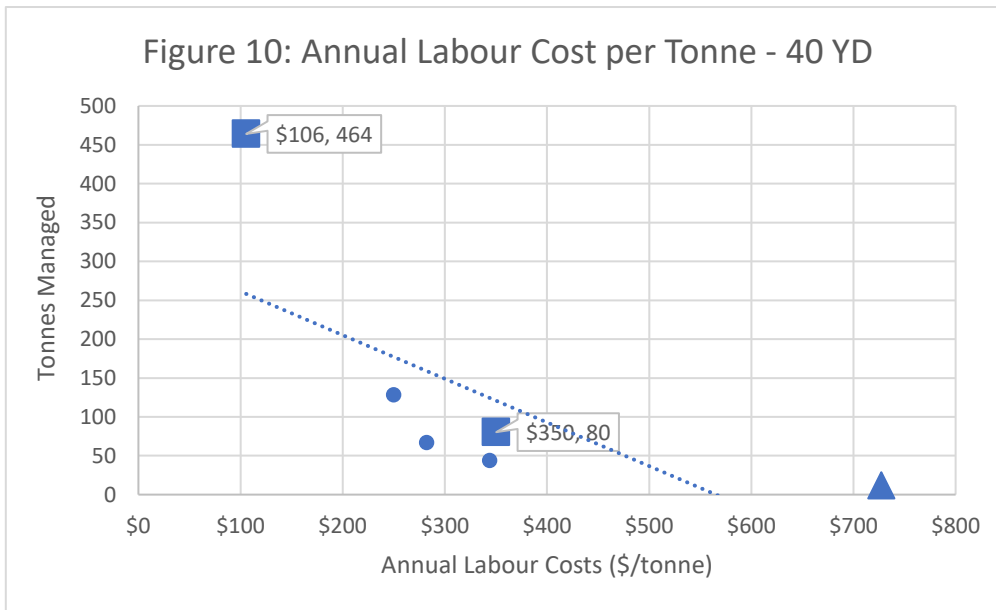
- At lower tonnages, systems using 8-yard bins appear to have lower cost per tonne compared to larger systems using 40 and 50-yard bins.
- Per tonne labour costs for systems using 50-yard bins decline significantly as the tonnage managed nears 100 tonnes per year.
- Three of the four sites with compactors have low labour cost per tonne relative the other sites. The compactor site with relatively less tonnage compared to the other compactor sites does not share this low labour cost. This indicates that there is a tonnage threshold where compactors benefit per tonne labour costs.
- While per tonne labour costs for 8-yard bin sites generally decrease as tonne increases, the rate of decrease is not as dramatic compared to other sites. This may be due to the additional bins required to operate and manage equivalent volumes, given the modular nature of smaller 8-yard bin systems.

The following charts depict annual labour costs per tonne plotted against total amount of tonnes managed, based on type of collection systems used (represented by bin type). Trendlines are used to illustrate that per tonne costs decrease as the annual tonnage managed increases. Based on the charts below, typical labour costs for sites using specific-sized bins fall within the following ranges:

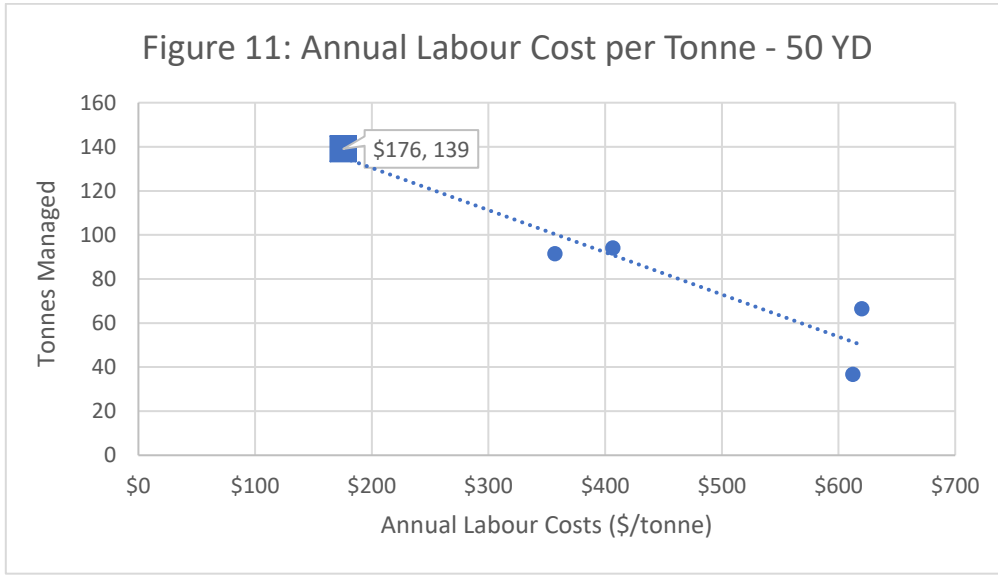
- 8 yard bins - \$200 to \$300 per tonne managed.
- 40 yard bins - \$250 to \$350 per tonne managed.
- 50 yard bins - \$325 to \$425 per tonne managed.



* The square marker with callout indicates use of a compactor at that site.



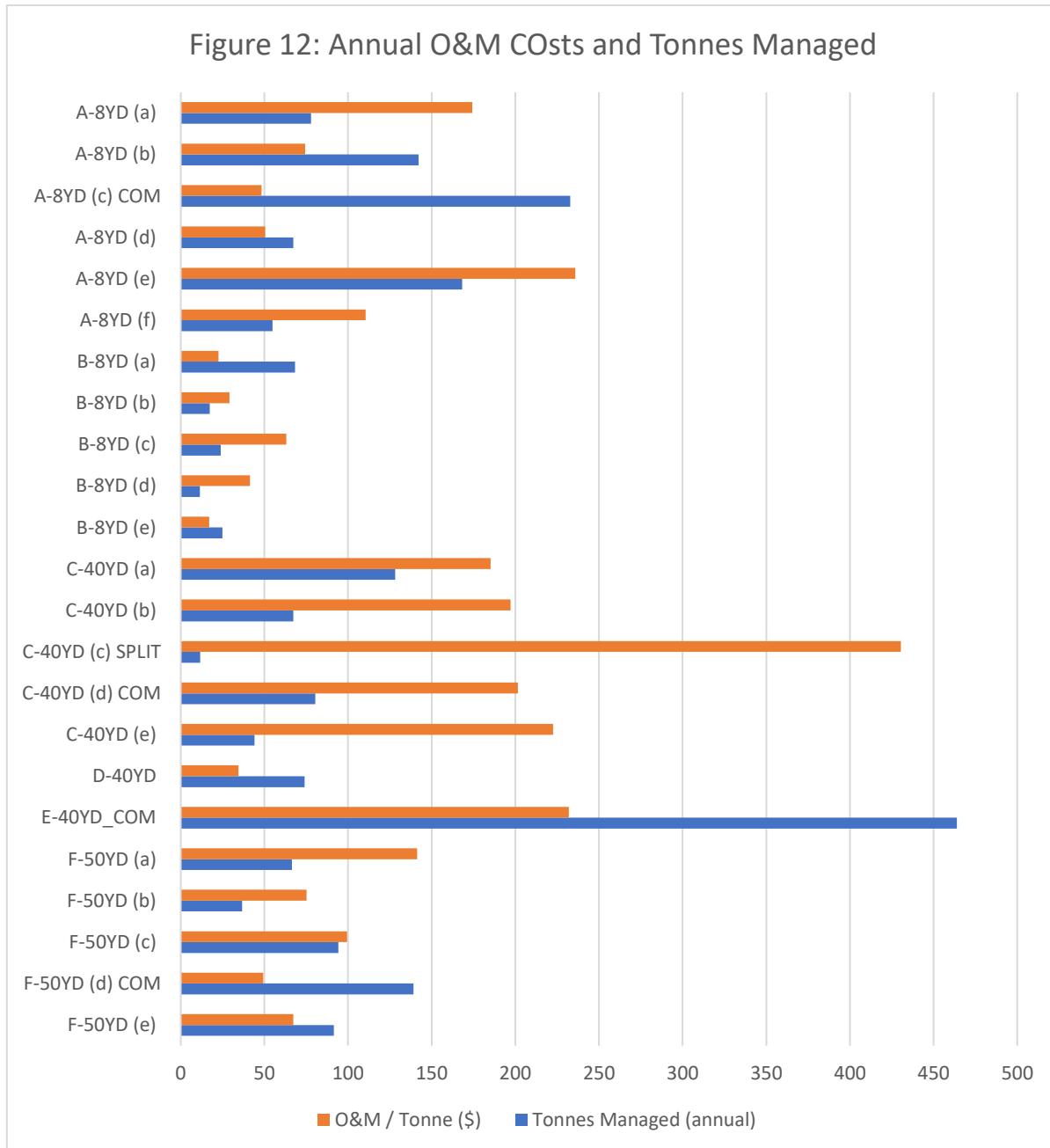
* The square marker with callout indicates use of a compactor at those sites. The triangle marker indicates use of a split bin.



* The square marker with callout indicates use of a compactor at that site.

3.3 Operating and Maintenance Costs

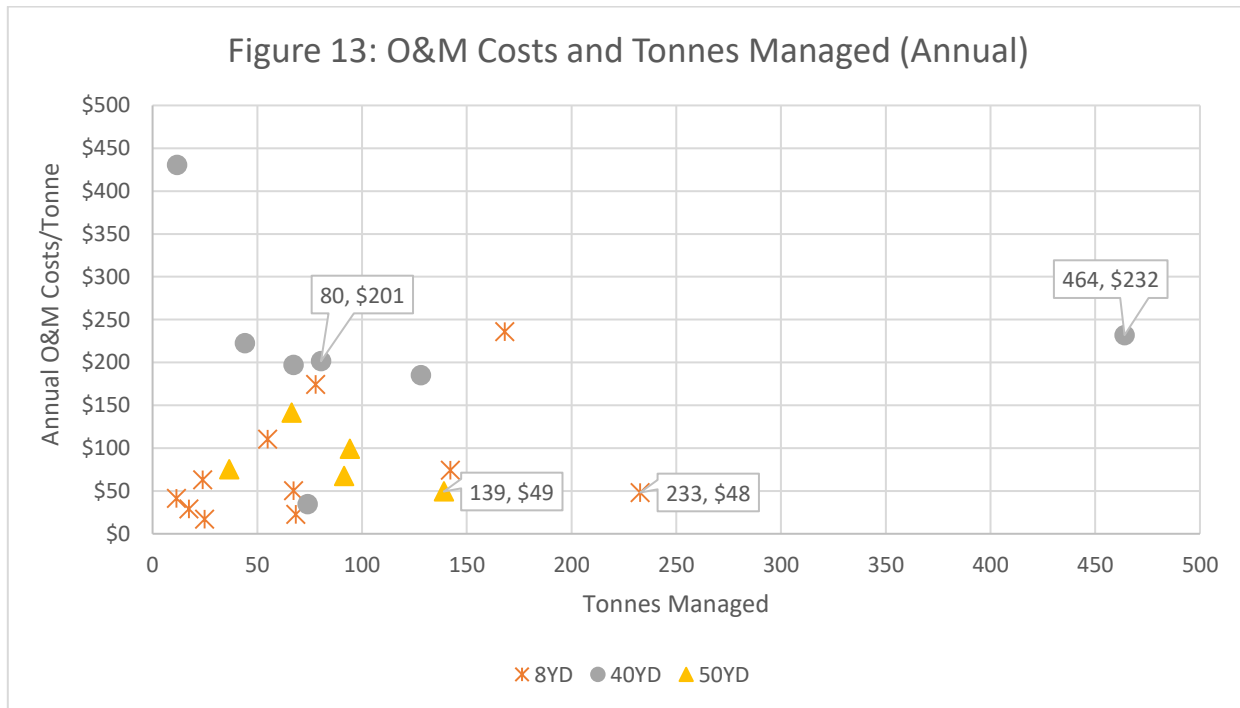
The chart below depicts the per tonne Operating and Maintenance (O&M) costs alongside the tonnes managed at the depot sites³. The average O&M cost was \$122 per tonne, and this ranged from \$17 per tonne up to \$430 per tonne. Most of the O&M costs were below \$250 per tonne; the lone cost exceeding that was \$430 for the site “C-40YD (c) SPLIT”, which has a relatively low tonnage and uses a split container. Excluding that site brings the average O&M cost down to \$108 per tonne.



³ O&M costs do not include costs to transfer materials off site.

The figure below presents the same data as the previous figure but in a scatter plot format. This helps to show that annual per tonne O&M costs are typically below \$250/tonne; however, the costs vary with the type of collection system used. Sites using compactors are indicated by the use of 'callout boxes'. Sites using 40-yard bins were found to have higher O&M per tonne costs, regardless of tonnage. Of particular note:

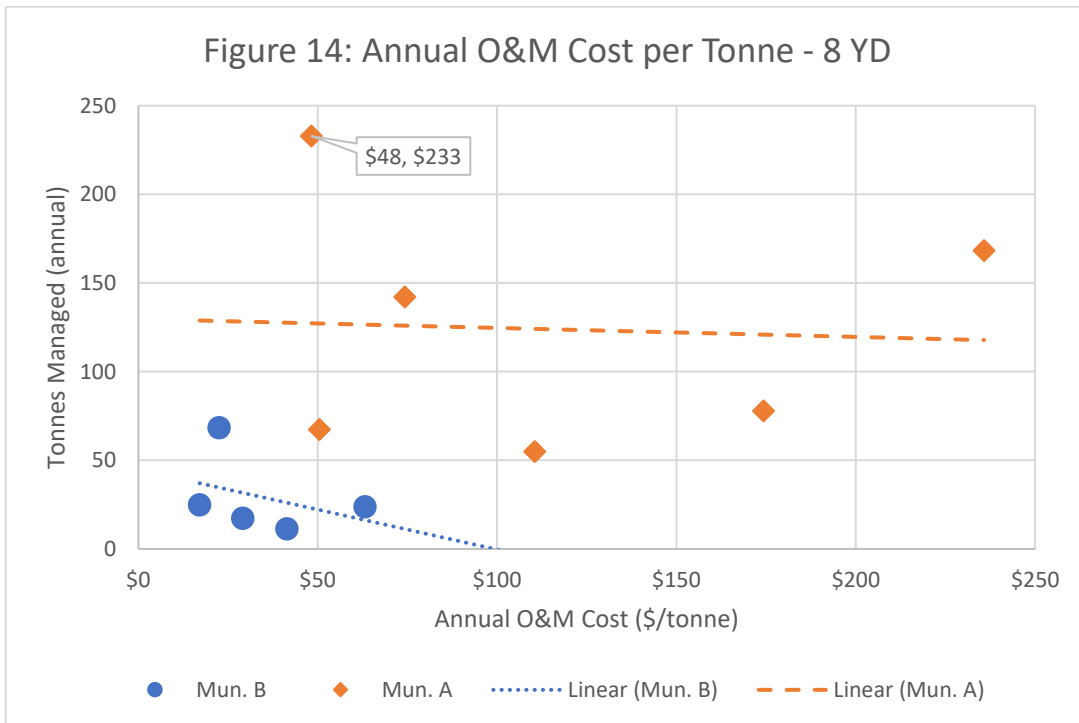
- One 40-yard bin site had a relatively low cost per tonne (i.e., \$34 per tonne). This was for a site whose recycling depot is situated at its landfill site and uses one active 40-yard container (with two replacements) for receiving its single-stream recyclables. As a result, the costs required to manage the bin is low.
- The O&M costs for systems using 8-yard bins differed between the two sample municipalities. For example, the O&M costs for Municipality B were generally lower compared to the other sites, despite their low tonnage. The O&M costs for Municipality A were generally higher, with three of the sites having O&M costs exceeding \$100 per tonne. The Municipality A site with the highest O&M costs included items such as equipment on site (e.g., loader) and annual monitoring and reporting. In addition, the two Municipality A sites with the highest O&M costs also reported bin painting, which made up 55% to 59% of the total maintenance costs. When bin painting is factored out, the resulting O&M costs for these sites are between \$78 and \$97 per tonne.
- For sites exceeding 100 tonnes per year, the sites with the lowest O&M cost per tonne are compactor sites. This indicates that compactors can be effective in reducing O&M costs for sites with higher tonnages.



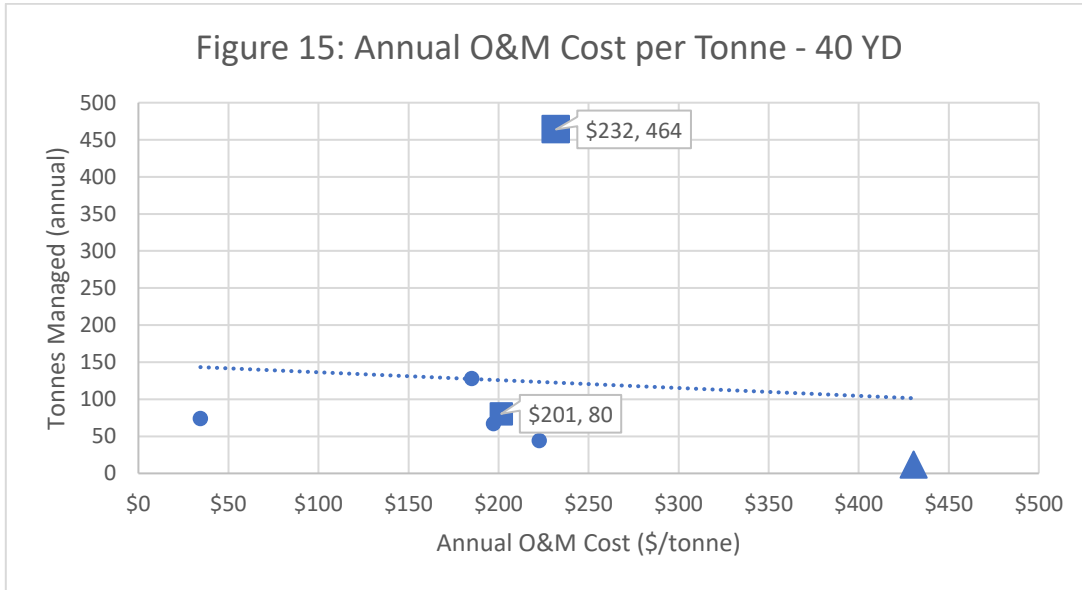
* The marker with callout indicates use of a compactor at that site.

The following charts depict annual O&M costs per tonne plotted against total annual tonnes managed, based on the type of collection system (as represented by the type of bin used). Trendlines illustrate the trend that per tonne O&M costs generally decrease with increasing annual tonnage. Based on the charts below, typical O&M costs for systems represented by common bin size include:

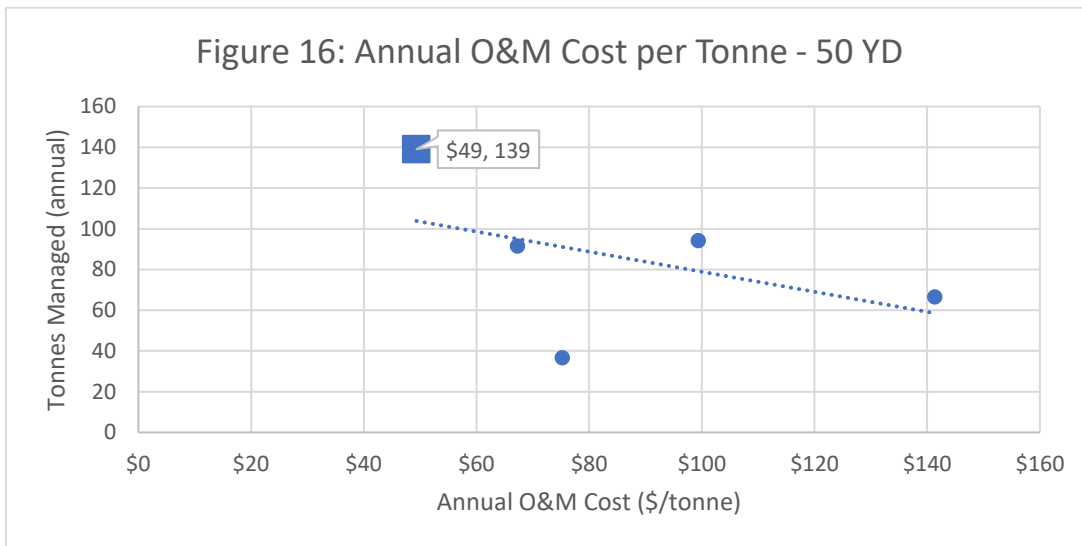
- 8 yard bins - \$110 or less per tonne managed.
- 40 yard bins - \$150 to \$250 per tonne managed.
- 50 yard bins - \$50 to \$100 per tonne managed.



* The marker with callout indicates use of a compactor at that site.



* The square marker with callout indicates use of a compactor at that site. The triangle marker indicates use of a split bin.

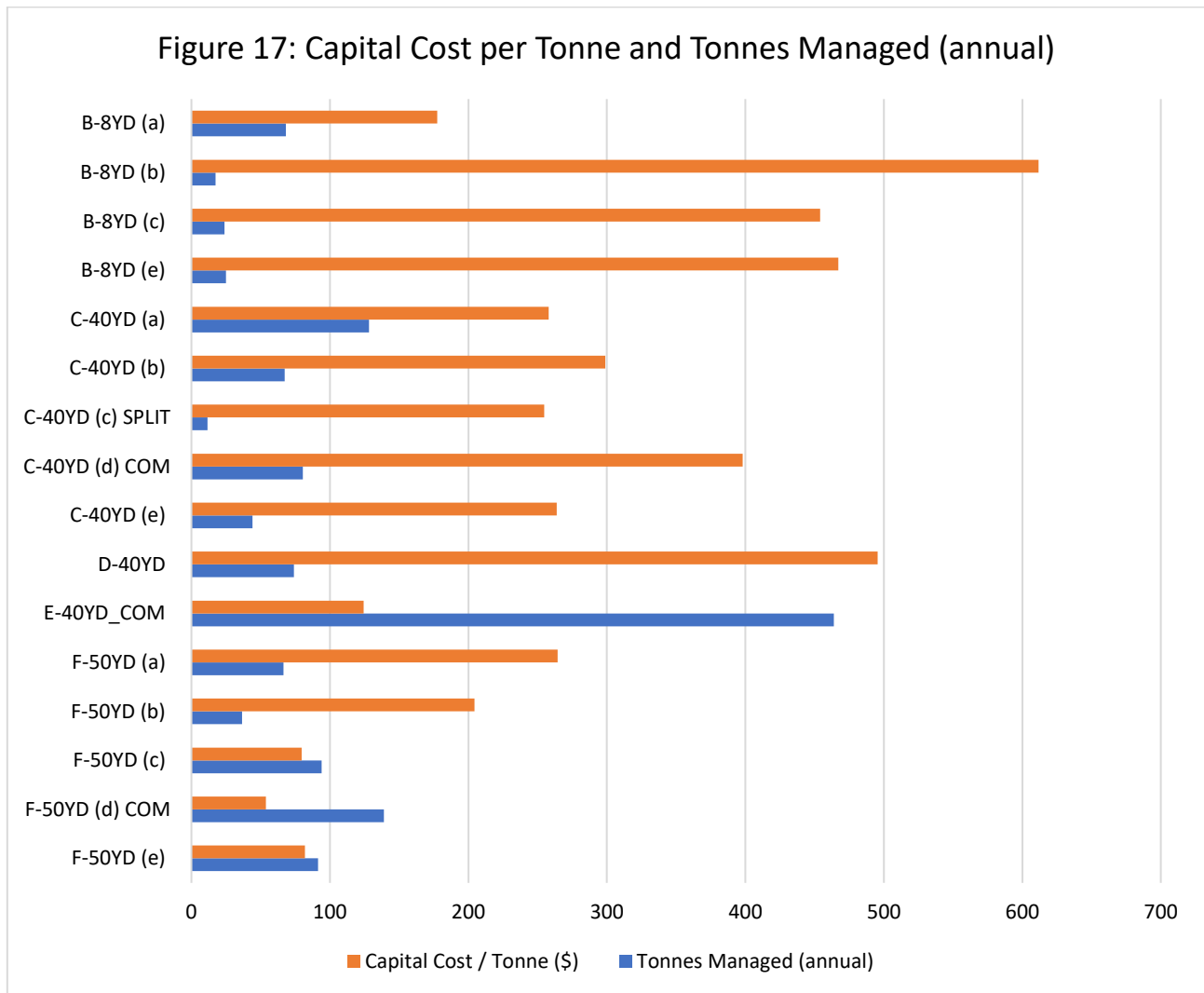


* The square marker with callout indicates use of a compactor at that site.

3.4 Capital Costs

The following chart depicts the per tonne capital costs alongside annual tonnes managed at the depot sites. The depot sites Municipality A (8-yard bins) has been excluded from this costing as detailed capital costs were not available.

The average per tonne capital costs ranged widely - the average cost was \$267 per tonne, but this ranged from low of \$54 to a high of \$612⁴. Most of the capital costs were below \$300 per tonne, with the higher costs belonging to the sites using smaller bins (e.g., 8 cubic yard) and managing lower tonnages.



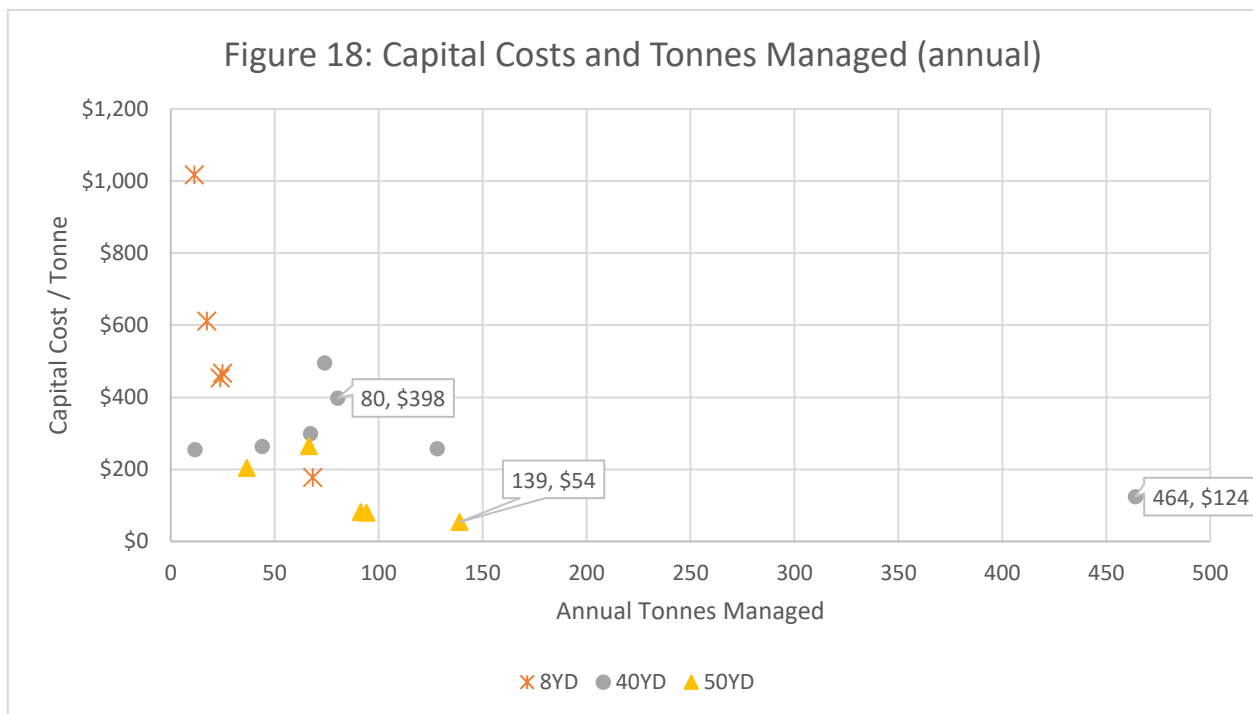
⁴ This excludes an anomalous cost of \$1,018 per tonne, which was for a site that managed low tonnage compared to the other sites.

The following figure presents the annual (amortized) per tonne capital costs on a scatter plot. Sites using compactors are indicated by the use of callouts. The graph clearly depicts the trend of decreasing per tonne capital costs as tonnage increases. Based on the graph, the following are suggested as reasonably achievable per tonne capital costs (amortized), regardless of collection system used:

- Up to 50 tonnes per year: Less than \$600 per tonne.
- 50 to 100 tonnes per year: Less than \$400 per tonne.
- More than 100 tonnes: Less than \$125 per tonne.

Of particular note:

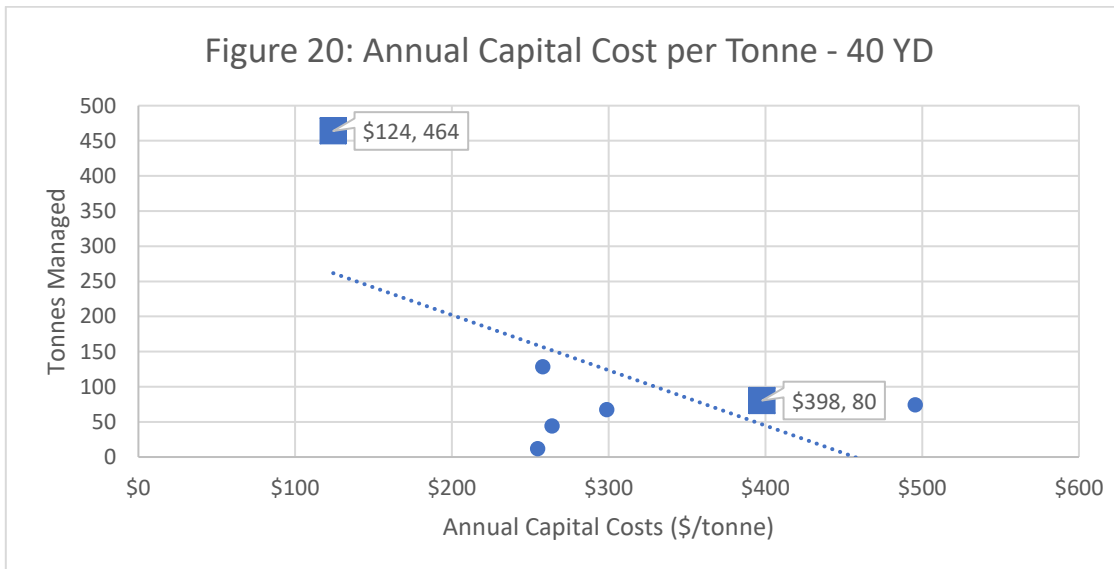
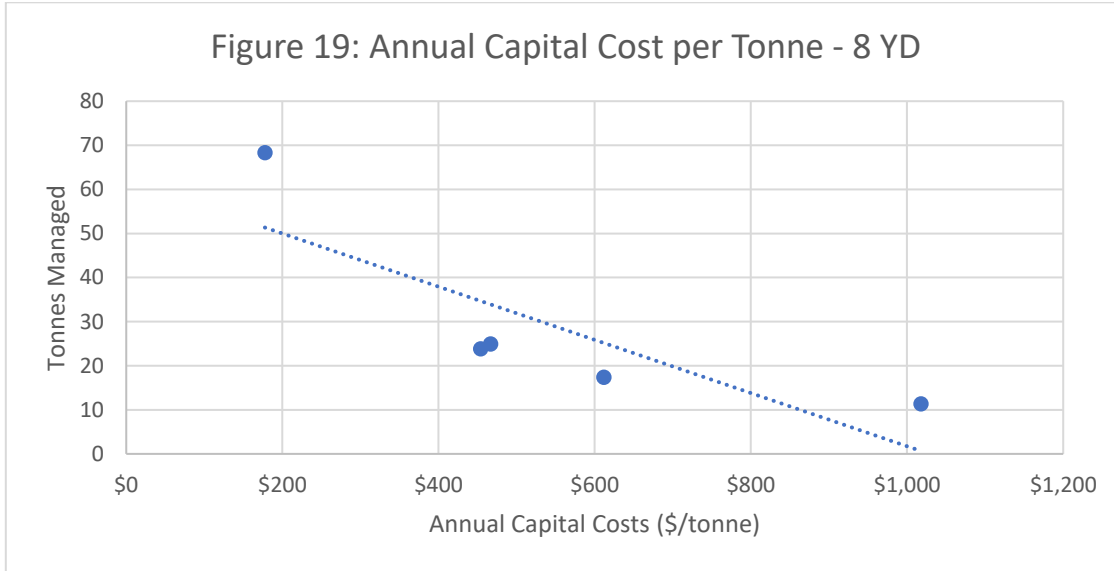
- One of the 8-yard bin sites has a relatively high capital cost per tonne (more than \$1,000 per tonne) compared to the other sites in the municipality. This is due to the low tonnage received at the site and installation of about 800 m of fencing, which is comparable or greater in length to other sites that receive more annual tonnage.
- The 40-yard bin site with the highest per tonne capital cost is for a municipality with a single depot site servicing its population. The site is located at a landfill site, and it includes capital costs that might not otherwise be included for a site with similar low tonnage. These capital costs cover a block retaining wall and paving.



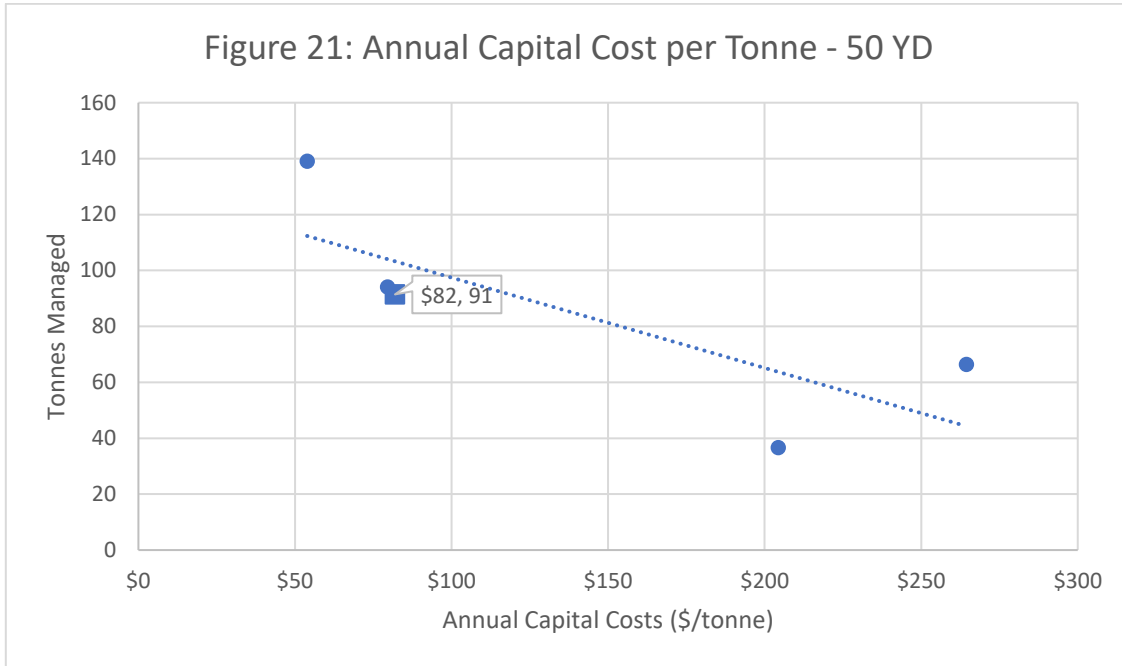
* The marker with callout indicates use of a compactor at that site.

The following charts depict the annual capital costs per tonne plotted against total tonnes managed annually, based on type of collection system. As with the other cost categories, cost per tonne declines as tonnes managed increases. While the costs range, typical capital costs for collection systems include:

- 8 yard bins - \$400 to \$600 per tonne managed.
- 40 yard bins - \$200 to \$300 per tonne managed.
- 50 yard bins - less than \$250 per tonne managed.



* The square marker with callout indicates use of a compactor at that site.



* The square marker with callout indicates use of a compactor at that site.

4 Conclusion

The cost analysis undertaken for this study show that costs for building, operating and managing recycling depots have a wide variance, even within individual municipalities. There can be a number of factors contributing to this variance, including:

- Types of bins used (such as size or whether compaction is used);
- Capital requirements of the depot site;
- Different staffing requirements (including number of staff, hours required, etc.);
- Tonnes managed at individual sites; and
- Number of households serviced by the municipality, among other factors.

Despite these variables, it appears the following trends can be observed:

- Depots operating at less than 50 tonnes per year typically have total costs in excess of \$600 per annual tonne, regardless of bin type.
- Smaller bin sizes (i.e., 8-yard bins) appear to be more economical for handling volumes of 100 tonnes per year or less.
- Compactors can reduce the per tonne cost of running a depot above a threshold 100 to 140 of tonnes per year. However, an accurate threshold would need to be considered in conjunction with hauling costs, which were not a part of this analysis.
- The general ceiling for annual labour costs is about \$400 per tonne for tonnages of less than 100 tonnes per year and about \$300 per tonne for tonnages greater than 100 tonnes per year. Selection of type of bin used in relation to tonnage may drive costs. For example, use of a FEL bin for low tonnage reduce the per tonne labour cost.
- While a general decline in labour cost per tonne was noted as tonnage increased at 4 and 8-yard bin sites, the decrease was not as significant as compared to sites with 50-yard bins. This may be due to the modular nature of 8-yard bins sites, which require proportionally more bins as tonnage increases.
- The general ceiling for annual O&M costs is about \$250 per tonne, regardless of tonnage. However, this does tend to decrease as tonnage increases, likely due to economies of scale.
- Type of bin used appears to have an influence on O&M costs. For instance, 8-yard bins generally had lower per tonne O&M costs compared to other types. Use of compactors also appears to help reduce cost per tonne at higher tonnages.
- The general ceiling of amortized capital costs decreases significantly as tonnage increases, with a ceiling of about \$600 per tonne for tonnages less than 50 tonnes per year, \$400 per tonne for tonnages between 50 to 100 tonnes per year, and \$125 per tonne for tonnages more than 100 tonnes per year.
- Not surprisingly, the general ceiling for the overall depot costs (per tonne) decreases as the tonnage of material handled increases. The data collected in this study suggests that the total cost of operating a depot managing less than 100 tonnes per year should be no more than \$1,000 per tonne, while the total cost of operating a depots managing more than 200 tonnes per year should be no more than \$500 per tonne (not including haulage costs).

This study also highlights the importance of building the appropriate depot infrastructure based on the site constraints and anticipated tonnage, or “right-sizing”, to manage per tonne depot costs. When building a new depot site or rebuilding an existing site, consideration should be given to:

- Collection systems that use 8-yard bins for sites managing 100 tonnes or less per year.
- Collection systems that use 40-yard or 50-yard bins for sites managing 100 tonnes or more per year.
- For sites that hover around the 100-tonne per year threshold, consideration should be given to hauling costs, since the benefits of compaction available through front end loader trucks can significantly reduce overall operating costs compared to roll-offs in certain situations⁵.
- Site characteristics may influence the type of bins that are more or less feasible at a site. For example, a site with a large, flat, and open area may be well suited for 8-yard bins, with additional bins being added if required for increasing tonnage. Conversely, a site with limited space availability or a pre-existing ‘sawtooth’ may be better suited for a fewer 40 or 50-yard bins.

⁵ Please visit <https://thecif.ca/centre-of-excellence/collection/compactors/> for more information on compactor feasibility.