INFORMATION REPORT

TO: Chair and Members Public Works Committee	**WARD(S) AFFECTED:** CITY WIDE
COMMITTEE DATE: April 18, 2011	
SUBJECT: Waste Collection and Recycling Processing Procurement Processes for 2013-2020 (PW11030) - (City Wide)	
SUBMITTED BY: Gerry Davis, CMA General Manager Public Works Department	**PREPARED BY:** Pat Parker 905-546-2424, Extension 3916
SIGNATURE:	

Information:

The current waste collection and material recycling processing contracts will expire in March 2013.

The purpose of this report is to provide information on the proposed approach to the internal costing and Request for Proposals (RFP) procurement processes for waste collection and material recycling processing for 2013 - 2020. As it takes at least a year to acquire trucks, the processes must be complete and contracts awarded by early 2012. With the assistance of Stantec Limited a report of best practices and current industry standards was undertaken to develop a number of system options for waste collection and recycling processing. The cost modelling of these options is included in a detailed report that is attached as Appendix A to Report PW11030.

In a separate Public Works Report PW04113a, Activity Based Costing for Public Sector Waste Collection 2013-2020, the public/private service delivery options have been addressed.

Following the procurement processes a recommendation report on the award of the contracts will be presented to the Public Works Committee.

1. Considerations for the Collection System RFP Process

During the past several months a review of best practices from other municipal situations and industry standards has been undertaken to develop a number of options. The advantages and disadvantages of the options were evaluated based on other municipal practices and industry standards based on a number of criteria, including:

- number of trucks

- implications on public acceptability
- potential effects on waste diversion
- effects on collection costs
- effect on recycling processing infrastructure
- effect on organics processing infrastructure
- effect on transfer/haul infrastructure
- environmental impacts
- degree of flexibility
- implementation requirements or barriers

All of the options reviewed were compared against the current waste collection system, which is: weekly curbside collection of garbage and green cart (collected at the same time in a single split body truck); weekly two stream recycling collection (stream one is containers and stream two is fibres, which are collected at the same time in a single split body truck); seasonal biweekly leaf and yard waste collection; seasonal bulk waste collection ; and front bin garbage collection from multi-family homes.

A number of the options involve bi-weekly collection of garbage as a means of increasing waste diversion. Although this may be perceived as a service level reduction, many households are setting out less than one bag of garbage per week, and the limit would be two bags every two weeks. The tonnage collected at curbside has been reduced by 43% since 2005, the last full year before the green cart program. In 2005, a total of 105,000 tonnes of curbside waste was collected and in 2010 it was 60,100 tonnes. Bi-weekly garbage generates significant savings in collection costs, ranging from $1.5 - $2.8 million per year based on the preliminary cost estimates. In conjunction with bi-weekly collection of garbage staff would review the existing Special Consideration provisions of the Solid Waste Management By-law No. 09-067.

Several options include single stream recycling, also as a means of increasing waste diversion. Single stream collection is easier for residents and collectors, although the processing costs are higher than two stream recycling. Recycling processing is addressed in the next section of this report.

Consideration was also given to extending the seasonal leaf and yard waste collection. There may be opportunities to share the City staff who collect leaf and yard waste with the winter control operations in the Roads section. Costs will be considered in the public service review.

Options that included more trucks and consequently more labour tend to have higher costs regardless of the processing method.

2. Considerations for the Recycling Processing RFP

The contract for processing recyclable materials at the City's Materials Recycling Facility (MRF) also ends in 2013.

In the Stantec Limited report, processing cost estimates are based on a review of the City's costs and other municipal costs for both two stream and single stream recycling processes and associated capital upgrades and costs. It is noted that a more detailed review specifically to evaluate the condition of the City's MRF and processing equipment and market conditions is currently underway. The details of that review will be provided to Council in a subsequent report and the results will be used to assist in the preparation of the recycling processing RFP.

At the present time the two stream MRF operates at about 60% of its approved capacity. It is estimated that the equipment has a remaining useful life of five (5) to ten (10) years. Although the City could attempt to market about 30,000 tonnes of merchant capacity per year to generate revenue, the market for two stream capacity has been reduced over the past several years with about 50% of municipal recycling tonnage in Ontario now processed in single stream. In addition the increased processing would reduce the useful life expectancy of the equipment. Through an RFP the City can secure two stream processing service for the life of the next collection period to 2020. Capital costs would be limited to those costs associated with upgrading equipment from time to time and annual maintenance of the facility.

Alternatively, single stream processing could be pursued. This would require capital investment either through the City's capital budget or as a build option in the processing contract, but would produce a marketable product for merchant capacity, as single stream processing capacity is currently in demand. Nearby, Toronto is seeking capacity to process 140,000 tonnes of single stream material per year. In addition Peel and Halton have single stream processing systems and will be seeking processing capacity in the next few years. The collection of single stream recyclables is easier for residents and collectors and can facilitate co-collection efficiencies. The RFP for a single stream processing system would likely be for longer period of time such as 15 years to amortize the cost of equipment. One of the concerns about single stream processing is that the time required for alterations to the building to facilitate the installation of the equipment and the relocation of waste collection operations will not likely meet a March 2013 operational start.

It is proposed that an RFP invite private sector operators to price both single stream and two stream processing, with and without the capital improvement component.

3. Concluding Comments

Following the evaluations of advantages and disadvantages of the nine (9) options, a short list of three (3) options was selected that would generate collection service efficiencies and cost effectiveness. These options were carried forward into a second evaluation using the same criteria, but also modelling the cost implications.

One option involves single stream recycling and two options involve two stream recycling. Two options include bi-weekly garbage collection and one option, the current system, includes weekly garbage collection. The details of the collection components of the three systems are contained in Table 1 that follows:

Table 1: Waste Collection System Review for 2013 - Collection Options

Option	Description	Collection System Features
1	Bi-weekly Garbage Weekly Single Stream Recycling Weekly Green Cart Seasonal Leaf & Yard Waste Seasonal Bulk Waste	• Trucks collect Garbage ½ City one week, the other ½ the second week • Co-collection of Recycling and Green Cart • Leaf & Yard Waste and Bulk alternate seasonally • 2½ passes per household per week
2	Bi-weekly Garbage Weekly Two Stream Recycling Weekly Green Cart Two Stream Recycling Weekly Leaf & Yard Waste Bi-weekly Bulk	• Trucks collect Garbage and Bulk together, ½ City one week, the other ½ second week • Separate collection of Recycling • Co-collection of Green Cart and Leaf & Yard Waste • 2½ passes per household per week
3	Weekly Garbage Weekly Green Cart Weekly Two Stream Recycling Seasonal Leaf & Yard Waste Seasonal Bulk Waste	• Co-collection of Garbage and Green Cart • Separate collection of Recycling • Leaf & Yard Waste and Bulk alternate seasonally
All Options	Multi-Residential Collection Services: Blue Cart Collection Bin Garbage Collection	 Weekly or more frequently Weekly or more frequently

It is proposed to take Options 1 and 2, together with the blue cart and bin garbage collection into the RFP process and the internal costing exercise to formalize the pricing. The detailed evaluation of the three shortlisted options is included in Appendix A to Report PW11030. This evaluation shows financial implications of the collection and recycling processing costs of this portion of the waste management system are $21.3 million for option 1, $22.6 million for option 2 and $24.1 million for option 3. It is noted that the sale of recycling capacity at the MRF has not been factored into these cost implications.

Other considerations that will be addressed through the procurement process include types of containers, length of collection day, special considerations for waste collection and opportunities for changes to bulk waste collection to facilitate reuse and recycling.

Next Steps

Processes are underway to ensure RFPs are issued so decisions can be made and implemented in accordance with timelines for 2013. The timelines are important as the successful proponent and/or City will need at least a one (1) year lead time to procure collection vehicles. Equipment for the Material Recycling Facility (MRF) will also need

to be purchased at least one (1) year, if not more, in advance of the April 1, 2013 commencement of contract.

The options for both the collection and processing RFPs will be brought together to analyse the overall costs of these activities to develop the systems for consideration for the next waste collection period 2013 to 2020.

Early next year (2012), a Public Works Committee report will present the results of the procurement processes and recommendation of the award of contract(s).

APPENDIX A
PW11030

City of Hamilton – Waste Collection Service Level Review

Final Report

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March 28, 2011

Project No. 160930141

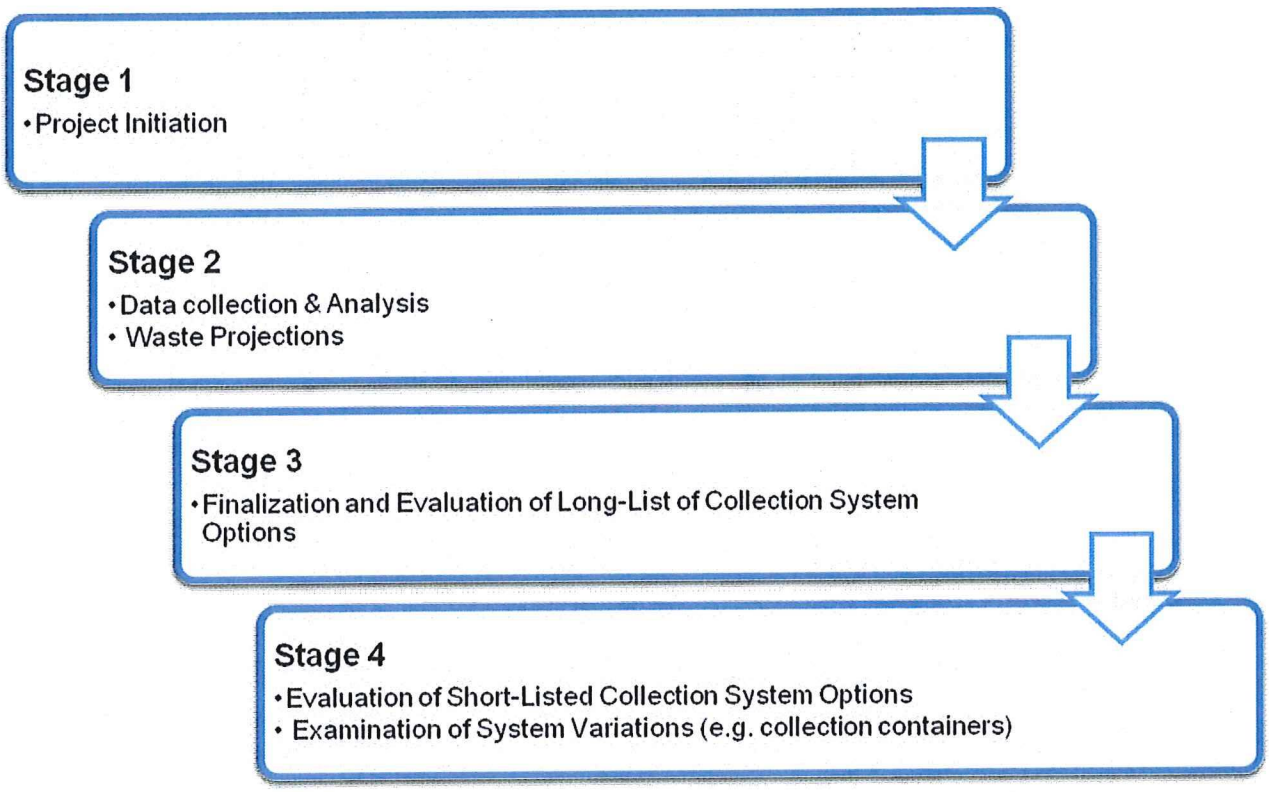
EXECUTIVE SUMMARY

Introduction

In September 2010, the City of Hamilton (the City) retained Stantec Consulting Ltd. (Stantec) to undertake a service level review of its residential waste collection system (the Study).

The goal of the Study was to identify the collection system(s) that could offer the greatest potential benefits to the City for the next collection contract slated to begin in April 2013.

The Study was undertaken in four stages as follows:



Stage 1 – Project Initiation

A project initiation meeting was held in September 2010. One of the key outcomes of the meeting was the development of an initial draft long-list of collection system options. This draft long-list of collection system options was finalized during Stage 3 of the Study.

Stage 2 – Description of Current Collection System and Waste Projections

During Stage 2, the performance of the current waste collection system was examined (i.e., tonnages and costs).

Waste projections were then developed to allow the Study Team to get a better idea of the composition and quantity of waste that would need to be managed by any waste collection system over the term of the next collection contract (2013-2020) assuming that no new diversion initiatives were implemented. Figure ES-1 below, indicates the current curbside diversion performance in the City..

Figure ES-1 Breakdown of Total Waste Collected via Curbside Collection (2009)

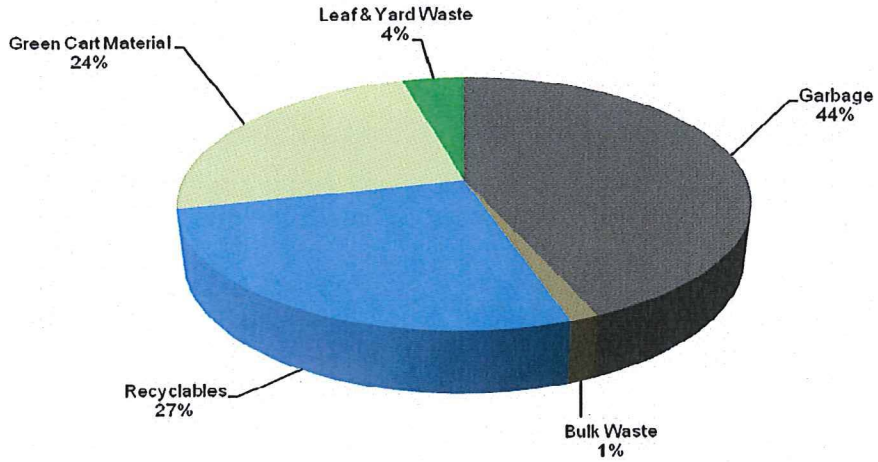


Table ES-1 indicates the current recovery rates for the residential materials managed at the curbside, illustrating that there is still a significant percentage of recyclables and food waste that could be diverted and which would increase the City's overall diversion rate.

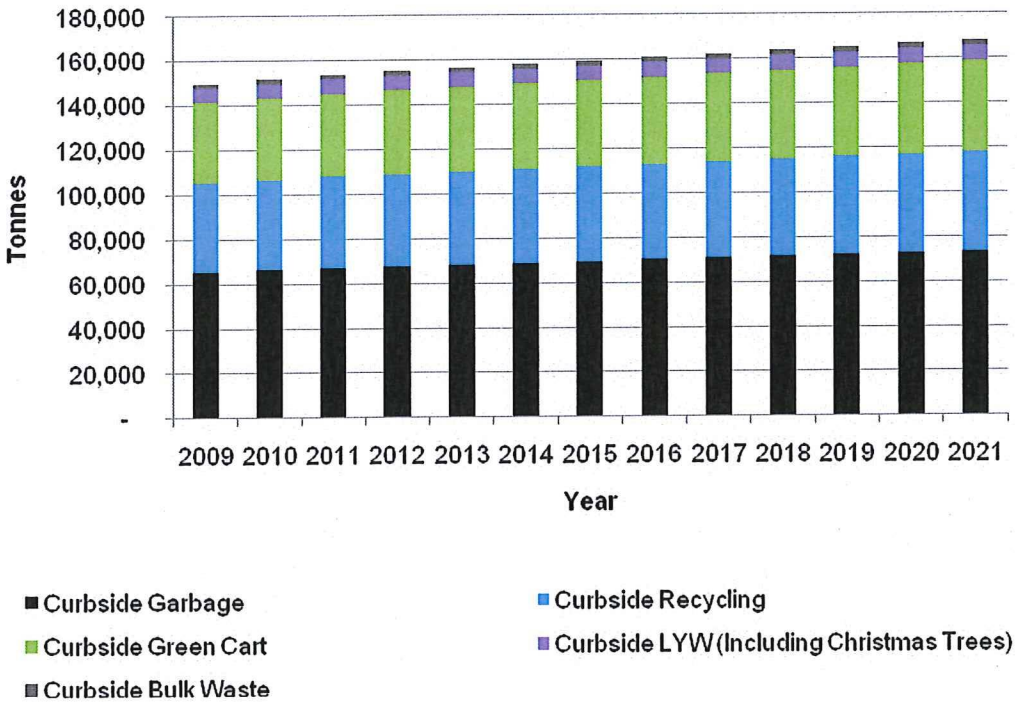
Table ES-1 Tonnage Produced, Diverted and Recovery Rates for Materials Generated at Curbside (2009)

Material Type	Estimated Tonnes Generated	Tonnes Diverted	Estimated Recovery Rate
Paper	22,075	16,884	76.5%
Paper Packaging	22,005	13,193	60.0%
Plastics	13,070	3,587	27.4%
Metals	4,179	2,166	51.8%
Glass	5,613	4,940	88.0%
Food Waste	37,495	19,560	52.2%
Leaf and Yard Waste	21,659	20,672	95.4%
Total	**126,097**	**81,001**	**64.2%**

One of the key aspects of the Service Level Review was to examine various methods of increasing the recovery rates for recyclables and organic materials, to improve the City's diversion performance.

As illustrated in Figure ES-2 below, should diversion rates not increase, the quantity of curbside residential garbage disposed in the City could increase from around 66,000 tonnes to around 73,000 tonnes by 2020, simply through population growth.

Figure ES-2 Status Quo: Estimated Annual Amount of Curbside Waste Diverted and Disposed



During Stage 4, estimates for the potential increase in diversion rates for the short-listed options were developed.

Stage 3 – Finalization and Evaluation of Long-List of Collection System Options

During Stage 3, the long-list of collection system options initially put forward during Stage 1 of the Study was finalized. The following bullet list describes the variety of collection approaches considered in the development of the long-list:

- Collection of garbage stream either weekly or bi-weekly. Review of Ontario municipalities with bi-weekly garbage collection indicates that the municipalities that are most similar to Hamilton and that have the highest diversion rates have implemented bi-weekly garbage collection. Bi-weekly garbage collection has been found to increase diversion by 4 to 6% in other communities. Bi-weekly garbage collection has also been found to be the most effective garbage collection approach in high-diverting municipalities as many residents have less than one bag of garbage each week. Collecting on alternating weeks ensures that the collection trucks are used more efficiently.
- Collection of recyclables in two-streams or in a single-stream. For two-stream systems, the frequency of pickup would be weekly (bi-weekly options would present storage issues for residents). For single-stream systems, the frequency of pickup can be weekly or bi-weekly. Two-stream and

single stream recycling collection and processing was examined to see if there would be any benefit from changing recycling services in the new contract.

- Collection of the Green Cart on a weekly basis. Bi-weekly collection was not considered publicly acceptable due to increases in odour etc.
- Leaf & Yard Waste (LYW) can be collected either seasonally on a bi-weekly basis (i.e., during the spring and fall and in January for Christmas tree collection) or continuously throughout the year on a weekly or bi-weekly basis separate from the Green Cart. Review indicated that there would be benefits in reducing the amount of LYW in the Green Cart stream as much as possible so as to preserve processing capacity at the Central Composting Facility (CCF) and reduce processing costs (it is much cheaper to compost LYW in a pad based system than at the CCF).

In addition to the above, each of the material streams can be collected in a separate vehicle or co-collected, that is, two-streams collected at the same time in the same vehicle.

Various combinations of the above approaches were used to identify the long-list of collection system options, which consisted of a total of nine (9) distinct collection systems.

The long-list of curbside collection systems was evaluated based on social, technical, environmental, and financial criteria. It was recommended that the three top-ranked two-stream recycling scenarios and the top-ranked single-stream recycling scenario be carried forward as the short-list of collection system options to be evaluated in more detail.

Table ES-2 Short-List of Collection Systems

Scenario	Description
System A (Status Quo)	Garbage – Weekly, Co-collected with Green Cart
	Recyclables – Weekly Two-stream, Co-collected
	Green Cart – Weekly, Co-collected with garbage
	LYW – Bi-weekly (Spring and Fall), separate collection
System B	Garbage – Bi-weekly, separate collection
	Recyclables – Weekly SS, Co-collected with Green Cart
	Green Cart – Weekly, Co-collected with SS Recycling
	LYW – Bi-weekly (Spring and Fall), separate collection
System H	Garbage - Bi-weekly
	Recyclables – Weekly Two-Stream
	Green Cart – Weekly, co-collected with LYW
	LYW – Weekly, co-collected with Green Cart
System I	Garbage - Bi-weekly, alternating with LYW
	Recyclables – Weekly Two-Stream
	Green Cart – Weekly
	LYW – Bi-weekly, alternating with Garbage

Detailed analysis of the top ranked two-stream recycling scenarios was undertaken to determine the potential cost savings and increased diversion performance associated with each of these three approaches, and to

determine if the savings and increased diversion associated with bi-weekly garbage collection is sufficient to offset the implementation challenges and public reaction to such a change.

The top ranked single-stream recycling scenario ranked behind the best two-stream recycling scenarios after the long-list evaluation. The single-stream approach, however, offers the use of one of the smallest overall collection fleets, allowing for one of the lowest overall collection costs. Detailed analysis was needed to determine if the potential decrease in collection costs for this scenario were sufficient to offset the potential increase in processing costs associated with single-stream recycling, particularly considering any potential loss of revenues.

Stage 4 – Evaluation of Short-Listed Collection System Options

Collection system modeling of each of the four short-listed collection system options was completed to estimate potential fleet size and associated collection costs that would apply to each system. The systems were then evaluated in detail in regards to:

- Public acceptability, considering the potential changes to collection services identified for each system.
- Potential effects on diversion. For each system, the potential change in diversion was calculated based on how much more material could be directed to the blue box or green bin.
- Financial implications, considering modeled collection costs and potential recyclables processing capital and operating costs and any implications that could affect the cost to manage organics.
- Environmental impacts, considering the green house gas emissions and other emissions of the collection fleet, and decreases in indirect air emissions associated with increased diversion.
- General implementation requirements or barriers, considering the level of effort required to support change, implications associated with developing new recycling processing capacity and the potential to free-up some processing capacity at the CCF to meet current contractual obligations and to accommodate increases in organics capture in the City.

Based upon the evaluation it was found that System H offers the most advantages, in regard to the potential social, environmental, and financial effects of the systems and is the recommended collection approach to be included in the next collection RFP.

System B was found to have a neutral ranking based on the consideration of all of the criteria, however, it does offer some advantages than the other systems in regards to increased diversion potential and as it has the lowest overall potential collection costs. System B could be carried forward as the preferred single-stream approach. System B would require significant capital investment. A review is underway that will refine the processing costs estimate.

System A (Status Quo) was the only system carried forward for detailed analysis which included weekly garbage collection. It was the best-ranked system with weekly garbage collection following evaluation of the long-list, but does not offer any significant advantages to the City except in regards to public acceptability.

System I was not carried forward as System H offered a much better bi-weekly garbage collection and two-stream recycling scenario.

The following table presents the results of the evaluation of System A (Status Quo), System B, and System H, re-ordered and renumbered to reflect their relative collection fleet sizes and collection costs.

Table ES-3 Summary of Evaluation of Short-Listed Systems

Criteria	System 1 (Formerly B)	System 2 (Formerly H)	System 3 (Formerly A, *Status Quo*)
Garbage	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Weekly, Co-Collected with Green Cart
Recyclables	Weekly, SS, Co-Collected with Green Cart	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with SS Recycling	Weekly, Co-Collected with LYW	Weekly, Co-Collected with Garbage
LYW	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Bi-Weekly (spring and fall), Separate Collection
Number of Truck Passes/Week	1.5 Truck Passes/Week	2.5 Truck Passes/Week	2 Truck Passes/Week
PUBLIC ACCEPTABILITY	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience. Change in service: - May be found to be inconvenient by some residents, in regards to garbage collection - Is more likely to cause odour in the home - Has the potential to have issues relative to garbage storage - Is likely to be found convenient in regards to recycling collection	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. Weekly collection of LYW may offset some impacts due to increase in convenience. Change in service: - May be found to be inconvenient by some residents, in regards to garbage collection - Is more likely to cause odour in the home - Has the potential to have issues relative to garbage storage - Is likely to be found convenient in regards to LYW collection	ADVANTAGE Likely high level of acceptability to residents given performance of current system. Current service: - Is convenient (weekly collection of all three major streams of materials) - Is less likely to cause odour in the home - Has minimal issues relative to material storage
POTENTIAL EFFECTS ON DIVERSION	MAJOR ADVANTAGE Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables. **Additional 7.6% Diversion, increasing residential diversion up to 62%.** 5,300 tpy of additional recyclables 5,600 tpy of additional organics	ADVANTAGE Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables. **Additional 5.7% Diversion, increasing residential diversion up to 60%.** 2,600 tpy of additional recyclables 5,600 tpy of additional organics	DISADVANTAGE The potential for additional diversion would be limited.
FINANCIAL IMPLICATIONS			
Effect on Collection Costs (2016$, equivalent to average cost over new 2013 to 2020 contract)	MAJOR ADVANTAGE 53 to 58 Truck Fleet - $16.6 to $17.6 million Plus 6 LYW & Bulky - $1.8 to $2 million Collection Support - $1.6 million **Annual Cost of $20 to $21.2 million**	ADVANTAGE 69 to 76 Truck Fleet - $21.6 to 23 million Plus 2 Peak LYW & 4 Bulky - $1.8 to $2 million Collection Support - $1.6 million **Annual Cost of $25 to 26.5 million**	DISADVANTAGE 73 to 80 Truck Fleet - $22.8 to 24.2 million Plus 6 LYW & Bulky - $1.8 to $2 million Collection Support - $ 1.6 million **Annual Collection Cost of $26.2 to 27.8 million**
Effect on Recycling Processing Infrastructure (2016$ representing operating costs at mid-point of the collection contract)	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned. Estimated Capital Equipment Cost (2013$) of $18.2 million for new MRF and $2 million for relocation of City Collection Fleet. Estimated Annual Operating Cost of $74/tonne or $5.8 million, based on proposed prices from last MRF RFP. Estimated Annual Revenue of ($109.5)/tonne or ($5) million. **Net Annual Processing Cost of $0.7 million.**	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned. To be confirmed in MRF Review. Estimated Operating Cost of $50.2/tonne or $2.3 million based on current contract costs. Estimated Annual Revenue of ($113)/tonne or ($4.8) million. **Net Annual Processing Cost of ($ 2.6) million.**	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned. To be confirmed in MRF Review. Estimated Operating Cost of $49.7/tonne or $2.1 million, based on current contract costs. Estimated Annual Revenue of ($113)/tonne or ($4.5) million. **Net Annual Processing Cost of ($2.4) million.**
Net Financial Implications	Net Annual Cost: $20.6 to $21.8 million	Net Annual Cost: $ 22.4 to $24 million	Net Annual Cost: $23.7 to 25.3 million
Effect on Organics Processing Infrastructure	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium cost.	ADVANTAGE Would provide opportunity to divert LYW from CCF to composting pad, processing some materials at a lower cost.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium cost.
ENVIRONMENTAL IMPACTS	MAJOR ADVANTAGE Highest potential for reduction in direct air emissions as has the lowest fleet requirements and lowest number of truck passes. GHG Emissions: 5,500 tonnes Smog Precursors: 1,300 kg Highest potential for decrease in indirect air emissions based on increased diversion of recyclables and organics.	ADVANTAGE Second highest potential for reduction in direct air emissions as has the lowest fleet requirements and lowest number of truck passes. GHG Emissions: 7,200 tonnes Smog Precursors: 1,700 kg Second highest potential for decrease in indirect air emissions based on increased diversion of recyclables and organics.	DISADVANTAGE Highest fleet requirements and thus highest potential fleet emissions. GHG Emissions: 7,600 tonnes Smog Precursors: 1,800 kg No additional diversion, therefore no potential for decrease in indirect air emissions.

Criteria	System 1 (Formerly B)	System 2 (Formerly H)	System 3 (Formerly A, *Status Quo*)
Garbage	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Weekly, Co-Collected with Green Cart
Recyclables	Weekly, SS, Co-Collected with Green Cart	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with SS Recycling	Weekly, Co-Collected with LYW	Weekly, Co-Collected with Garbage
LYW	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Bi-Weekly (spring and fall), Separate Collection
Number of Truck Passes/Week	1.5 Truck Passes/Week	2.5 Truck Passes/Week	2 Truck Passes/Week
GENERAL IMPLEMENTATION REQUIREMENTS AND/OR BARRIERS			
GENERAL	DISAVANTAGE Will require increased efforts with P&E. Would require shift in public/private service level split. Would not require much change in current bulky waste collection approach (both SFD and MFD).	DISADVANTAGE Will require increased efforts with P&E. Would not require shift in public/private service level split. Would require change in current bulky waste collection approach (both SFD and MFD).	ADVANTAGE No change in implementation requirements and/or barriers. Would accommodate current public/private service level split. Would not require shift in bulky collection approach.
RECYCLING PROCESSING	DISADVANTAGE Could accommodate regional MRF concept. May require extension in processing contract beyond 2013 to provide enough time for new single-stream capacity to be developed. Somewhat less flexible to changes in WDA and minimal additional investment in system required.	ADVANTAGE Unlikely to accommodate regional MRF concept. Not likely to require extension in processing contract beyond 2013. Somewhat flexible to changes in WDA and minimal additional investment in system required.	ADVANTAGE Unlikely to accommodate regional MRF concept. Not likely to require extension in processing contract beyond 2013. Somewhat flexible to changes in WDA and minimal additional investment in system required.
ORGANICS PROCESSING	DISADVANTAGE Bulk of LYW still combined with green cart materials, using CCF capacity that would otherwise be available for expansion of the green cart program to other City sectors and/or to accommodate increases in SSO capture rates for SFD and MFD.	ADVANTAGE Bulk of LYW collected separately from green cart materials, freeing up CCF capacity needed for expansion of the program to other City sectors and to accommodate increases in SSO capture rates for SFD and MFD.	DISADVANTAGE Bulk of LYW still combined with green cart materials, using CCF capacity that would otherwise be available for expansion of the green cart program to other City sectors and/or to accommodate increases in SSO capture rates for SFD and MFD.
Overall Result	**NEUTRAL**	**MAJOR ADVANTAGE**	**NEUTRAL**

In summary, System 2 (Formerly System H) is the collection system recommended to be carried forward into the collection RFP for the new collection contract as:

- While bi-weekly garbage collection would be a further restriction, it would better fit residential needs as many households are currently setting out less than one bag a week. The increase in leaf and yard waste collection service to weekly would be a great benefit to residents that generate a lot of these materials.
- Implementing bi-weekly garbage collection and weekly leaf and yard waste collection is expected to increase diversion by nearly 6%, pushing residential diversion rates to 60%. The top-performing municipal programs in Ontario (York and Halton) have achieved in the order of 57% diversion as of 2009 with a combination of diversion program improvements, container limits and implementation of bi-weekly garbage collection.
- System 2 has the second lowest potential collection cost, and second lowest overall collection and recyclables processing cost. Compared with the Status Quo, it requires fewer collection trucks and would cost around $1.4 million less for collection each year. Over the term of the next collection contract, this could save the City just under $10 million.
- Minimal new investment would have to be made to process recyclables. In comparison, implementing System 1 (formerly System B) could require $20.2 million in new capital investment.
- System 2 is the only one of the three systems that would allow for leaf and yard waste to be kept as a separate stream of materials, that could be directed for separate composting (at a relatively lower cost) at the composting site at Glanbrook. The exact savings have not been quantified as the redirection of leaf and yard waste would occur as reasonable, but based on current operating costs for both facilities the savings could reduce the differential in the overall system costs between System 1 and System 2.
- System 2 allows for a decrease in GHG emissions and emissions of smog precursors compared to the Status Quo, through a reduction in fleet size. Increased diversion resulting from bi-weekly garbage collection will also decrease GHG emissions.
- Overall, in regards to implementation, System 2:
    - will require a supporting promotion & education campaign;
    - will require the minimum of change in regards to recycling processing, and
    - has the capacity to 'free-up' capacity in the CCF by directing leaf and yard materials to Glanbrook for composting.

Variations for the Preferred Collection System(s)

Container types for recyclables (boxes, bags, or carts)

It was determined that there could be benefits to the City if use of bags for recyclables was encouraged:

- Ceasing distribution of blue boxes could save approximately $400,000 in blue box purchase and distribution costs annually. The City already has some infrastructure at the MRF to handle film plastic. The MRF review that is currently underway will identify if any additional infrastructure (i.e. bag breaker on the fibre line) is needed to support transition to bagged recyclables. The capital cost of adding another bag- breaker is currently estimated as around $100,000 to $160,000. The City already incurs operating costs to break and handle bags.
- Collection of material in blue bags is more efficient which has the potential to reduce recycling collection costs. While some additional processing costs may be incurred it is expected that there could be annual savings for the City by transitioning to a more bag based system.
- The use of bags for recyclables will reduce litter, reducing costs incurred for litter collection and improving the aesthetics of the streetscape.
- The use of bags for recyclables will improve material quality, keeping paper and other materials dry during inclement weather. This will improve MRF operations and can increase revenues.

Container Restrictions for Garbage (rigid containers or bags)

It was assumed that the transition to bi-weekly garbage, would involve setting a bi-weekly two-container limit for curbside garbage customers. However, there are some disadvantages to setting a two-container limit that were reviewed being:

- A bi-weekly two-container limit is the equivalent of setting a bi-weekly four to six garbage bag limit. This is generous and may not encourage diversion.
- It takes longer to pick-up and empty garbage containers. Setting a bag-limit could improve collection efficiency.

It was recommended that the City examine diversion performance after the transition to bi-weekly garbage collection, and that if diversion performance was not meeting expectations, that the City could either move to a more stringent bag-limit and/or consider requiring clear bags for collection.

Special Considerations Policy

Some households have difficulty meeting the current weekly one-container limit and are eligible for special considerations. Review of the current policy indicates that it is currently meeting the

needs of residents. No change to the policy was recommended, with the exception of modifying it slightly to allow for a bi-weekly six-container limit for eligible households.

Bulky waste collection

The recommended approach is to continue to provide separate bi-weekly call-in bulk collection service throughout the year.

Collection Operating Hours

Review of collection and facility operating hours indicated that collection could take place over 10 hours each day (7 a.m. to 5 p.m.). This would accommodate the current facility operating schedules as the scale houses at most of the City's facilities close at 6 p.m. to haulers.

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1 INTRODUCTION

In September 2010, the City of Hamilton (the City) retained Stantec Consulting Ltd. (Stantec) to perform a service level review of its residential waste collection system. The study was broken down into two phases as follows:

Phase 1. The first phase of the study involved conducting a service level evaluation of Hamilton's residential waste collection program. The goal of this phase was to identify a preferred collection system(s) to be used during the term of the next collection contract slated to begin in April 2013. The service level review also addressed the matter of recyclables processing as the current processing contract will expire as of the end of March 2013 and as the method of recyclables processing (two stream vs. single stream) was also under consideration.

Phase 2. The second phase of the project (which is yet to be completed) is to assist the City in developing the Collection and Processing Requests for Proposals (RFPs) based upon the results of the service level review.

The purpose of this report is to document the results of Phase 1 of the Study (Identification of the Preferred Collection System Option(s)). Phase 1 of the study consisted of four tasks (which were outlined in our original proposal) as follows:

- Task 1 – Project Initiation
- Task 2 – Projections of Short-Term Material Composition and Quantity
    - Data Collection and Analysis
    - Detailed Curbside Waste Composition and Projected Material Quantities
    - Finalize long-list of Collection System Options
- Task 3 – Evaluation of Long-Listed Collection System Options
- Task 4 – Evaluation of Short-Listed Collected System Options
    - Examination of Variations for the Preferred Collection System Option(s)

The following sections document the results of Phase 1 of the study.

2 PROJECT INITIATION

A project initiation meeting was held on September 13th, 2010 between key Stantec team members and City staff to confirm scope of work, gather further details and background information concerning the City's waste collection and processing system, and to enable

Stantec staff to gain a well-rounded understanding of the circumstances surrounding the City's current and future diversion and collection requirements.

One of the key outcomes of the project initiation meeting was the development and refinement of a matrix that set out the initial draft long-list of collection system options. This draft matrix included collection system options based on combinations of the following three variables:

- Two-stream or single-stream collection for recyclables;
- Frequency of recycling, garbage, and leaf & yard waste (LYW) collection (weekly, bi-weekly). City staff decided that Green Cart organics should remain weekly; and,
- Options for separate collection or co-collection of materials to improve system efficiencies.

After combining these three variables in different ways, a total of nine (9) different potential collection systems were developed (the draft long-list). The following table (Table 2-1) presents the initial draft long-list of collection system options. This list was further refined during Task 2 of the study and a finalized long-list was determined. This finalized long-list is presented and discussed in Section 4.1 of this report.

Table 2-1 Initial Draft Long-List of Collection System Options

System	Frequency	Separate Collection	Co-collection	Comments
System A (Status Quo)				
Garbage	weekly		✓	Garbage and Green Cart co-collection
Green Cart Organics	weekly		✓	
LYW	bi-weekly (spring and fall)	✓		Separate peak collection of LYW.
Containers (2 Stream)	weekly		✓	Co-collection of 2-stream recyclables
Fibres (2 Stream)	weekly		✓	
System B				
Garbage	bi-weekly	✓		Bi-weekly collection of Garbage
Green Cart Organics	weekly		✓	Weekly co-collection of Green Cart and SS Recyclables
LYW	bi-weekly (spring and fall)	✓		Separate peak collection of LYW.
SS Recycling	weekly		✓	
System C				
Garbage	bi-weekly	✓		Bi-weekly collection of Garbage
Green Cart Organics	weekly	✓		
LYW	bi-weekly (spring and fall)	✓		Separate peak collection of LYW.
SS Recycling	weekly	✓		
System D				
Garbage	bi-weekly	✓		Bi-weekly collection of Garbage
Green Cart Organics	weekly	✓		
LYW	bi-weekly (spring and fall)	✓		Separate peak collection of LYW.
Containers (2 Stream)	weekly	✓		Weekly Co-collection of 2-stream recyclables
Fibres (2 Stream)	weekly	✓		
System E				
Garbage	bi-weekly		✓	Green Cart co-collected with Garbage and SS recyclables
Green Cart Organics	weekly		✓	on alternating weeks (week 1 Green Cart/Garbage, week 2 Green Cart/recyclables)
LYW	bi-weekly (spring and fall)	✓		Separate peak collection of LYW.
SS Recycling	bi-weekly		✓	
System F				
Garbage	weekly		✓	Weekly Garbage and SS recyclable co-collection
Green Cart Organics	weekly		✓	Weekly Green Cart and LYW co-collection
LYW	weekly (year-round)		✓	
SS Recycling	weekly		✓	
System G				
Garbage	bi-weekly	✓		Alternating week Garbage and SS recyclable collection
Green Cart Organics	weekly		✓	Weekly Green Cart and LYW co-collection
LYW	weekly (year-round)		✓	
SS Recycling	bi-weekly	✓		
System H				
Garbage	bi-weekly	✓		Bi-weekly collection of Garbage
Green Cart Organics	weekly		✓	Weekly Green Cart and LYW co-collection
LYW	weekly (year-round)		✓	
Containers (2 Stream)	weekly		✓	Weekly Co-collection of 2-stream recyclables
Fibres (2 Stream)	weekly		✓	
System I				
Garbage	bi-weekly		✓	Alternating weekly collection of Garbage and LYW
Green Cart Organics	weekly	✓		Separate weekly collection of Green Cart
LYW	bi-weekly (year-round)		✓	
Containers (2 Stream)	weekly		✓	Weekly Co-collection of 2-stream recyclables
Fibres (2 Stream)	weekly		✓	

3 CURRENT COLLECTION SYSTEM AND WASTE PROJECTIONS

3.1 Introduction

This section provides a brief description of the current waste collection system and projections for the material composition and quantity that would be managed over the term of the next collection contract (2013-2018). The waste projections provided a baseline from which to project the City's future waste collection needs.

3.1.1 Information Sources

The following is a list of information sources that were used in the development of the current system description and waste projections:

- RIS International Ltd. 2004. Waste Collection Services Strategy: A Discussion Paper on Collection Options.
- City of Hamilton By-Law No. 09-067 – Solid Waste Management By-Law
- City of Hamilton 2009 Waste Diversion Ontario Datacall
- Stantec Consulting Ltd. 2009. 2009 Waste Composition Studies Project A: 2009 Waste Composition Study.
- Stantec Consulting Ltd., 2010. 2010 Multi-Residential Waste Composition Study.
- Various data spreadsheets provided by the City including:
    - 2009 Processed Tonnes (Actuals).xls
    - 2009 Units - Info for Collection Service Review.xlsx
    - AFR 512520 Recycling Nov22_2010.xls
    - AFR Waste Collection Nov22_2010.xls
    - 2009 Bulk Waste Tonnage & Calls.xls
    - Copy of ABC Dec 2009 November 8th.xls
    - Truck Data1 - updated.xls
    - A Zone Time Motion Study.xls
    - Data required for modelling.xls

3.2 Current Waste Management System Performance

3.2.1 Overview of Current Waste Management System

The following table (Table 3-1) provides a high level overview of the City's current waste management system as of 2009, including the facilities used to manage residential materials. Units serviced refer to all units serviced including residential, institutional, and commercial units.

Table 3-1 Overview of the City of Hamilton's Waste Management System[1]

	City of Hamilton Waste Management System Overview	2009
Facilities	Operating Municipal Landfill Sites	1
	Closed Landfill Sites	12
	Thermal Waste Treatment Facilities	0
	Community Recycling Centres & Transfer Stations	3
	Material Recovery Facilities (MRFs)	1
	Central Composting Facilities	1
	Leaf & Yard Waste Composting Facilities	1
Collection Programs	Garbage Collection (Units Serviced)	204,183
	Recyclable Material Collection (Units Serviced)	213,836
	Leaf & Yard Waste Collection (Units Serviced)	163,066 (curbside)
	Green Cart Organics Collection (Units Serviced)	213,836
	Total Garbage Collected (tonnes)	86,341
	Total Recycling Collected (tonnes)	44,263
	Total Leaf & Yard Waste Collected (Tonnes)	6,242
	Total Green Cart Organics Collected (tonnes)	37,038
	Total Materials Collected (tonnes)	173,884

3.2.2 Diversion Performance

Waste Diversion Ontario (WDO) undertakes a "General Agreed Principles" (GAP) analysis of residential materials diverted and disposed of within the province based on the information gathered during the annual WDO datacall. WDO considers a number of information sources when conducting their annual datacall and for calculating the diversion rate, including:

- An allowance for deposit containers returned from the residential sector;
- An allowance for residential on-property management through backyard composting and grasscycling.
- Municipally operated reuse activities;
- Municipally operated recycling activities; and,
- Municipally operated centralized composting of SSO and leaf and yard waste (LYW).

GAP diversion rates for the City based on 2006 to 2009 datacall information are provided in Table 3-2.

[1] Information obtained from City of Hamilton Waste Management website at http://www.hamilton.ca/CityDepartments/PublicWorks/WasteManagement/

Table 3-2 WDO General Agreed Principles (GAP) Diversion Rates for the City of Hamilton, 2006-2009[2]

Year	Population	Residential Waste Generated		Residential Waste Diverted		Residential Waste Disposed		Estimated Diversion Rate
		Tonnes	kg/cap	Tonnes	kg/cap	Tonnes	kg/cap	
2006	504,559	231,936	460	88,560	176	143,376	284	38.2%
2007	518,181	228,229	440	98,161	189	130,068	251	43.0%
2008	519,109	227,210	438	100,687	194	126,522	244	44.3%
2009	525,697	222,670	424	103,585	197	119,085	227	46.5%

As shown in the table above, the estimated waste diversion rate achieved by the City has increased fairly steadily over the past four (4) years. It is also interesting to note that the residential waste generated per capita has decreased every year for the past four years, as has the overall quantity of residual waste disposed.

In order to evaluate the performance of waste diversion programs, WDO places municipalities in one of nine (9) municipal grouping categories in order to compare program performance (i.e. tonnages and costs) in an 'apples to apples' manner.

WDO created the current municipal groupings based on program size (population and tonnage), geography (northern or southern), density (rural or urban) and collection process (curbside or depot collection). The municipal groupings are: large urban, medium urban, small urban, urban regional, rural collection north, rural collection south, rural depot north, rural depot south, and rural regional.

Presently, the City of Hamilton is placed in the 'large urban' grouping along with the following other municipalities:

- Regional Municipality of York;
- Regional Municipality of Halton;
- Regional Municipality of Peel;
- City of Toronto; and,
- City of London.

The following table (Table 3-3) presents a performance comparison of the different municipalities in the 'large urban' grouping. In 2008 (the latest year for which full data is available), in comparison to the other municipalities found in the 'large urban' grouping, the diversion performance of Hamilton was slightly below average. However, the 2008 results pre-

[2] Waste Diversion Ontario. 2009. Retrieved from http://www.wdo.ca/reports/default.aspx on September 22, 2010. Year 2009 data taken from spreadsheet provided by City called 2009 Processed Tonnes (Actuals).xls.

date recent system changes including the one container limit. The comparative position of Hamilton in relation to the other municipalities is expected to shift in 2009 and 2010.

Table 3-3 Program Performance for 'Large Urban' Municipalities, 2008[3]

Municipality	Residential Waste Generated		Residential Waste Diverted		Residential Waste Disposed		Estimated Diversion Rate
	Tonnes	kg/cap	Tonnes	kg/cap	Tonnes	kg/cap	
York	344,683	341	182,547	180	162,136	160	53.0%
Halton	201,103	435	102,822	222	98,281	212	51.1%
Peel	503,126	420	244,414	204	258,712	216	48.6%
Hamilton	227,210	438	100,687	194	126,522	244	44.3%
Toronto	921,605	367	405,069	161	516,536	206	44.0%
London	159,309	420	65,655	173	93,653	247	41.2%

3.2.3 Current Waste Collection System

Waste collection services are provided to all eligible properties participating in the collection program. Eligible properties that are permitted to participate in the collection program include[4]:

- Single detached dwellings and multiple dwellings with a maximum of 5 dwelling units, including street townhouse dwellings and excluding block townhouse complexes;
- Multiple dwellings with 6 or more dwelling units, including block townhouse complexes and trailer parks;
- Other residential property, including lodging houses and residential care facilities in residential neighbourhoods;
- Commercial properties, excluding commercial properties with four or more floors, regional shopping centres, community shopping centres, neighbourhood shopping centres and strip malls;
- Places of worship, except uses that are accessory or ancillary to the place of worship; and,
- Elementary and secondary schools, for the collection of organic waste and recyclable materials only.

The following table (Table 3-4) lists the number and types of units serviced by the waste collection system in 2009. The list does not include schools, some of which participate in the recycling collection program.

[3] Waste Diversion Ontario. 2009. Retrieved from http://www.wdo.ca/reports/default.aspx on September 22, 2010.
[4] City of Hamilton By-Law No. 09-067 – Solid Waste Management By-Law

Table 3-4 Number and Types of Units Serviced, 2009[5]

	Unit Type	Number of Units
Curbside Collection	Single Family (up To 5 Units)	138,598
	Other Eligible Curbside (group homes, boarding homes, churches)	1,821
	Multi-Residential Horizontal (row housing, six-plexes, mobile home communities)	17,395
	Commercial	5,252
Automated Collection	Multi-Residential Blue Cart	50,369
	Multi-Residential Bin Garbage	41,117
	Other Blue Cart (e.g. City Facilities)	401

3.2.3.1 Curbside Collection

Curbside collection of garbage, recycling, Green Cart organics, Leaf & Yard Waste (LYW), and bulk waste is provided to most eligible units. In 2009, 163,066 curbside units were serviced (this is made up primarily of residential units with some institutional and commercial units included).[6] Table 3-5 provides a summary of the current curbside collection level of service.

Table 3-5 Curbside Waste Collection Level of Service, 2010

System Component	Frequency of Collection	Separate Collection	Co-Collection
Garbage	Weekly		✓ (with SSO)
Green Cart Organics	Weekly		✓ (with Garbage)
Blue Box (Containers)	Weekly		✓ (with Fibres)
Blue Box (Fibres)	Weekly		✓ (with Containers)
LYW (incl. Christmas trees)	Bi-Weekly Seasonal (alternates with Bulk Waste)	✓	
Bulk Waste	Seasonal Call-In Service (alternates with LYW)	✓	

The City is sub-divided into six (6) zones for collection of all curbside waste materials. The collection zones were established in 2001 as part of the harmonization of waste collection services that resulted from the formation of the new City of Hamilton. The zones were established in pairs based on their collection characteristics:

[5] Taken from spreadsheet provided by City entitled "2009 Units – Info for Collection Service Review.xlsx"
[6] Taken from spreadsheet provided by City entitled "2009 Units – Info for Collection Service Review.xlsx"

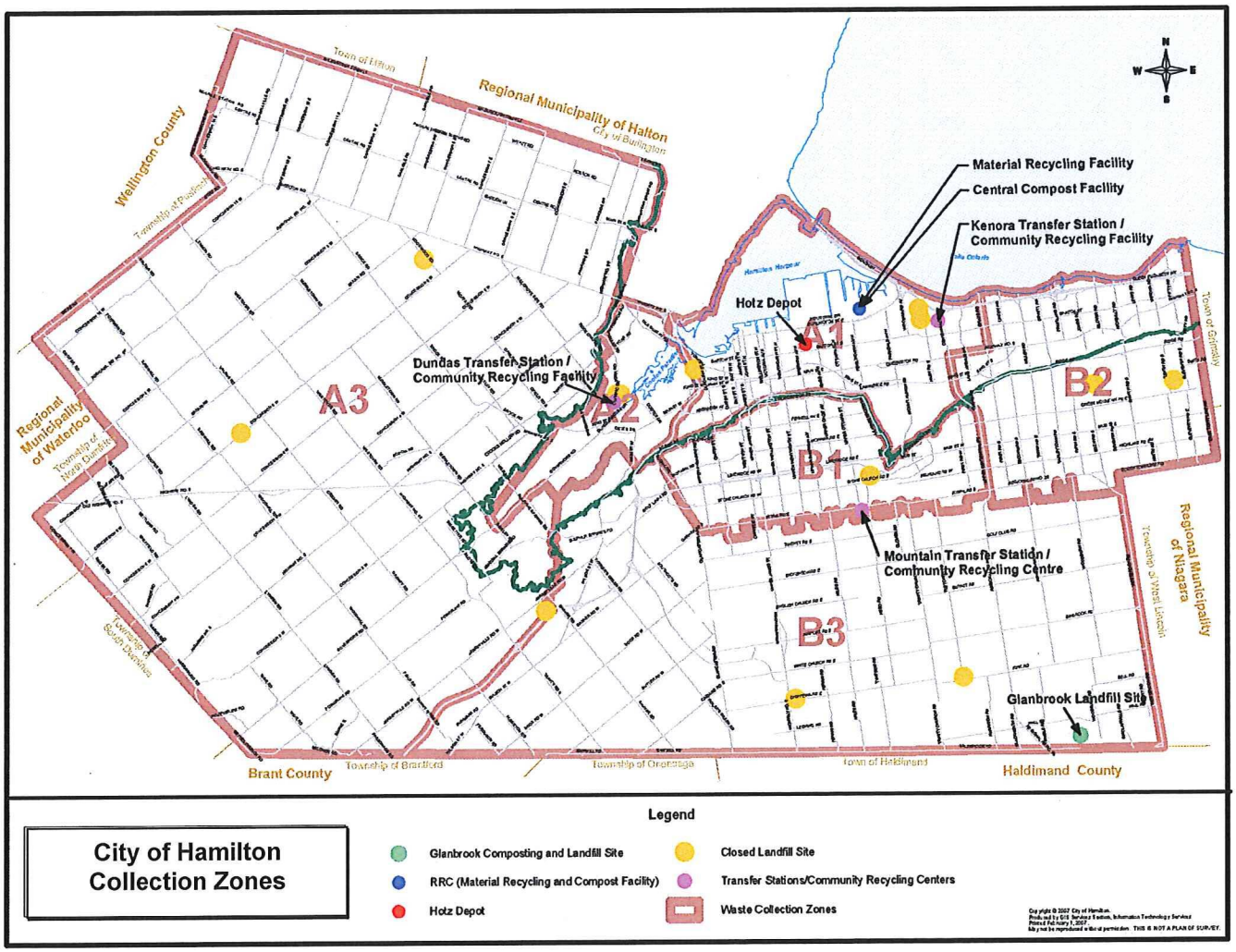
- Urban (A1/B1)
- Suburban (A2/B2)
- Rural (A3/B3).

Garbage and organics co-collection is provided by a combination of public forces and private contractors. The A zones are serviced by public forces while B zones are serviced by National Waste Services Inc. (NWS) (Contract Number C11-11-05 which runs until March 31, 2013). The split in service provision provides a competitive environment and has been studied by the City as part of an activity based costing model.

Blue Box co-collection (fibres and containers) is provided City-wide by NWS (Contract Number C11-127-06 which runs until March 31, 2013).

LYW and Bulk Waste are collected in each zone by the contractor responsible for the collection of garbage and organics in that zone. The current curbside collection zones are outlined in Figure 3-1.

Figure 3-1 Map Displaying Curbside Collection Zones



3.2.3.2 Multi-Residential (Automated) Collection

The collection of materials from large multi-residential buildings is completed separately from curbside collection (with the exception of Green Cart organics and bulk waste which are collected via the curbside collection program). Currently, the following materials are collected from large multi-residential buildings: garbage, recycling, Green Cart organics, and bulk waste materials. For large multi-residential buildings, bulk waste material collection is provided on a year-round basis (on a call-in basis) as compared to curbside customers who receive bulk waste collection on a seasonal basis.

The collection of Green Cart organics and bulk waste is completed by the contractor responsible for curbside collection in that collection zone. The collection of garbage (automated bin) and recyclable containers (automated cart) is provided by NWS. BFI Canada is responsible for the collection of fibre recycling bins from multi-residential buildings.

Note: Although the collection of Green Cart organics and bulk waste materials from large multi-residential is technically a curbside service, for the purposes of this report, they were included under the multi-residential collection program.

3.2.4 Garbage Collection

3.2.4.1 Overview

For curbside customers, garbage is currently co-collected weekly with green cart organics. For residential properties participating in the curbside collection program, there is currently a one (1) container limit per week (except for the weeks following Victoria Day, Thanksgiving Day, and New Year's Day when there is a three (3) container limit). For commercial properties participating in the curbside collection program there is currently a six (6) container limit per week unless it is located in a Special Policy area when collection may be provided up to three (3) times per week. Curbside garbage containers must have a volume of less than 135 litres and not exceed 23 kg in weight.

For participants in the multi-residential automated collection program, garbage collection is provided for up to three (3) bins up to three (3) times per week. Garbage bins must not exceed 6.12 m^3 for loose garbage and 2.293 m^3 for compacted garbage.

After reaching capacity, trucks drop-off loads of garbage at one of the City's three Transfer Stations depending on the collection zone. Trucks serving collection zones A2 and A3 utilize the Dundas transfer station, trucks serving collection zones A1 and B2 utilize the Kenora

transfer station, trucks servicing collection zones B1 and B3 utilize the Mountain transfer station. Garbage is transferred from the transfer stations for disposal at the Glanbrook Landfill.

3.2.4.2 Garbage Collection Program Performance

In 2009, a total of 83,512 tonnes of residential garbage was collected in the City compared to 95,983 tonnes in 2008, a decrease of 13%. It is expected that garbage tonnages collected will decrease further in 2010 due to implementation of the mandatory one container limit effective April 5th 2010.

The following table (Table 3-6) provides a summary of City-wide garbage collection program performance from 2008 to 2009 (both curbside and multi-residential).

Table 3-6 City-Wide Garbage Collection Program Performance, 2008-2009

Parameter	2008 Actual	2009 Actual
Serviced Units[A]	203,887	204,183
Tonnes Collected[B]	95,983	83,512
Kg Collected/Unit	470.8	409.0

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls

The City completed a two (2) week residential curbside waste characterization audit in the fall of 2009. The study involved the collection of all waste streams from 100 single family households located across the City and curbside collection areas. The results of the audit show that the weekly set-out rate for garbage is approximately 76.5%. During the audit, each household placed approximately 6.09 kg/week of garbage at the curb.

The following table (Table 3-7) provides an overview of residential curbside garbage collection costs and tonnes by curbside collection area in 2009.

Table 3-7 Curbside Garbage Collection Costs and Tonnes by Curbside Collection Area, 2009

Parameter	City	NWS	City	NWS	City	NWS
	A1	B1	A2	B2	A3	B3
Serviced Units[A]	51,386	53,439	12,462	14,600	13,996	17,182
Tonnes Collected[B]	23,540	20,502	3,966	5,652	5,288	6,310
Kg Collected/Unit	458.1	383.6	318.3	387.1	377.8	367.2
Collection Cost/Tonne[C]	$124.82	$123.36	$156.94	$144.00	$145.16	$114.67
Annual Total Collection Cost	$2,938,188	$2,529,039	$622,432	$813,917	$767,565	$723,547

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls
C – Copy of ABC Dec 2009 November 8th.xls

The following table (Table 3-8) provides an overview of multi-residential garbage collection tonnes in 2009. There was a significant degree of variation in the multi-residential tonnes per unit collected with generally those units in the urban centre placing more garbage out for collection.

Table 3-8 Multi-Residential Garbage Collection Tonnes, 2009

Parameter	A1	B1	A2	B2	A3	B3
Serviced Units[A]	25,734	8,678	2,943	3,027	642	93
Tonnes Collected[B]	11,910	4,710	540	794	290	11
Kg Collected/Unit	462.8	542.7	183.4	262.4	451.7	116.9

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls

3.2.5 Recycling Collection

3.2.5.1 Overview

For curbside customers, the City operates a two-stream recycling system with fibres and containers being co-collected on a weekly basis. Curbside customers are permitted to place their recyclable material in a clear or translucent bag, a blue box provided by the City or a plastic receptacle comparable in weight and dimensions to a blue box as long as fibres and containers are kept separate. Bulkier material such as corrugated cardboard is bundled and placed beside the other recyclable containers. Although there is no limit placed on the amount of recyclables that may be placed out for collection, the weight limit for any single container or bundle is 13 kg.

For participants in the multi-residential collection program, recycling collection is provided up three (3) times per week for multi-residential facilities with six (6) or more dwelling units, residential care facilities, and commercial properties in Special Policy Areas. Collection is provided once (1) per week at commercial properties which are not located in a Special Policy Area and elementary or secondary schools. Eligible containers are a rigid, reusable container provided by the City having a hinged lid, wheels and a volume not exceeding 364 litres, a receptacle similar to the above, or a bin container not less than 2.293 m^3 and not exceeding 6.12 m^3 for fibres only.

The following items are currently accepted for paper recycling:

- Cardboard
- Molded Pulp (egg cartons, coffee cup trays etc.)
- Boxboard
- Fine Paper
- Newspapers and Magazines
- Paper Towel or Toiler Paper Cores
- Soft-cover Books
- Telephone Books

The following items are currently accepted for container recycling:

- Glass – Bottles and jars
- Metal – Metal cans, Soft drink cans, Aluminum containers, Clean foil, Empty paint cans with lids removed, Aerosol cans (empty hairspray, paint, whipping cream), Spiral-wound canisters with metal ends (frozen concentrate cans, potato chip tube)
- Plastic – HDPE & PETE plastic bottles, jars and jugs, tubs and tub lids (yogurt, sour cream, hand cleaner, margarine containers), plastic grocery or shopping bags, Styrofoam (coffee cup lids, plastic bakery trays, Styrofoam containers)
- Cartons – Milk and juice cartons
- TC Tetra Pak – Drink boxes, Soup boxes, Milk boxes

After reaching capacity, trucks deposit these materials for processing at the City's Material Recovery Facility (MRF) located at 1579 Burlington St. East.

3.2.5.2 Recycling Collection Program Performance

In 2009, a total of 44,263 tonnes of residential recyclables were collected in the City compared to 45,282 tonnes in 2008. It is expected that the amount of recyclable tonnage collected will increase in 2010 due to implementation of the mandatory one container limit in April of 2010.

Table 3-9 provides a summary of City-wide recycling collection program performance from 2008 to 2009. As the recycling contract is a City-wide contract (including both curbside and multi-residential customers), costing is presented as a lump sum contract cost and is not broken down by collection zone.

Table 3-9 City-Wide Recycling Collection Program Performance, 2008-2009

Parameter	2008 Actual	2009 Actual
Serviced Units[A]	209,479	213,836
Tonnes Collected[B]	45,282	44,263

Parameter	2008 Actual	2009 Actual
Kg Collected/Unit	216.2	207.0
Overall Collection Costs[C]	$6,806,647	$6,376,387
Collection Costs/Tonne	$150.32	$144.06

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls
C – From 2009 WDO datacall submission (curbside collection contract costs)

As mentioned previously, WDO categorizes municipalities into one of nine groupings based upon various program characteristics (e.g. size, geographic location etc.). Presently, the City of Hamilton is placed in the 'large urban' grouping along with the following other municipalities:

- Regional Municipality of York;
- Regional Municipality of Halton;
- Regional Municipality of Peel;
- City of Toronto; and,
- City of London.

Over the past number of years, Stantec has created a database of blue box program performance data for all municipalities located in the province. Currently, the database consists of data collected by WDO from the years 2006 to 2009.

Blue box program performance can be measured in a number of different ways including:

- Net cost per household;
- Net cost per tonne of material marketed;
- Collection costs per household;
- Kg of material marketed per household; and,
- Promotion and education costs per household;

The following table (Table 3-10) illustrates the program performance for the 'large urban' grouping as a whole and how the City of Hamilton's program performance compares.

Table 3-10 WDO Program Performance Data for 'Large Urban' Municipalities

Year	Minimum	Maximum	Median	Hamilton
Net Annual Residential Recycling Program Cost per Household				
2006	$21.4	$49.3	$34.1	$35.1
2007	$20.1	$38.2	$30.9	$31.3
2008	$24.4	$43.8	$37.7	$36.8

Year	Minimum	Maximum	Median	Hamilton
2009	$36.2	$64.3	$45.1	$39.4
Net Annual Residential Recycling Program Cost per Tonne Marketed				
2006	$123.3	$192.2	$136.2	$181.2
2007	$118.4	$157.9	$139.1	$157.7
2008	$145.6	$182.1	$150.1	$182.1
2009	$189.8	$288.8	$222.3	$209.3
Total Annual Collection Costs per Household				
2006	$20.1	$37.9	$31.6	$34.3
2007	$22.2	$38.1	$30.0	$30.7
2008	$23.8	$42.4	$31.8	$34.8
2009	$24.9	$46.8	$29.1	$32.1
Total Annual Recycling Materials Marketed per Household (kg)				
2006	168.3	265.8	225.0	193.6
2007	155.0	251.5	217.1	198.3
2008	167.2	261.2	222.5	201.9
2009	150.6	249.0	205.7	188.1
Promotion and Education Costs per Household				
2006	$0.27	$1.95	$0.48	$0.49
2007	$0.63	$1.88	$0.93	$1.69
2008	$0.57	$2.23	$1.36	$2.12
2009	$0.62	$2.07	$1.47	$ 2.07

As the table above shows, generally speaking, the performance of the City's recycling program tends to be close to the median for the 'large urban' grouping.

The results of the curbside waste audit completed in the fall of 2009 show that the weekly set-out rate for recycling is 81%. Each household produced approximately 1.43 kg/wk of containers and 3.81 kg/wk of fibres.

The following table (Table 3-11) provides an overview of residential curbside recycling collection tonnes by curbside collection area in 2009.

Table 3-11 Curbside Recycling Collection Tonnes by Curbside Collection Area, 2009

Parameter	NWS A1	NWS B1	NWS A2	NWS B2	NWS A3	NWS B3
Serviced Units[A]	51,386	53,439	12,462	14,600	13,996	17,182
Tonnes Collected[B]	10,619	13,576	3,614	3,463	3,501	5,147
Kg Collected/Unit	206.7	254.1	290.0	237.2	250.2	299.6

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls

Table 3-12 provides an overview of multi-residential recycling collection tonnes in 2009.

Table 3-12 Multi-Residential Recycling Collection Tonnes, 2009

Parameter	A1	B1	A2	B2	A3	B3
Serviced Units[A]	30,820	9,999	6,105	2,704	785	357
Tonnes Collected[B]	2,260	1,078	304	358	217	125
Kg Collected/Unit	73.3	107.8	49.8	132.3	277.0	350.3

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls

3.2.5.3 Recycling Processing Performance

Recyclables are processed at the city owned Material Recycling Facility (MRF) which is operated by Canada Fibers Ltd. (CFL). In addition to processing recyclable material collected via the curbside multi-residential recycling programs, the MRF also accepts material collected from community events, public spaces, some other municipalities, schools, and material collected at the three CRCs.

The following table (Table 3-13) illustrates the MRF processing performance from 2008 to 2009.

Table 3-13 Recycling Processing Performance, 2008-2009

Parameter	2008	2009
Tonnes Processed[A]	46,969	46,223
MRF Residue[A]	4,608.2	3,856
Processing Contract Cost[B]	$2,212,422	$2,027,775
Processing Cost/Tonne	$47.10	$43.87

Data Source:
A – Copy of 2009 Processed Tonnes (Actuals).xls
B – 2009 WDO Datacall submission (contract cost only)

3.2.6 Green Cart Organics Collection

3.2.6.1 Overview

For curbside (and most multi-residential) customers, the City collects Green Cart organics on a weekly basis (co-collected with garbage). The only permitted container for organic waste is a 120 L green, rigid, reusable container equipped and maintained with handles and a hinged lid

with a maximum capacity as approved by the City. Residents are permitted to use compostable liners.

The following materials are accepted in the Green Cart Program:

- Baked goods
- Bones
- Bread
- Butter and margarine
- Cake
- Candy
- Cereal
- Cheese
- Coffee filters and grounds
- Cookies
- Corn cobs and husks
- Dairy products
- Eggs and eggshells
- Fish and fish parts
- Flour
- Fruit
- Grains
- Gravy and sauces
- Grease / lard / fat
- Herbs and spices
- Jams and jellies
- Mayonnaise
- Meat and meat products
- Nuts and nut shells
- Oatmeal
- Pasta
- Peanut butter
- Pizza
- Popcorn
- Pumpkins
- Rice
- Salads
- Shellfish
- Sugar
- Syrup
- Tea bags
- Vegetables
- Watermelon
- Yogurt
- Facial tissues
- Freezer paper
- Greasy pizza boxes
- Microwave popcorn bags
- Paper bags
- Paper coffee cups
- Paper napkins / plates
- Paper towels
- Waxed paper
- Waxed paper coffee cups
- Dryer lint
- Feathers
- Hair
- Houseplants
- Nail clippings
- Pet Hair
- Popsicle sticks
- Sawdust (in paper bags)
- Toothpicks
- Wood ashes (cold – in paper bags)
- Wood chips soil

Unacceptable materials include aluminum foil, animal carcasses, ceramics, compostable chip bags, dead animals, diapers, dirt, earth, soil or sod, drinking straws, dryer sheets, glass jars, hazardous waste, medical waste, pet waste, plastic bags and containers, rocks, sanitary products, styrofoam products, textiles, tree stumps, or wood.

3.2.6.2 Green Cart Organics Program Performance

In 2009, a total of 37,038 tonnes of residential Green Cart waste was collected in the City compared to 33,797 tonnes in 2008. Approximately 10% more organics were collected in 2009.

Table 3-14 City-Wide Green Cart Collection Program Performance, 2008-2009

Parameter	2008 Actual	2009 Actual
Serviced Units[A]	209,479	213,836
Tonnes Collected[B]	33,797	37,038
Kg Collected/Unit	161.3	173.2

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls

The following table (Table 3-15) provides an overview of residential curbside organics collection costs and tonnes for 2009.

Table 3-15 Curbside Organics Collection Costs and Tonnes by Curbside Collection Area, 2009

Parameter	City A1	NWS B1	City A2	NWS B2	City A3	NWS B3
Serviced Units[A]	51,386	53,439	12,462	14,600	13,996	17,182
Tonnes Collected[B]	9,012	13,640	2,162	3,784	2,963	4,666
Kg Collected/Unit	175.4	255.2	173.5	259.2	211.7	271.5
Collection Cost/Tonne[C]	$124.82	$123.36	$156.94	$144.00	$145.16	$114.67
Annual Total Collection Cost	$1,124,822	$1,682,571	$339,286	$544,894	$430,087	$535,034

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls
C - Copy of ABC Dec 2009 November 8th.xls

3.2.7 Leaf & Yard Waste (LYW) Collection

3.2.7.1 Collection Methodology

For curbside customers, the City operates a dedicated seasonal bi-weekly LYW collection program from mid April to the end of July, and from the beginning of September to the end of November (a total of 13 weeks of LYW collection are provided to each household - 13 weeks for A zones and 13 weeks for B zones) . When the program is in operation, residents are permitted to place an unlimited amount of LYW out for collection. The City also operates a one week Christmas tree collection program in January. In addition to the dedicated LYW collection program, residents are also permitted to top-up their green bins with LYW and place up to two (2) additional containers of LYW beside their green cart throughout the year.

LYW may be placed in the green cart (topped up), compostable paper yard waste bags, open top rigid reusable containers, or tied in a bundle. Containers and bundles cannot weigh more than 23 kg. Branches are to be tied with string in bundles of less than 1.2 m in length and 75 cm in width with individual branches measuring less than 7 cm in diameter.

The following materials are not collected as part of the LYW waste program:

- Blue box materials;
- Branches exceeding 7cm (2.5 inches) in diameter;
- Branches exceeding 1.2m (4ft) in length;
- Earth;
- Garbage of any kind;
- Planting containers;
- Rocks;
- Sod;
- Soil;
- Tree stumps; and,
- Wood (lumber).

LYW material is collected and processed separately from green cart material when the dedicated seasonal LYW collection program is in effect (at the composting pad located at the Glanbrook landfill). During periods when the dedicated program is not in effect, LYW is co-collected with green cart material and processed at the central composting facility (CCF).

3.2.7.2 Leaf & Yard Waste Program Performance

In 2009, a total of 6,241 tonnes of LYW was collected in the City compared to 6,285 tonnes in 2008. Peak LYW tonnages appear to have been very stable over this period.

The following table provides an overview of residential curbside LYW collection costs and tonnes by curbside collection area for 2009.

Table 3-16 Curbside LYW Collection Costs and Tonnes by Collection Area, 2009

Parameter	A1	B1	A2	B2	A3	B3
Serviced Units[A]	51,386	53,439	12,462	14,600	13,996	17,182
Tonnes Collected[B]	1,205	2,113	504	544	836	1,040
Kg Collected/Unit	23.4	39.5	40.5	37.2	59.8	60.5
Collection Cost/Tonne	$192.11	$215.92	$136.23	$221.07	$196.08	$133.88
Annual Total Collection Cost[C]	$231,443	$456,174	$68,720	$120,205	$163,988	$139,230

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls
C - Copy of ABC Dec 2009 November 8th.xls

3.2.8 Bulk Waste Collection

3.2.8.1 Collection Methodology

For curbside customers, the City operates a seasonal call-in bulk waste collection program during periods when the LYW collection program is not in effect (in the order of 18 weeks of the year). For multi-residential buildings, the City operates the bulk waste collection service year-round on a call-in basis. Each bulk waste item can weigh no more than 90 kg.

For properties including a single detached dwelling, multiple dwelling with a maximum of 5 dwelling units, lodging house, residential care facility or place of worship a total of four (4) items can be set out. For a property considered a multiple unit dwelling, no more than eight (8) items can be sent out.

The following items are accepted in the Bulk waste collection program:

- Bathtubs: porcelain tubs must be broken into pieces that do not weigh more than 23 kg or 50lbs;
- Carpet: tied and bundled. No longer than 1.2m;
- Computers;
- Floor lamps;

- Furniture;
- Glass: large, unbroken glass in a frame - windows, for example - with strong tape applied in an 'X' across both sides of the glass;
- Mattresses;
- Plastic bicycle and tricycle parts;
- Pool filters;
- Pool pumps;
- Sinks;
- Tires from passenger vehicles separated from the rim. One tire counts as one item;
- Toilets;
- Televisions; and,
- Wood - less than 1.2m long; must be bundled and tied, with nails hammered down (or taken out). Pressure treated wood is not collected.

3.2.8.2 Bulk Waste Collection Program Performance

In 2009, a total of 2,829 tonnes of bulk waste was collected in the City compared to 3,403 tonnes in 2008. The following table provides an overview of bulk waste collection costs and tonnes by collection area in 2009.

Table 3-17 Curbside and Multi-Residential Bulk Waste Collection Costs and Tonnes by Area, 2009

Parameter	A1	B1	A2	B2	A3	B3
Serviced Units[A]	82,206	63,438	18,567	17,304	14,781	17,539
Tonnes Collected[B]	1,506	720	136	118	238	112
Kg Collected/Unit	18.3	11.3	7.3	6.8	16.1	6.4
Collection Cost/Tonne	$279.82	$163.89	$504.99	$254.94	$689.17	$98.75
Annual Total Collection Cost[C]	$421,371	$117,932	$68,720	$30,132	$163,988	$11,017

Data Source:
A – 2009 Units - Info for Collection Service Review.xlsx
B – Copy of 2009 Processed Tonnes (Actuals).xls
C - Copy of ABC Dec 2009 November 8th.xls

3.3 Waste Facility Profiles

3.3.1 Transfer Stations/Community Recycling Centres (CRCs)

The City has three (3) Transfer Stations and three (3) Community Recycling Centres (CRCs) located in east Hamilton, Dundas and Hamilton Mountain. The Transfer Stations and CRCs are

two distinct areas and operations which share a single site and the same certificate of approval (C of A).

One portion of the Site is dedicated to Transfer Station operations and accepts various materials from curbside collection vehicles and IC&I customers. This part of the Site includes a Transfer Station building with tipping floor and loading bay and also has outdoor bunkers which are used to collect and store materials such as scrap metal and LYW.

The CRCs have been designed as Container Stations where residents and small commercial customers are able to dispose of waste and a variety of recyclable materials in roll-off bins. Each CRC has a HHW depot for residential drop-off. Roll-off bins of varying sizes are currently used to collect and store the materials at the CRCs and from there they are transported for recycling or disposal.

The Mountain CRC also has a Reuse Centre where customers can drop-off reusable items and purchase items in the retail store area of the Reuse Centre. Weigh scales are located at each Transfer Station and CRC. The scale-house operator processes all inbound/outbound vehicles dropping off materials at the Transfer Stations and Garbage only at the CRCs. No fees are charged for divertible materials at the CRCs, excluding shingles. The operations of the Transfer Stations, CRCs and scale-house operations are currently all separate contracts.

3.3.2 Material Recovery Facility (MRF)

The Material Recycling Facility (MRF) is owned by the City of Hamilton and is operated by Canada Fibers Ltd. (CFL). The MRF receives two stream recyclables (mixed fibers and mixed containers) from a blue box based program from the residents of the City. All recyclable materials are hauled by a collection contractor in split collection trucks. Materials are tipped at the MRF (mixed fibers in one area, mixed containers in another area) and processed on the mixed fiber line and mixed container line. Separated material is then sent to markets and residue sent to landfill.

3.3.3 Central Composting Facility (CCF)

The Central Composting Facility (CCF) is owned by the City of Hamilton and operated by Aim Environmental Group (supported by Van Kaathoven Group). The CCF is designed to process 60,000 tonnes of Source Separated Organics (SSO) and leaf and yard waste and convert this material into usable compost which is sold. The CCF has a design peak capacity of 90,000 tonnes per year to manage seasonal fluctuations (i.e., during peak periods of LYW production in the fall).

The CCF utilizes an aerobic in-vessel composting technology that has been successfully operating in the Netherlands and other countries for nearly two decades. It was constructed through a partnership between the City and Maple Reinders Constructors Ltd. and the design-build-operate (DBO) team which includes Associated Engineering as the design consultant, the Christians Group B.V. who provided the technology and Aim Environmental Group supported by Van Kaathoven Group who operates the facility.

3.4 Projected Waste Collection Requirements

3.4.1 Methodology

The projected waste collection needs of the City for the next collection contract (2013 until 2018) were determined in two steps:

First, the performance of the current waste management collection system was analyzed. This was accomplished by obtaining current residential waste generation data from the City and analyzing the data to determine performance (i.e. current diversion rates, capture rates etc.).

Second, based on the system's current collection system performance, per capita waste generation estimates were determined and waste generation projections were established to project the amount and composition of waste the City will need to manage during the next collection contract. These projections were developed assuming that the status quo system would not change significantly from that in place in 2010 (constant diversion rate; no new diversion initiatives etc.). Potential changes in waste diversion performance were determined during the evaluation of short-listed collection system options), and waste disposal projections were adjusted for options where improvement in diversion system performance could be anticipated.

Most of the data used to describe the performance of the current waste management system and develop waste projections was based on the City's records for the period of January 2009 to December 2009 as this was the most recent full year of data available during the drafting of this report.

3.4.2 Current Collection System Performance

The performance of the City's current residential waste management system was analyzed by assessing the two primary residential waste management programs separately:

- Curbside Collection Program; and,
- Multi-Residential (Automated) Collection Program.

3.4.2.1 Overall Waste Collected

In 2009, the City collected approximately 173,884 tonnes of solid waste (this number is made up primarily of material from the residential sector but also includes some material from the commercial and institutional sectors). This includes garbage, recycling, Green Cart organics, LYW, and bulk waste collected via the curbside collection service and automated collection service offered to the multi-residential sector.

Table 3-18 presents the quantities of waste collected through Hamilton's waste management system via curbside collection and multi-residential collection. Although all Green Cart and Bulk Waste is technically collected at the curbside, the amounts of these materials collected at multi-residential buildings was separated out to show how much of this material is produced by the multi-residential sector. As noted in the table, approximately 86% of residential waste is collected via curbside collection and 14% via the multi-residential collection program.

Table 3-18 Quantity of Waste Collected (2009)

Program Element	Curbside Collection (tonnes)	Multi-Residential Collection (tonnes)	Total (tonnes)
Garbage	65,258	18,255	83,514
Bulk Waste	2,089	740	2,829
Recyclables	39,920	4342	44,261
Green Cart Material (Kitchen Waste and some LYW)	36,226	811	37,038
Peak Leaf & Yard Waste	6,242	-	6,242
Total Quantity	**149,735**	**24,149**	**173,884**
Total % of Waste	**86%**	**14%**	**100%**

Figure 3-2 presents the relative composition of total waste managed via curbside collection in 2009. Figure 3-3 presents the relative composition of total waste managed via multi-residential collection in 2009.

Figure 3-2 Breakdown of Total Waste Collected via Curbside Collection (2009)

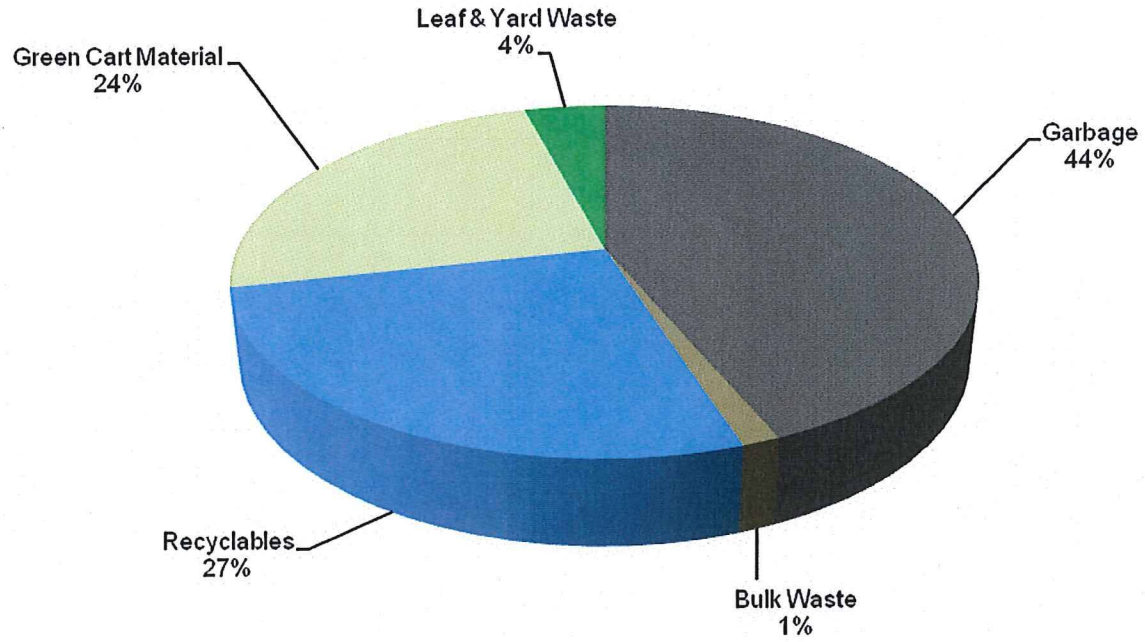
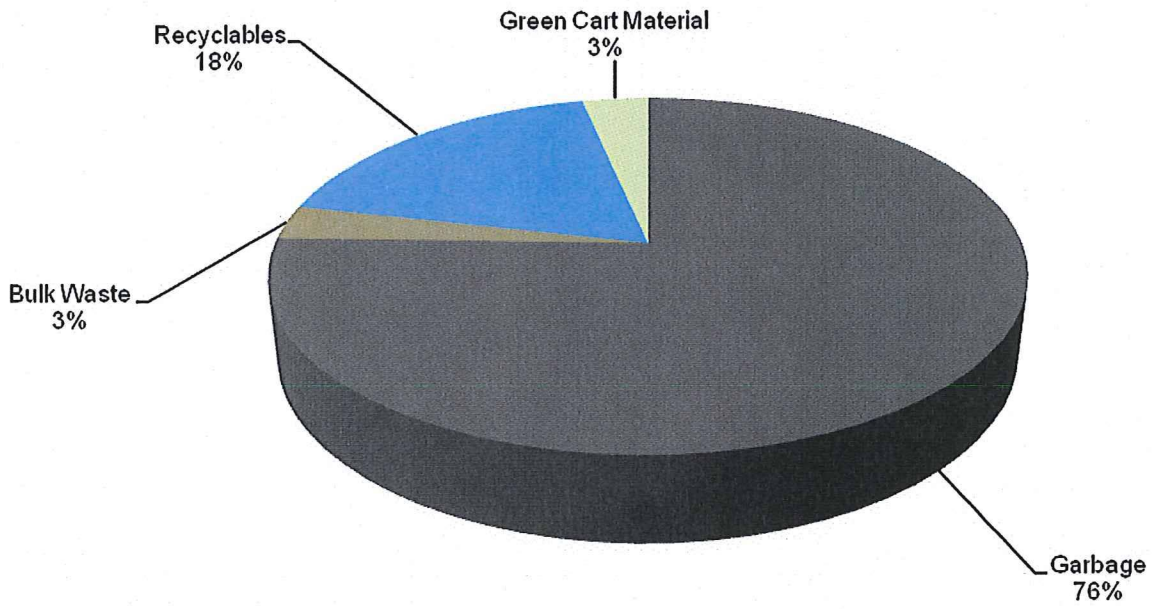


Figure 3-3 Breakdown of Total Waste Collected via Multi-Residential Collection (2009)



The composition of the total waste stream was determined in the following manner.

- The composition of waste collected via curbside collection was based on the average composition of curbside waste observed during the 2008 and 2009 City of Hamilton Single Family Waste Composition Studies. This data was compared to the actual full-year tonnage data for 2008 and 2009 and data from other residential audits to determine if adjustments needed to be made to waste generation rates. Based on the comparison, several slight adjustments were made including:
    - The amount of "Boxboard/Cores" was reduced by 0.1 kg/hh/week. This adjustment was made because the amount of boxboard found during the audits was very high in comparison to other municipalities with similar demographics.
    - The amount of "Corrugated" was increased by 0.3 kg/hh/week. This adjustment was made because the amount of corrugated cardboard found during the audits was very low in comparison to other municipalities with similar demographics.
    - The amount of "Aluminum Food & Beverage Cans" was decreased by 0.1 kg/hh/week. This adjustment was made because the amount of aluminum food & beverage cans found during the audit was very high in comparison to other municipalities with similar demographics.
    - The amount of 'Food Waste' was decreased by 0.3 kg/hh/week. This adjustment was made because the amount of food waste found during the audit was very high in comparison to other municipalities with similar demographics.
    - The proportion of LYW waste was reduced because the 2008 and 2009 audits were performed in the fall (October/November) and caught the "peak" production of LYW. Based on data provided by the City, in 2009, LYW production in October/November was approximately 45% higher than the average amount produced during the entire year. Therefore, the amount found during the audit was reduced by 45% in order to get an accurate depiction of the amount of LYW produced, on average, during an entire year.
- The composition of waste collected from multi-residential buildings was based on the composition of curbside waste observed during the 2010 Multi-Residential Waste Composition Study.

3.4.2.2 Estimated Waste Diverted

Curbside Collection

As indicated in Table 3-18, 149,735 tonnes of solid waste was collected at the curbside in 2009. Of this waste, 82,388 tonnes, or 55.0%, was diverted from the garbage stream via the recycling program, the LYW program, and Green Cart composting. It is important to note that this number also includes residues that would be removed during processing. Figure 3-4 presents the composition of diverted materials managed at the curbside. LYW makes up the largest proportion of diverted materials (26%) followed closely by food waste (24%).

Figure 3-4 Composition of Waste Diverted at Curbside (2009)

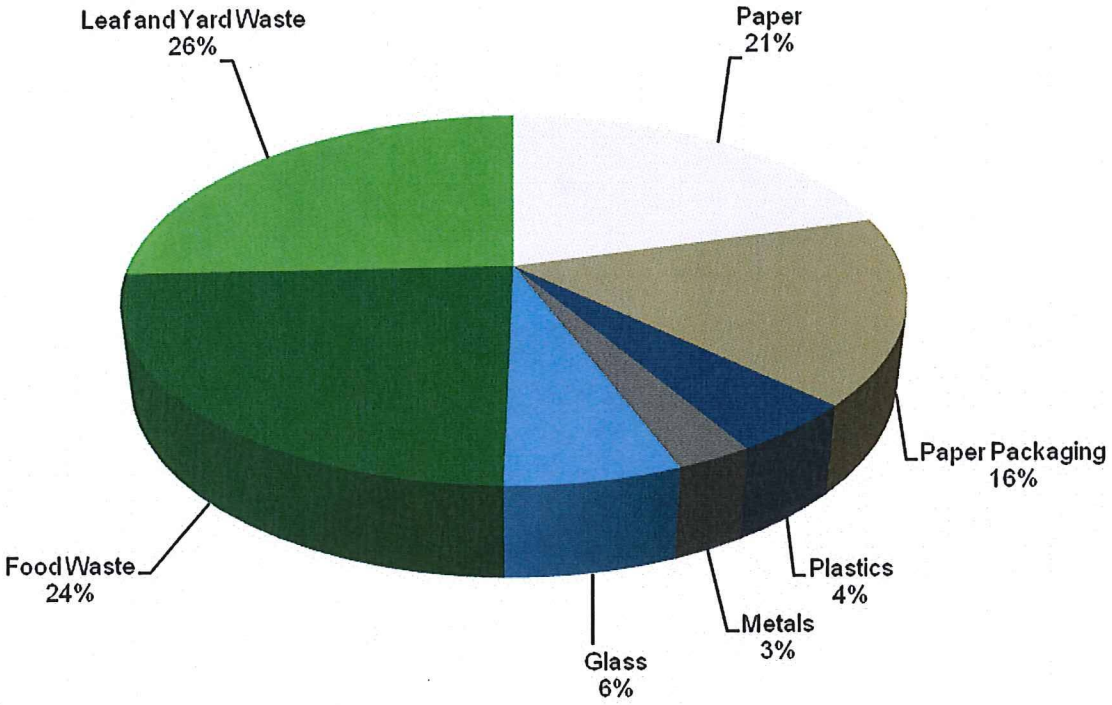


Table 3-19 presents estimated recovery rates for the major material types targeted for curbside collection under the current diversion system. These tonnages reflect the total quantity of materials generated in the general material categories targeted for diversion, but do not include other materials that would be managed through garbage collection. Recovery rates are measured across all materials in a category including those materials that are not recycled (e.g. non-recyclable plastic film, broken window glass etc.). The recovery rate (otherwise known as the recycling rate or diversion rate) is the proportion of a material that is recycled or recovered for some other purpose out of the total available quantity of material generated.

Table 3-19 Tonnage Produced, Diverted and Recovery Rates for Materials Generated at Curbside (2009)

Material Type	Estimated Tonnes Generated	Tonnes Diverted	Estimated Recovery Rate
Paper	22,075	16,884	76.5%
Paper Packaging	22,005	13,193	60.0%
Plastics	13,070	3,587	27.4%
Metals	4,179	2,166	51.8%

Material Type	Estimated Tonnes Generated	Tonnes Diverted	Estimated Recovery Rate
Glass	5,613	4,940	88.0%
Food Waste	37,495	19,560	52.2%
Leaf and Yard Waste	21,659	20,672	95.4%
Total	**126,097**	**81,001**	**64.2%**

Table 3-20 presents the estimated capture rates for individual recyclable and organic material streams collected curbside. The capture rate is the proportion of the divertible material collected out of the total amount of material available for collection (produced or generated). Curbside capture rates were adapted from those found during the 2008 and 2009 curbside waste audits. Adjustments to capture rates were made where appropriate, to ensure that conceptual tonnages captured actually matched up with City haulage records for 2009.

If the capture rates found during the audits were used directly, the calculated performance of the City's diversion programs would not reflect their actual performance. For example, the average capture rate for newspaper (dailys and weeklys) observed during the 2008 and 2009 curbside waste audits was 96.2%. This capture rate suggests that 98% of residents participate in the diversion programs and 98% of the time they place newspaper in the recycling box or Green Cart. Although this is theoretically possible, it is unlikely that this is actually occurring especially in dense urban areas where participation in diversion programs is typically very poor. Based on City haulage records and professional judgment, Stantec staff determined that a capture rate of 82.2% was a more reasonable number for newspaper (dailys and weeklys, captured by the blue box or green bin). This capture rate still reflects excellent program performance but takes into account the fact that there is still room for improvement in the City's diversion programs and takes into account the actual quantity of material marketed in 2009.

Table 3-20 Estimated Capture Rates for Curbside Materials Diverted (2009)

	Recycling Capture Rates (%)	Organic Capture Rates (%)
PAPER		
Newspaper – Dailys and Weeklys	80.1%	2.1%
Newspaper - Other	78.7%	0.2%
Telephone Books / Directories	80.0%	
Magazines & Catalogues	73.4%	
Mixed Fine Paper	51.0%	2.3%
Books	26.9%	

	Recycling Capture Rates (%)	Organic Capture Rates (%)
PAPER PACKAGING		
Corrugated	79.5%	1.8%
Kraft Paper	11.7%	34.5%
Boxboard / Cores	73.8%	0.6%
Molded Pulp	47.3%	8.7%
Paper Cups and Paper Ice-Cream Containers		11.6%
Composite Cans	20.7%	
Gable Top	70.3%	
Aseptic Containers	25.5%	
Tissue/Toweling		20.4%
PLASTICS		
PET Beverage Bottles	79.9%	
PET Other Bottles & Jars	61.6%	
HDPE Beverage Bottles	75.7%	
HDPE Other Bottles & Jugs	72.9%	
Polystyrene Packaging	36.7%	
Wide Mouth Tubs & Lids	68.7%	
Large HDPE & PP Pails & Lids	46.6%	
Polyethylene PE Plastic Bags & Film - Packaging	23.8%	
METALS		
Aluminum Food & Beverage Cans	79.9%	
Aluminum Foil & Foil Trays	17.1%	
Other Aluminum Containers	39.2%	
Steel Food & Beverage Cans	78.8%	
Steel Aerosol Cans	64.2%	
Steel Paint Cans	17.9%	
GLASS		
LCBO Clear	85.1%	
LCBO Coloured	81.5%	
Clear	76.7%	
Coloured	87.6%	
ORGANICS		
Food Waste		52.2%
Yard Waste		95.4%

Multi-Residential (Automated) Collection

As noted in Table 3-18, 24,149 tonnes of solid waste was collected via multi-residential collection in 2009. Of this waste, 5,153 tonnes, or 21.3%, was diverted from the garbage stream via the recycling and Green Cart programs. It is important to note that this number also includes residues that would be removed during processing. Figure 3-5 presents the composition of diverted materials collected via automated collection. Paper makes up the largest proportion of diverted materials (42%) followed closely by paper packaging (22%).

Figure 3-5 Composition of Waste Diverted via Automated Collection (2009)

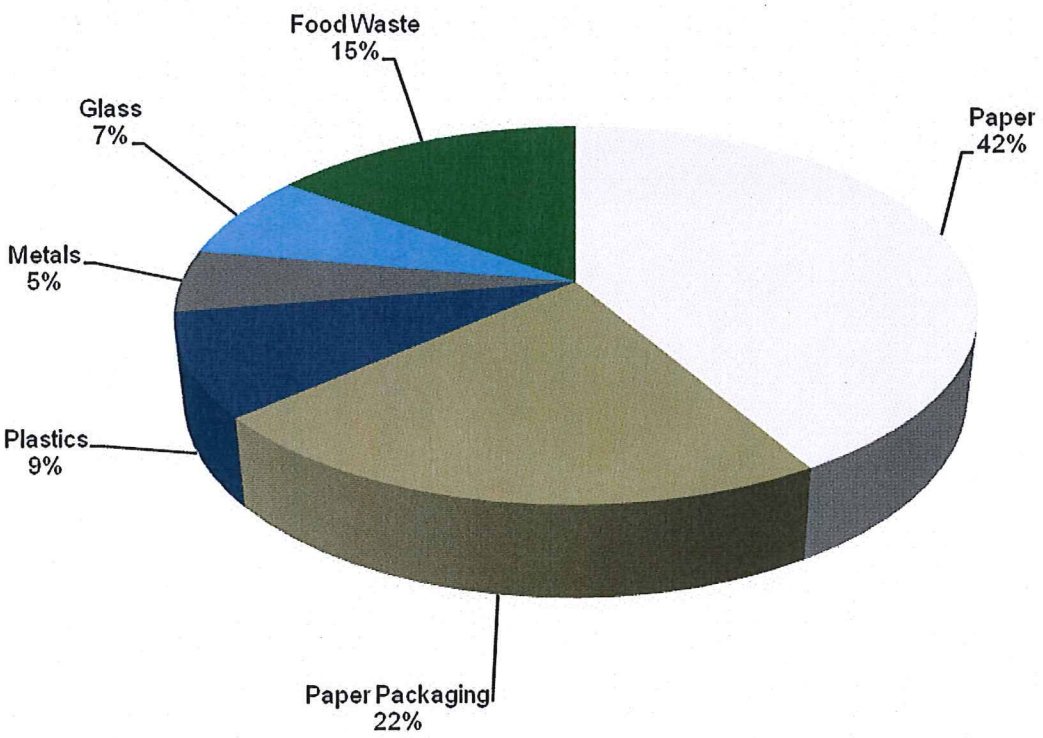


Table 3-21 presents estimated recovery rates for the major material types targeted for diversion and collected via automated collection. Recovery rates are measured across all materials in a category including those materials that are not recycled (e.g. plastic film, broken window glass etc.). The recovery rate (otherwise known as the recycling rate or diversion rate) is the proportion of a material that is recycled or recovered for some other purpose out of the total available quantity of material generated.

Table 3-21 Residential Tonnage Produced, Diverted and Recovery Rates for Materials Collected via Automated Collection (2009)

Material Type	Tonnes Generated	Tonnes Diverted	Recovery Rate
Paper	3,356	1,959	58.4%
Paper Packaging	3,405	1,040	30.6%
Plastics	3,048	418	13.7%
Metals	867	249	28.8%
Glass	937	338	36.1%
Food Waste	7,021	702	10.0%
Total Diverted	**18,633**	**4,706**	**25.3%**

Table 3-22 presents the estimated capture rates for recyclable and organic materials collected via automated collection. The capture rate is the proportion of the divertible material collected out of the total amount of material available for collection (produced or generated).

Multi-residential collection capture rates were taken directly from the 2010 multi-residential waste audit, undertaken in October 2010.

Table 3-22 Estimated Capture Rates for Materials Diverted via Automated Collection (2010)

	Recycling Capture Rates (%)	Organic Capture Rates (%)
PAPER		
Newspaper – Dailys and Weeklys	74.7%	0.2%
Newspaper - Other	64.8%	0.7%
Telephone Books / Directories	0.0%	
Magazines & Catalogues	48.0%	
Mixed Fine Paper	36.0%	0.4%
Books	51.9%	
PAPER PACKAGING		
Corrugated	66.0%	0.2%
Kraft Paper	8.6%	2.5%
Boxboard / Cores	30.1%	0.2%
Molded Pulp	27.1%	0.9%
Paper Cups and Paper Ice-Cream Containers		1.3%
Composite Cans	31.7%	
Gable Top Cartons	48.9%	

	Recycling Capture Rates (%)	Organic Capture Rates (%)
Aseptic Containers	29.0%	
Tissue/Toweling		5.4%
PLASTICS		
PET Beverage Bottles	40.3%	
PET Other Bottles & Jars	38.4%	
HDPE Beverage Bottles	49.2%	
HDPE Other Bottles & Jugs	39.4%	
Polystyrene Packaging	23.8%	
Wide Mouth Tubs & Lids	36.8%	
Large HDPE & PP Pails & Lids	56.1%	
Polyethylene Plastic Bags & Film - Packaging	9.2%	
METALS		
Aluminum Food & Beverage Cans Total	34.4%	
Aluminum Foil & Foil Trays	5.4%	
Other Aluminum Containers	45.5%	
Steel Food & Beverage Cans Total	38.2%	
Steel Aerosol Cans	35.7%	
Steel Paint Cans	100.0%	
GLASS		
LCBO Clear	47.6%	
LCBO Coloured	43.3%	
Clear	43.0%	
Coloured	89.9%	
ORGANICS		
Food Waste		10.0%
Yard Waste		2.2%

3.4.3 Projected Waste Generation

Projected waste generation was determined based on per capita waste generation rates for 2009 and population projections for the City based on *Places to Grow: Growth Plan for Greater Golden Horseshoe (Schedule 3).*

Capture rates and diversion performance for all other material types were assumed to remain steady at 2009 values. Many of the collection system options under consideration could

enhance the diversion system which should increase the diversion rate over the planning period. During later stages of the project, estimates for the potential increase in diversion rates for the suite of short-listed options considered were developed and revised waste projections were undertaken.

Table 3-23 presents the population projections year-by-year from 2009 to 2021.

Table 3-23 City of Hamilton Population Projections 2009-2021

Year	Population
2009	525,697
2010	532,849
2011	540,000
2012	545,000
2013	550,000
2014	555,000
2015	560,000
2016	565,000
2017	570,000
2018	575,000
2019	580,000
2020	585,000
2021	590,000

In 2009, residents produced a total 173,884 tonnes of solid waste that required collection by the City (this includes 149,735 tonnes of curbside collected material and 24,149 tonnes of multi-residential material). To project waste generation over the planning period, a constant per capita waste generation rate between 2009 and 2021 was applied to population projections.

Table 3-24 presents our initial estimates of the projected total amount of waste requiring management year by year from 2009 to 2021.

Table 3-24 Projected Total Amount of Waste Requiring Management (2009-2021) (tonnes)

Year	Total Waste Generated (Curbside)	Total Waste Generated (Multi-Residential)	Total Diverted (Curbside)	Total Diverted (Multi-Residential)	Total Garbage (Curbside)	Total Garbage (Multi-Residential)
2009	149,735	24,149	82,388	5,153	65,258	18,255
2010	151,772	24,477	83,509	5,223	66,146	18,504
2011	153,809	24,806	84,629	5,293	67,034	18,752

Year	Total Waste Generated (Curbside)	Total Waste Generated (Multi-Residential)	Total Diverted (Curbside)	Total Diverted (Multi-Residential)	Total Garbage (Curbside)	Total Garbage (Multi-Residential)
2012	155,233	25,035	85,413	5,342	67,654	18,926
2013	156,658	25,265	86,197	5,391	68,275	19,099
2014	158,082	25,495	86,980	5,440	68,896	19,273
2015	159,506	25,724	87,764	5,489	69,517	19,447
2016	160,930	25,954	88,547	5,538	70,137	19,620
2017	162,354	26,184	89,331	5,587	70,758	19,794
2018	163,778	26,413	90,115	5,636	71,379	19,967
2019	165,202	26,643	90,898	5,685	71,999	20,141
2020	166,627	26,873	91,682	5,734	72,620	20,315
2021	168,051	27,102	92,465	5,783	73,241	20,488

Table 3-25 presents our initial estimates of the projected amount of waste being diverted via curbside collection year-by-year from 2009 to 2021.

Table 3-25 Projected Amount of Curbside Waste Diverted (2009-2021) (tonnes)

Year	Total Waste Generated (Curbside)	Total Diverted (Curbside)	Recycling (Curbside)	Green Cart (Curbside)	LYW (Curbside)	Garbage (Curbside)	Bulk Waste (Curbside)
2009	149,735	82,388	39,920	36,226	6,242	65,258	2,089
2010	151,772	83,509	40,463	36,719	6,327	66,146	2,118
2011	153,809	84,629	41,006	37,212	6,412	67,034	2,146
2012	155,233	85,413	41,386	37,556	6,471	67,654	2,166
2013	156,658	86,197	41,765	37,901	6,530	68,275	2,186
2014	158,082	86,980	42,145	38,245	6,590	68,896	2,206
2015	159,506	87,764	42,525	38,590	6,649	69,517	2,225
2016	160,930	88,547	42,904	38,935	6,709	70,137	2,245
2017	162,354	89,331	43,284	39,279	6,768	70,758	2,265
2018	163,778	90,115	43,664	39,624	6,827	71,379	2,285
2019	165,202	90,898	44,043	39,968	6,887	71,999	2,305
2020	166,627	91,682	44,423	40,313	6,946	72,620	2,325
2021	168,051	92,465	44,803	40,657	7,005	73,241	2,345

Table 3-26 presents our initial estimates of the projected amount of waste being diverted via multi-residential collection year-by-year from 2009 to 2021.

Table 3-26 Projected Amount of Waste Diverted via Multi-Residential Collection (2009-2021) (tonnes)

Year	Total Waste Generated (Multi-Residential)	Total Diverted (Multi-Residential)	Recycling (Multi-Residential)	Green Cart (Multi-Residential)	Garbage (Multi-Residential)	Bulk Waste (Multi-Residential)
2009	24,149	5,153	4,342	811	18,255	740
2010	24,477	5,223	4,401	822	18,504	750
2011	24,806	5,293	4,460	833	18,752	760
2012	25,035	5,342	4,501	841	18,926	767
2013	25,265	5,391	4,542	849	19,099	774
2014	25,495	5,440	4,584	857	19,273	781
2015	25,724	5,489	4,625	864	19,447	788
2016	25,954	5,538	4,666	872	19,620	795
2017	26,184	5,587	4,708	880	19,794	802
2018	26,413	5,636	4,749	888	19,967	809
2019	26,643	5,685	4,790	895	20,141	817
2020	26,873	5,734	4,831	903	20,315	824
2021	27,102	5,783	4,873	911	20,488	831

Figure 3-6 illustrates the estimated total amount of curbside waste diverted and disposed over the planning period. Figure 3-7 illustrates the estimated total amount of multi-residential automated collected waste diverted and disposed over the planning period.

Figure 3-6 Status Quo: Estimated Total Amount of Waste Diverted and Disposed Year-by-Year (Curbside Collection)

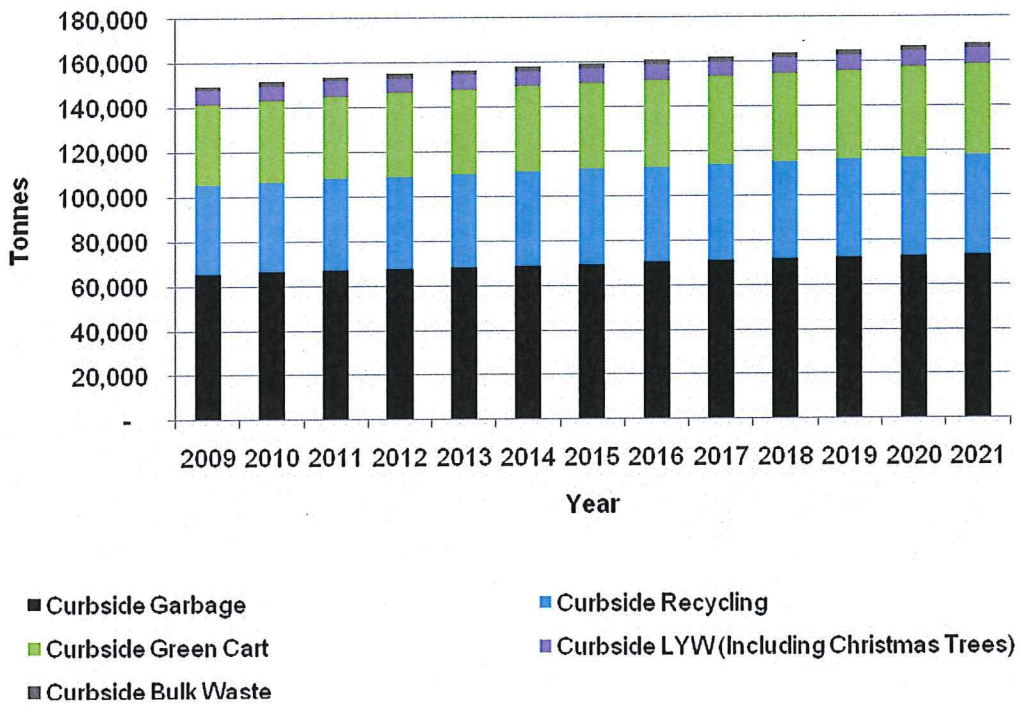
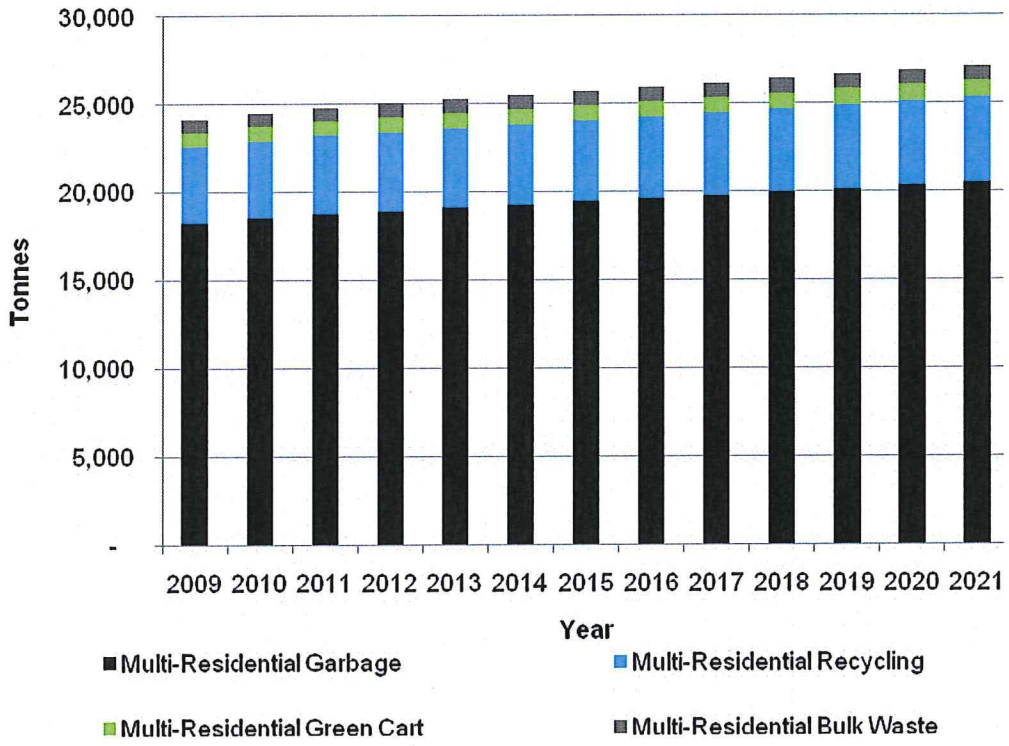


Figure 3-7 Status Quo: Estimated Total Amount of Waste Diverted and Disposed Year-by-Year (Multi-Residential Collection)



4 EVALUATION OF LONG-LISTED COLLECTION SYSTEM OPTIONS

4.1 Development of the Long-List of Collection System Options

4.1.1 Introduction

Following the analysis of the current status of the waste management system in the City, a review of the potential combination of collection system options was undertaken, to ensure that a full suite of scenarios that would offer potential for increased diversion and system efficiency would be considered.

As mentioned in Section 1, at the project initiation meeting held on September 13th, 2010, a draft matrix of collection systems was generated. Following this meeting, the draft matrix of options was reviewed, and adjustments were made to ensure that it reasonably reflected the range of collection system configurations available for consideration by the City and the areas where the City is considering adjustments to their current collection approach. Based on the adjustments made and on further discussions which took a place at a meeting between Stantec and City staff on October 22nd, 2010, a 'finalized' long-list of collection system options to be carried forward for evaluation was developed.

In regards to the long-list of collection service options there were a few key items that were taken into consideration. These key items are presented in the following bullet list:

- The focus of the service level scenarios was on curbside collection service, not the automated collection service offered to multi-residential buildings. The choice of service level made by the City in regards to the curbside service can influence the services offered to multi-residential buildings and were discussed later in the study following the identification of the preferred scenario.
- The options presented address primary curbside material streams (garbage, Green Cart, leaf & yard waste (LYW), and recyclables). Bulk waste collection service levels would be addressed during the evaluation of short-listed systems.
- Discussions on September 13th indicated that certain collection system options would be unacceptable for consideration. No options that would reduce the frequency of Green Cart collection to anything less than weekly were considered, as the City's experience with its current program indicates that this would be unacceptable to residents and would pose other implications such as increasing the potential for odour management issues at the Central Composting Facility (CCF).
- Further, no options that would see the City adopt an alternating week schedule for collection of two-stream recyclables were considered, as this adjustment would be difficult for residents given the success the City has experienced in promoting weekly collection of all recyclable streams as a means of assisting residents in achieving the one-container

limit for garbage. In addition, a shift to alternating weekly collection for two-stream recyclables would present storage issues for residents (blue boxes would likely be over capacity).

Table 4-1 outlines the long-list of collection scenarios that were developed. The table is divided into a number of systems which have varied frequency and methods of collection. The following bullet list describes the variety of collection approaches considered during the development of the collection scenarios:

- The garbage stream can be collected weekly or bi-weekly.
- The recycling stream can be collected in two-streams (fibres and containers separated in two different containers) or in a single-stream (recyclable material, including both fibres and containers, placed in a single container). For two-stream systems, the frequency of pickup would be weekly (the rationale for not including alternating weekly collection as an option is noted in the previous bullet list). For single-stream systems, the frequency of pickup can be weekly or bi-weekly.
- The Green Cart (which currently can be topped up with LYW material) stream would be collected weekly. The rationale for not including bi-weekly collection as an option is noted above.
- LYW would be collected either seasonally on a bi-weekly basis during times of the year when there is a significant upswing in LYW quantity (i.e., during the spring and fall and in January for Christmas tree collection) or continuously throughout the year on a weekly or bi-weekly basis. Generally, the City desires to reduce the amount of LYW in the Green Cart stream as much as possible so as to preserve processing capacity at the Central Composting Facility (CCF) and reduce processing costs (it is much cheaper to compost LYW in a pad based system than at the CCF). Further, the capacity reclaimed at the CCF could be used to process additional Green Cart material collected within the City due to an increase in program participation (particularly in the multi-residential sector); moreover, any additional CCF capacity could be marketed to other municipalities which could further increase revenue and offset operating costs. By offering more frequent collection for LYW material, the City will be able to better keep LYW material out of the Green Cart stream and therefore preserve CCF processing capacity.

In addition to the above, each of the material streams can be collected in a separate vehicle or co-collected, that is, two-streams collected at the same time in the same vehicle. Typically, in co-collection, a truck is divided into two or more compartments to keep the streams separate. This method of collection works best when there is transfer capacity (i.e. material is dumped at a transfer station and transferred to a processing facility when enough material is collected) or when processing/disposal facilities are physically located close to each other so trucks do not have to drive long distances half empty. Hamilton benefits from having an existing system of three (3) municipally owned transfer stations that are currently used to transfer garbage and LYW to the Glanbrook landfill facility, and in that both the MRF and the CCF are located within the same site. Some co-collection options could require reconsideration of the material streams transferred through the existing transfer stations.

Table 4-1 Long-List of Collection System Options.

System	Frequency	Separate Collection	Co-collection	Comments
System A (Current Status Quo System) 2 Truck Passes per Week(plus peak LYW)				
Garbage	Weekly		✓	Garbage and Green Cart co-collection – split 50/50 (public/private) across the City.
Green Cart Organics	Weekly		✓	
LYW	Bi-Weekly (spring and fall)	✓		Separate peak collection of LYW.
Containers (2 Stream)	Weekly		✓	Co-collection of two-stream recyclables.
Fibres (2 Stream)	Weekly		✓	

Considerations for System A:

- Current approach is understood by residents, poses less issues and costs in regards to promotion & education etc. Likely high level of acceptability to residents given performance of current system.
- The potential to drive additional diversion would be limited.
- Costs over the next collection contract should remain within the same range as the current contract costs as there would be no change in collection service. Minimal to no capital investment for recycling processing would be required beyond that which is currently planned. No additional container costs beyond those currently planned as there is no change in collection type.
- Will not address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues would remain with current CCF.
- No potential for change in direct or indirect GHG or other emissions.
- Accommodates current split in service delivery between public and private forces.
- Somewhat more flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as no additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System B **1.5 Truck Passes per Week (plus peak LYW)**				
Garbage	Bi-Weekly	✓		Garbage collection split 50/50 (public/private) across the City.
Green Cart Organics	Weekly		✓	Weekly co-collection of Green Cart and Single-stream Recycling.
LYW	Bi-Weekly (spring and fall)	✓		Separate peak collection of LYW.
Single-stream Recycling	Weekly		✓	

Considerations for System B:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. However, single-stream recycling collection can prove more convenient to residents and may offset some concerns.
- Higher potential for additional organics diversion through increased garbage restrictions. The combination of bi-weekly garbage collection and single-stream recycling should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high. Note however that for recycling, the move to single-stream will increase residue rates affecting the net increase in diversion.
- Would require reduced collection fleet (1.5 truck passes per week plus peak LYW) compared to status quo, thus likely reducing overall collection costs. However, significant capital investment for recycling processing would be required beyond that which is currently planned. Additional container costs would be required beyond those currently planned should the City implement cart-based single-stream collection. Should not affect transfer or haul costs as both green cart and single-stream recycling materials are processed at the same site.
- Will not address issue with current SSO approach where a large portion of LYW over the growing season is collected weekly with Green Cart materials during the summer months. Capacity issues would remain with current CCF.
- Potential reduction in direct air emissions due to decrease in size of collection fleet. Some potential for decrease in indirect air emissions due to increased capture of organics and recyclables.
- Would result in changes in the current split of service delivery across the City due to shift to co-collection of Green Cart and recyclables from co-collection of garbage and Green Cart. Would require City forces collect all three major materials streams in collection zones assigned to City forces.
- Somewhat less flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System C **2.5 Truck Passes per Week(plus peak LYW)**				
Garbage	Bi-Weekly	✓		Bi-weekly collection of garbage - split 50/50 (public/private) across the City.
Green Cart Organics	Weekly	✓		
LYW	Bi-Weekly (spring and fall)	✓		Separate peak collection of LYW.
Single-stream Recycling	Weekly	✓		

Considerations for System C:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. However, single-stream recycling collection can prove more convenient to residents and may offset some concerns.
- Higher potential for additional organics diversion through increased garbage restrictions. The combination of bi-weekly garbage collection and single-stream recycling should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high. Note however that for recycling, the move to single-stream will increase residue rates affecting the net increase in diversion.
- Would require increased collection fleet (2.5 trucks plus peak LYW) compared to status quo, thus likely increasing overall collection costs. Significant capital investment for recycling processing would be required beyond that which is currently planned. Additional container costs would be required beyond those currently planned should the City implement cart-based single-stream collection. Should not affect transfer or haul costs as the system does not include co-collection.
- Will not address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues would remain with current CCF.
- Potential increase in air emissions due to increase in size of collection fleet. Some potential for decrease in indirect air emissions due to increased capture of organics and recyclables.
- Will accommodate the current split in service delivery across the City as Garbage and Green Cart would be collected separately from single-stream recycling.
- Somewhat less flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System D **2.5 Truck Passes per Week(plus peak LYW)**				
Garbage	Bi-Weekly	✓		Bi-weekly collection of garbage - split 50/50 (public/private) across the City.
Green Cart Organics	Weekly	✓		
LYW	Bi-Weekly (spring and fall)	✓		Separate peak collection of LYW.
Containers (2 Stream)	Weekly		✓	Weekly co-collection of two-stream recyclables.
Fibres (2 Stream)	Weekly		✓	

Considerations for System D:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream.
- Higher potential for additional organics diversion through increased garbage restrictions. Should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high.
- Would require increased collection fleet (2.5 trucks plus peak LYW) compared to status quo, thus likely increasing overall collection costs. Minimal capital investment for processing would be required beyond that which is currently planned. Should not affect transfer or haul costs.
- Will not address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues would remain with current CCF.
- Potential increase in air emissions due to increase in size of collection fleet. Some potential for decrease in indirect air emissions due to increased capture of organics and recyclables.
- Will accommodate the current split in service delivery across the City as Garbage and Green Cart would be collected separately from two-stream recycling.
- Somewhat more flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as no additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System E **1 Truck Passes per Week (plus peak LYW)**				
Garbage	Bi-Weekly		✓	Bi-weekly co-collection with Green Cart
Green Cart Organics	Weekly		✓	Co-collected on alternating weeks (Green Cart/Garbage, Green Cart/recycling).
LYW	Bi-Weekly (spring and fall)	✓		Separate peak collection of LYW.
Single-stream Recycling	Bi-Weekly		✓	Bi-weekly co-collection with Green Cart

Considerations for System E:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. Single-stream recycling collection can prove more convenient to residents and may offset some concerns, however, the move to bi-weekly collection would increase concerns regarding storage of materials.
- Higher potential for additional organics diversion through increased garbage restrictions. Should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high. Note however that for recycling, the move to single-stream will increase residue rates affecting the net increase in diversion.
- Would require decreased collection fleet (1 truck plus peak LYW) compared to status quo, thus decreasing overall collection costs. However, significant capital investment for recycling processing would be required beyond that which is currently planned. Additional container costs would be required beyond those currently planned should the City implement cart-based single-stream collection. Likely to increase transfer and haul costs based on co-collection approach.
- Will not address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues would remain with current CCF.
- Potential reduction in direct air emissions due to decrease in size of collection fleet. Some potential for decrease in indirect air emissions due to increased capture of organics and recyclables.
- Will not accommodate the current split in service delivery across the City as Garbage and Green Cart would be collected with single-stream recycling.
- Somewhat less flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System F **2 Truck Passes per Week**				
Garbage	Weekly		✓	Weekly garbage and SS recyclable co-collection.
Green Cart Organics	Weekly		✓	Weekly Green Cart and LYW co-collection.
LYW	Weekly		✓	
Single-stream Recycling	Weekly		✓	

Considerations for System F:

- Single-stream recycling collection can prove more convenient to residents and may increase public acceptability.
- The potential to drive additional diversion would be limited. For recycling, capture rates at the curb would likely be similar to status quo as they are already quite high.
- Would require slightly decreased collection fleet compared to status quo as fewer 'peak' LYW vehicles would be required, thus likely decreasing overall collection costs. However, significant capital investment for recycling processing would be required beyond that which is currently planned. Additional container costs would be required beyond those currently planned should the City implement cart-based single-stream collection. Decreased SSO processing costs are likely as LYW would be processed separately and recovered capacity at CCF would be available for current contracts and for increased organics recovery in the City. Could have an effect on transfer and haul costs.
- Will address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues with current CCF would be addressed.
- Potential slight reduction in direct air emissions due to slight decrease in size of collection fleet. Minimal change in indirect air emissions.
- Will not accommodate the current split in service delivery across the City as Garbage would be co-collected with single-stream recycling.
- Somewhat less flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System G **2 Truck Passes per Week**				
Garbage	Bi-Weekly	✓		Alternating week garbage and single-stream recyclable collection.
Green Cart Organics	Weekly		✓	Weekly Green Cart and LYW co-collection.
LYW	Weekly		✓	
Single-stream Recycling	Bi-Weekly	✓		

Considerations for System G:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. Single-stream recycling collection can prove more convenient to residents and may offset some concerns, however, the move to bi-weekly collection would increase concerns regarding storage of materials. A change in resident behavior (and a P&E campaign) will be necessary.
- Higher potential for additional organics diversion through increased garbage restrictions. Should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high. Note however that for recycling, the move to single-stream will increase residue rates affecting the net increase in diversion.
- Would require slightly decreased collection fleet (2 trucks) compared to status quo as fewer peak LYW vehicles would be required, thus likely decreasing overall collection costs. However, significant capital investment for recycling processing would be required beyond that which is currently planned. Additional container costs would be required beyond those currently planned should the City implement cart-based single-stream collection. Decreased SSO processing costs are likely as LYW would be processed separately and recovered capacity at CCF would be available for current contracts and for increased organics recovery in the City. Likely to increase transfer and haul costs based on co-collection approach.
- Will address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the Green Cart materials during the summer months. Capacity issues with current CCF would be addressed.
- Potential slight reduction in direct air emissions due to slight decrease in size of collection fleet. Minimal change in indirect air emissions.
- Will not easily accommodate the current split in service delivery across the City as Garbage would likely be collected by the same fleet alternating with single-stream recycling.
- Somewhat less flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System H **2.5 Truck Passes per Week**				
Garbage	Bi-Weekly	✓		Bi-weekly collection of garbage - split 50/50 across the City.
Green Cart Organics	Weekly		✓	Weekly Green Cart and LYW co-collection.
LYW	Weekly		✓	
Containers (2 Stream)	Weekly		✓	Weekly co-collection of two-stream recyclables.
Fibres (2 Stream)	Weekly		✓	

Considerations for System H:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. A change in resident behavior (and a P&E campaign) will be necessary to remove LYW from the Green Cart.
- Higher potential for additional organics diversion through increased garbage restrictions. Should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high.
- Would require slight increase in collection fleet (2.5 trucks) compared to status quo, thus likely increasing overall collection costs. Minimal capital investment for processing would be required beyond that which is currently planned. Decreased SSO processing costs are likely as LYW would be processed separately and recovered capacity at CCF would be available for current contracts and for increased organics recovery in the City.
- Will address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the green bin materials during the summer months. Addresses capacity issues with current CCF.
- Potential increase in air emissions due to increase in size of collection fleet. Minimal change in indirect air emissions.
- Will accommodate the current split in service delivery across the City as Garbage and SSO would be collected separately from two-stream recycling.
- Somewhat more flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as no additional investment in recycling processing would be required.

System	Frequency	Separate Collection	Co-collection	Comments
System I **3 Truck Passes per Week**				
Garbage	Bi-Weekly	✓		Alternating weekly collection of garbage and LYW.
Green Cart Organics	Weekly	✓		Separate weekly collection of SSO.
LYW	Bi-Weekly	✓		
Containers (2 Stream)	Weekly		✓	Weekly co-collection of two-stream recyclables.
Fibres (2 Stream)	Weekly		✓	

Considerations for System I:

- Change in level of service for bi-weekly garbage collection will require additional support and 'exceptions' to improve acceptability to residents, as pet waste and diapers are likely to remain in the garbage stream. A change is resident behavior (and a P&E campaign) will be necessary to remove LYW from the Green Cart.
- Higher potential for additional organics diversion through increased garbage restrictions. Should have some effect on recycling capture rates at the curb, although there is limited room for significant improvement as they are already quite high.
- Would require increased collection fleet (3 trucks) compared to status quo, thus likely increasing overall collection costs. Minimal capital investment for processing would be required beyond that which is currently planned. Decreased SSO processing costs are likely as LYW would be processed separately and recovered capacity at CCF would be available for current contracts and for increased organics recovery in the City. No change to transfer and haul costs.
- Will address issue with current SSO approach where a larger portion of LYW over the growing season is collected weekly with the green bin materials during the summer months. Addresses capacity issues with current CCF.
- Potential increase in air emissions due to increase in size of collection fleet. Minimal change in indirect air emissions.
- Will accommodate the current split in service delivery across the City as Garbage and SSO would be collected separately from two-stream recycling.
- Somewhat more flexible in dealing with potential changes in Ontario with the Waste Diversion Act and Blue Box Program Plan as no additional investment in recycling processing would be required.

4.1.2 Key Considerations

There were a number of considerations within the major system components that were taken into account during the development of the long-list of service level scenarios. The following sections describe considerations with regard to garbage collection, recycling collection, Green Cart and LYW collection.

4.1.2.1 Garbage Collection

The City currently provides for weekly collection of garbage for single-residential units and enforces a one container limit (a container is defined as either a non-returnable plastic garbage bag weighing not more than 23 kg or a rigid reusable container with a volume of less than 135 L, weighing not more than 23 kg). The following subsections describe the various issues associated with bi-weekly and weekly garbage collection.

Weekly Garbage Collection

There is little potential for collection efficiencies or cost savings with weekly garbage collection as a separate collection service. The biggest advantage to weekly garbage collection is the convenience to residents. This advantage is also the biggest drawback as residents are not as motivated to maximize diversion: it is just as easy for residents to throw a material in the garbage as to recycle or compost it. This has been partially addressed by the recent implementation of the one-container limit for garbage collection, which can have a similar effect on material capture rates.

Advantages to maintaining the status quo include operating on a schedule that is easy for residents to remember, reducing the requirement for P&E with the new collection contract, reduced need for special considerations, and fewer winter collection cancellation problems/challenges. Disadvantages include no reduction in disposal capacity requirements and no reductions in fleet size to collect garbage. Public dialogue with residents indicates that there are residents that are no longer setting out waste on a weekly basis, as the use of the City's diversion programs has reduced the volume of garbage requiring management rendering weekly garbage collection superfluous.

Table 4-2 provides a summary of the implications associated with weekly garbage collection.

Table 4-2 Implications Associated with Weekly Garbage Collection

Option: Weekly Garbage Collection	
Implications on Public Acceptability	• High public acceptability – current level of service. • Fewer complaints due to odours from materials in the waste stream such as diapers, pet waste, especially in warmer months. • The segment of population who are actively participating in waste diversion efforts will likely support a move to bi-weekly collection as it will be seen as environmentally preferable. • Public dialogue with residents indicates that there are residents that are no longer setting out waste on a weekly basis.
Potential Effects on Diversion	• Minimal effect on diversion.
Financial Implications	• Minimal financial implications. • No opportunities for cost reductions due to decreased collection fleet or disposal costs.
Environmental Impacts	• Greater environmental impact as no change to the required number of collection vehicles and no reduction in the requirement for disposal capacity.
Degree of Flexibility	• This option is flexible to changes in the Waste Diversion Act (WDA).
Potential General Implementation Requirements and/or Barriers	• No barriers or implementation requirements. • Increasing need for disposal capacity as compared to bi-weekly garbage collection.

Bi-Weekly Garbage Collection

One of the primary concerns with moving from weekly to bi-weekly garbage collection is the possibility for negative public reaction. In many cases this is perceived as a decrease in level of service. Householders are also often concerned about the potential for increased odours from garbage material—especially in the summer months—due to the longer storage period (being stored at their home for two weeks rather than one). Notwithstanding, some portion of the populace is likely to welcome a switch to bi-weekly garbage collection as the move will be perceived as an "environmentally-friendly" switch and as they may already be setting our garbage less frequently.

Since the City has implemented a curbside Green Cart waste collection program which removes much of the more odorous material from the garbage stream, the option of bi-weekly collection of garbage is more viable. However, the current Green Cart program does not accept all potentially odorous materials that are in the waste stream such as pet wastes, diapers and other sanitary paper products. One of the primary reasons that the City does not accept these materials in the Green Cart stream is due to the fact that processing organic materials with high

levels of fecal content can result in degraded compost quality. Lesser quality compost would be more difficult to market and could results in significant losses in potential revenue.

One of the main benefits with moving to bi-weekly garbage collection is potential cost savings associated with reduced collection frequency. Cost savings associated with bi-weekly collection reflect the concept that half the fleet would be needed for collection of 'garbage' only each week, with 'half' of the City collected on one week and 'half' the next.

In regards to diversion, residents are more likely to properly sort organics and recycling when these streams have frequent and convenient collection available for divertible materials (particularly effective with organics due to odours) and there is less frequent/convenient collection of garbage. Reducing the frequency of garbage collection and/or increasing the frequency of blue box collection have been demonstrated to have a positive effect on recovery rates for recyclable material. Bi-weekly garbage collection is likely to result in reasonable increases in organics recovery rates based on the current capture rates for food waste, and some modest increases in recovery of recyclable material likely resulting in a two (2) to five (5) percent increase in overall diversion.

Risks associated with bi-weekly garbage collection include communication (promotion and education) challenges to ensure that residents are aware of and use the appropriate schedule for set-outs, and addressing winter collection cancellation problems/challenges.

Overall, a move to bi-weekly garbage collection would be easier if the collection system could direct pet wastes and diapers from the garbage stream to the Green Cart stream to deal with odour issues. As the CCF is not approved to process pet wastes and diapers, removing these materials from the garbage stream and into the Green Cart stream is significantly constrained at this time. Should it not be possible to expand the Green Cart program to include these more odourous materials, special consideration such as special collection services may need to be given to certain households (e.g. in-home daycares, homes with elderly residents), similar to the special services currently provided in support of the one-container garbage limit.

The following table (Table 4-3) provides a summary of the implications associated with bi-weekly garbage collection.

Table 4-3 Implications Associated with Bi-Weekly Garbage Collection

Option: Bi-Weekly Garbage Collection	
Implications on Public Acceptability	• Public may perceive move from weekly to bi-weekly collection as a reduction in service. • Potential for increased complaints due to odours from materials such as diapers, pet waste, especially in warmer months. • The segment of population who are actively participating in waste diversion efforts could support reduced frequency of collection for garbage. • Public dialogue with residents indicates that there are residents that are no longer setting out waste on a weekly basis.
Potential Effects on Diversion	• Potential for additional organics diversion through increased garbage restrictions. • Some increase in recyclable capture rates is anticipated.
Financial Implications	• Extensive P&E campaign would be required. • Potential increase in organic waste processing fees with increased tonnage. • Potential decrease in garbage collection fees due to reduction in collection frequency.
Environmental Impacts	• Potential for reduced impact to environment due to fewer collection vehicles being on the road at any one time. • Potential for increased diversion will lessen environmental impact due to decreased disposal needs and increase in amount of material diverted.
Degree of Flexibility	• This option is flexible to changes in the Waste Diversion Act (WDA).
Potential General Implementation Requirements and/or Barriers	• P&E material development and distribution/notification. • Impact to processing capacity at CCF with increased capture of organic waste. • Inclusion of pet wastes and diapers in the Green Cart stream is constrained as CCF is not currently approved to process these materials. • Review of special considerations program will be necessary, particularly as Green Cart stream cannot currently be expanded.

4.1.2.2 Recycling Collection

The City currently operates a two-stream recycling collection system and provides for weekly collection of both streams. As described below, a number of other 'larger' municipalities in Ontario have recently switched to single-stream recycling systems. The following subsections describe a number of the considerations that should be taken into account when assessing the costs/benefits of a single-stream or two-stream recycling system.

Single-Stream and Two-Stream Recycling

The manner in which recyclables are collected and processed across Ontario can generally be broken down into two types of systems: single-stream systems, in which all recyclables are commingled and placed by residents in one container, and two-stream systems, in which recyclables are separated by residents into two different containers (fibres and containers).

Although many of the larger municipalities in Ontario (e.g., City of Toronto, Region of Peel, Region of York) and in the United States (over 40 new programs in 2008[7]) have switched from two-stream systems to single-stream systems over the past five years, there is insufficient information available to definitively determine whether single-stream systems are the best option for communities like Hamilton. The following sub-sections describe some of the key issues associated with single-stream recycling.

Resident Participation

The move from two-stream recycling to single-stream recycling is often driven by the idea that residents are more likely to participate in a recycling program if it is more convenient.[8] Generally, this has proven to be the case: municipalities who have moved to single-stream recycling report an increase in resident participation in the recycling program (at least initially) following the switch.

The increase in participation following the switch to single-stream may not be solely due to the change in recycling system; it may also be influenced by a combination of other factors such as increased promotion of the recycling program, the introduction of garbage limits, and/or the implementation of user pay; changes which are often introduced concurrently with single-stream recycling. Moreover, any time a change is made to a municipal waste management system and is accompanied by a promotion and education campaign, there tends to be a surge in participation in diversion programs. This increase in participation tends to dissipate over time.

Currently, the City's two-stream curbside collection system achieves high capture rates for recyclable material and it is unlikely that a move to a single-stream system could significantly increase curbside capture rates particularly for single-residential households. Modest increases are reasonably possible for this sector. For multi-residential building residents, a switch to single-stream recycling would likely lead to increased capture rates for recyclables: anything that makes recycling easier for multi-residential building dwelling residents, particularly those in

[7] Container Recycling Institute. 2009. Understanding the Economic and Environmental Impacts of Single-Stream Collection Systems.
[8] Container Recycling Institute. 2009. Understanding the Economic and Environmental Impacts of Single-Stream Collection Systems.

high rise dwellings, may produce better diversion results. The higher turnover rate in multi-residential dwellings makes it difficult to get out a common message, as people move into the area from other municipalities where the waste management system may not be the same. Also, as multi-residential dwellers often have to go outside to the rollout carts for recyclables, single-stream makes it more convenient as not sorting is required in the cold (or wet).

Overall, it is likely that resident participation in Hamilton may increase somewhat with the introduction of a single-stream recycling program, with less impact on the single family residential sector that generally has higher current capture rates and more impact on the multi-residential sector for which single-stream offers more convenience.

Recovery and Diversion Rates

Typically, it is assumed that recovery and diversion rates of recyclable material will increase with a switch from a two-stream to a single-stream recycling system. This is not necessarily the case. Although the total quantity of material being collected and transported to material recovery facilities (MRFs) does indeed increase in most cases after a switch to single-stream recycling, a larger portion of this additional material if often residual waste which must be removed during processing and ends up being sent for landfill disposal.

Examining the data provided through the WDO datacall for various municipal groupings does not indicate that there is any real difference in the kilograms marketed per household for those programs with single-stream recycling as compared to households with two-stream recycling.

Moreover, the quality of material marketed from single-stream MRFs tends to be lower (i.e. contains higher levels of contamination). Some of this contamination is recyclable material winding up in the wrong bale (e.g., aluminum in the newspaper bale). Many processors send the contaminated bales back to the source to be re-sorted.

Costs

A study completed in 2008 looked at the costs of single-stream and two-stream recycling systems in various Ontario municipalities.[9] This study analyzed data collected through the annual Waste Diversion Ontario datacall . Without taking into account economies of scale (municipalities operating single-stream systems in the study were larger), two-stream programs were found to have on average lower net costs per tonne ($27.82 lower) and lower net costs per

[9]. Lantz, D. 2009. Single-stream vs. Two-stream: Round 3 in Solid Waste and Recycling. Lantz, D. 2009. Single-stream vs. Two-stream: Round 3 in Solid Waste and Recycling.

household ($6.44 lower) than single-stream systems, when considering collection and processing costs and program revenues.[10]

Single-stream recycling collection systems tend to be somewhat more efficient than two-stream recycling collection systems. Stop-time is reduced, given that the contractor is no longer required to sort two different material streams. Automated single-stream collection (systems that utilize automated cart collection such as the system used in Toronto) can reduce the number and size of the collection crews, improve route efficiency, and reduce worker compensation costs.[11]

In single-stream systems, collection vehicles are used more efficiently since there is no separation of fibres and containers in the vehicle. In two-stream programs using split vehicles, one side (typically fibres) may fill up more quickly than the other, requiring a trip to the MRF to unload. Single-stream collection vehicles only unload once the entire truck is full resulting in fuel savings, reductions to air emissions and less "wear and tear" on vehicles and road networks.

The benefit of increased collection productivity resulting from single-stream collection is highest in large urban collection areas, where stop times represent a high portion of the on-route collection operation. In rural areas, most of the on-route time is comprised of driving time between setouts (as opposed to stop times).

A 2007 presentation by the Solid Waste Association of North America (SWANA) estimated the collection savings from single-stream recycling at $10 to $20 per tonne as compared to two-stream collection.[12] Another study, which looked only at Ontario municipalities, compared the collection cost differences between single-stream and two-stream systems and found that costs savings associated with single-stream systems tend to be as low as $0 to $3 per tonne.[13] Generally speaking, therefore, collection costs tend to be lower for single-stream systems than for two-stream systems, but the exact difference needs to be determined on a system by system basis (i.e., via collection system modeling) for specific municipal jurisdictions.

Processing costs associated with single-stream recycling systems tend to be significantly higher than for two-stream recycling systems, and revenues tend to be lower. Higher capital costs are associated with new single-stream processing equipment, and the requirement to have a sorting line that separates containers from paper fibre, as well as certain specialized equipment (e.g.

[10] Lantz, D. 2009. Single-stream vs. Two-stream: Round 3 in Solid Waste and Recycling.
[11] Container Recycling Institute. 2009. Understanding the Economic and Environmental Impacts of Single-Stream Collection Systems.
[12] Scozzafava, L. July 19, 2007. To Single-stream or Not to Single-stream? Presentation by SWANA at US EPA Meeting, Philadelphia, PA.
[13] Lantz, D. December 2008. Mixed Residuals. In Resource Recycling Magazine.

optical sorters) that are often used in such MRFs. In addition, there would also be an increase in costs associated with MRF operations including:

- Higher labor costs due to increased sorting requirements;
- Higher level of residue requiring disposal from the MRF due to higher levels of contamination;
- Potential for decreased revenues from marketed materials due to higher contamination rates (e.g., #8 ONP); and,
- Revenue losses due to recyclables ending up in the wrong stream (containers in the fibre stream and fibres in the container stream).

Significant savings in collection costs are necessary to offset the increase in processing costs and reduction in revenues from the sale of recyclable materials that can be experienced through single-stream recycling programs.

Summary

The KPMG Best Practices study[14] found that as a general guideline, single-stream recycling was most applicable to programs collecting and processing about 40,000 tonnes or more per year of recyclable material. Recycling tonnages in the City of Hamilton are currently at about 38,875 tonnes marketed per year and given the largely urban nature of the City, single-stream recycling is a potentially feasible option. The merits of single-stream recycling can only be fully assessed when considering the full system cost of collection and processing. This was assessed in detail during the evaluation of the short-list of collection systems.

The following table (Table 4-4) provides a summary of the implications associated with single-stream recycling.

[14] Blue Box Program Enhancement and Best Practices Assessment Project'; KPMG, R. W. Beck and Entec Consulting Ltd.; July 2007

Table 4-4 Implications Associated with Single-Stream Recycling

Option: Single-Stream Recycling	
Implications on Public Acceptability	• Generally speaking, single-stream recycling seems to be more appealing and acceptable to residents as they are not responsible for sorting recyclables. • There is a potential for increased participation from multi-family dwellers due to the increase in convenience. The participation from single-family dwellers is already high and would not likely increase significantly over the long-term due to a switch to single-stream recycling.
Potential Effects on Diversion	• May lead to increased capture rates (mostly in multi-residential dwellings) • Tends to result in collection of "more of what you want and don't want" in the residential recycling collection program. Although the tonnage of material collected will likely increase, the quantity of residues sent to landfill will also increase. • The net impact on diversion is likely to be minimal.
Financial Implications	• Cost of a new single-stream MRF (capital and operating) would be in the order of 15 to 25% more than a comparably sized two-stream MRF.[15] • Cost of new carts if decision is made to switch to automated cart-based system • Less revenue from marketed materials due to possibility of cross-contamination and lower product quality.[16] • Potential lower collection costs from single-stream collection system. Estimated decrease in cost of $0 to $3 per tonne in Ontario.[17]
Environmental Impacts	• Reduced emissions as fewer collection vehicles would be used (depending on the configuration of the fleet) and the vehicles would have less idling time at each stop. • Single-stream collection vehicles only unload once the entire truck is full, resulting in fuel savings, reductions to air emissions and less "wear and tear" on vehicles and road networks.
Degree of Flexibility	• Would provide more opportunity to partner with other municipalities (single-stream MRFs can accept commingled or separated recyclables) • Some potential risk associated with investing in a new single-stream MRF given uncertainties with the future of the Blue Box Program Plan (BBPP) in Ontario.
Potential General Implementation Requirements and/or Barriers	• Will require comprehensive P&E program to educate public. • Will require retrofit of the current MRF, development of a new MRF (public or private) or export to outside processing capacity. • May require new recycling containers. • Would likely require new collection trucks for the City's fleet.

[15] Stantec Consulting Ltd. 2010. County of Simcoe Solid Waste Management Strategy: Phase 2 Task F: Diversion and Disposal Options.
[16] Stantec Consulting Ltd. 2010. County of Simcoe Solid Waste Management Strategy: Phase 2 Task F: Diversion and Disposal Options.
[17] Lantz, D. December 2008. Mixed Residuals. In Resource Recycling Magazine.

The following table (Table 4-5) provides a summary of the implications associated with two-stream recycling.

Table 4-5 Implications Associated with Two-Stream Recycling

	Option: Two-Stream Recycling
Implications regarding Public Acceptability	• No change to current level of service. • Participation in the current system is fairly high.
Potential Effects on Diversion	• Diversion rate would likely remain steady.
Financial Implications	• Costs would likely remain steady.[18]
Environmental Impacts	• Would remain steady, no change from current system. However, no opportunities for reduced impacts.
Degree of Flexibility	• Less flexible in regards to offering a 'regional' processing option given the collection programs offered by surrounding municipalities. • Less risk in regards to the uncertainties associated with the BBPP as minimal capital investment is required.
Potential General Implementation Requirements and/or Barriers	• No change, therefore minimal effects.

4.1.2.3 Leaf & Yard Waste (LYW) Collection

Year Round LYW Collection

The City currently collects Green Cart material on a weekly basis while it only provides bi-weekly collection of LYW during the peak periods of production in the spring and fall. In order to promote maximum LYW diversion, the City allows residents to 'top-up' their Green Carts with LYW material and currently permits residents to place up to two (2) additional containers of LYW out for collection beside the Green Cart each week throughout the year. During peak periods of LYW production (spring and fall) the City sends out (bi-weekly) a separate fleet of trucks to collect LYW material which is processed at the City's composting pad located at the Glanbrook Landfill. During off-peak periods, all LYW that is set out for collection (i.e., the two allowable containers) or placed in the Green Cart is collected along with the Green Cart material and sent to the CCF for processing.

One of the issues that the City currently faces is that some of the capacity at the CCF is committed under contract to other jurisdictions (e.g. Halton, Simcoe County) and capacity is also needed to support the expansion of the organics program to multi-residential dwellings. Furthermore, options such as a move to bi-weekly garbage collection, has the potential to

[18] WDO Datacall. 2009. Financial Highlights.

significantly increase capture rates for organics, which currently sits at around 54% for food wastes. Part of the problem is that a large portion of LYW is currently set out weekly in separate containers alongside the Green Cart and is collected with the Green Cart material and is sent to the CCF for processing. Ideally, a certain portion of LYW material would remain in the Green Cart (i.e. 'top-up' material) as it is beneficial to the process to have some LYW collected and processed along with food waste. However, the LYW material set out in separate bags/containers next to the Green Cart would be collected separately from Green Cart material and could be sent to the composting pad at the Glanbrook Landfill for processing or directed to the CCF as needed.

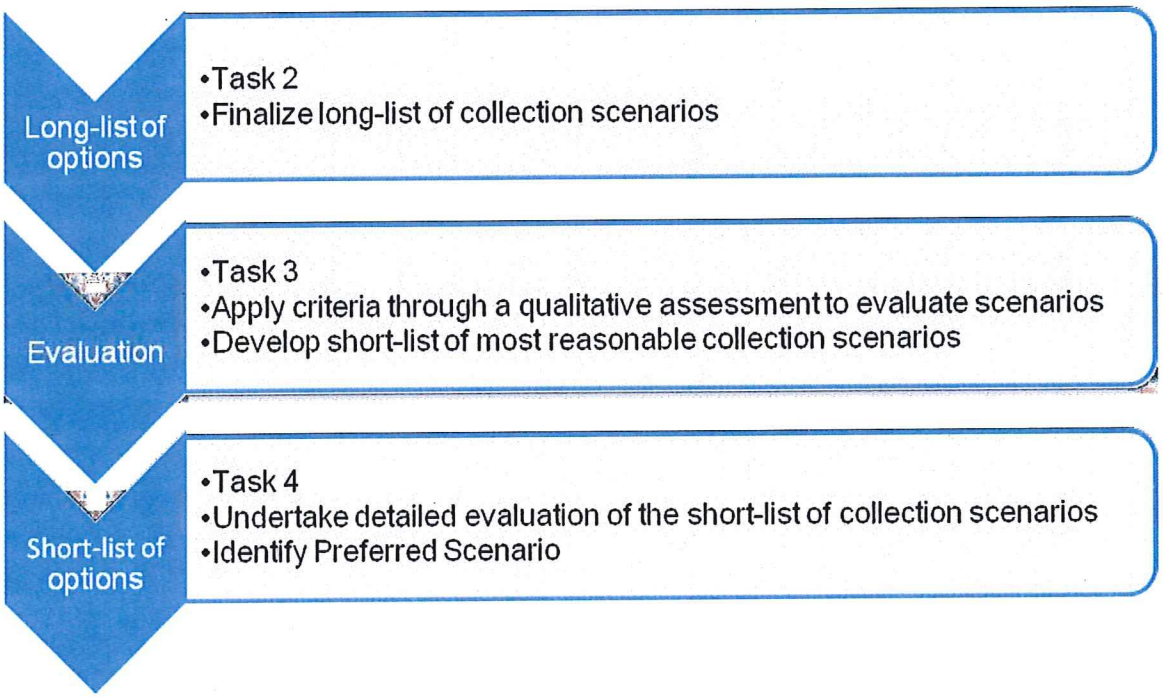
Separating LYW into two streams will assist the City in reducing processing costs (the costs associated with operating the composting pad are much lower than the CCF) and preserving valuable processing capacity at the CCF which is really intended for SSO material. Freeing up processing capacity at the CCF the City will support current market commitments, therefore resulting in increased revenues and offsets. By offering LYW collection throughout the year (weekly or bi-weekly), it is likely that a larger proportion of LYW could be removed from the Green Cart stream which will save valuable CCF processing capacity. The main drawback to implementing year-round LYW collection is the additional cost associated with operating a larger fleet of vehicles. This cost increase could potentially be offset through co-collection with another waste stream. Another drawback is the potential for increased environmental impacts with the operation of a larger fleet of vehicles. The following table (Table 4-6) provides a summary of the implications associated with weekly LYW collection.

Table 4-6 Implications Associated with Year-Round LYW Collection

Public Acceptability	• Would not likely have a significant effect on public acceptability.
Potential Effects on Diversion	• Little effect on diversion as capture rate for LYW material is already very high.
Financial Implications	• Additional costs may be associated with purchasing more collection vehicles. This could be (partially offset) by co-collecting the LYW stream with another waste stream. • Processing costs would be reduced as LYW would be processed in a more cost effective manner at the Glanbrook composting pad. • Freed-up capacity at the CCF could be made available to other municipalities which could result in increased revenues.
Environmental Impacts	• Potential for increased environmental impacts with the operation of a larger collection fleet.
Degree of Flexibility	• This option is flexible to changes to the WDA.
Implementation Requirements or Barriers	• No major barriers to implementation.

4.2 Evaluation of Long-Listed Collection System Options

After finalizing the long-list of collection system options, they were evaluated qualitatively at a relatively high level (the results of the evaluation are presented in this section) in order to determine the most reasonable short-list of scenarios to carry forward for detailed evaluation. The diagram below provides an overview of the process that was used in Task 2, Task 3 and Task 4.



4.2.1 Methodology

Evaluation criteria were developed to compare the long-list of systems. These criteria were applied to compare the advantages and disadvantages of the collection scenarios where there are distinct differences in the options that would result in the choice of one scenario over another. The criteria and rationale as to why each criterion was selected for inclusion in the evaluation process is provided below in Table 4-7.

Table 4-7 Evaluation Criteria

Criteria	Indicator	Rationale
Public Acceptability	Experience from other municipalities.	Systems with greater public acceptance will be easier to implement, and generally would incur lower P&E and general support costs. The system chosen must be perceived as being equivalent or an improvement in level of service and must provide "value for money".

Criteria	Indicator	Rationale
Potential Effects on Diversion	Range of percentage increase in diversion.	Collection systems that can encourage/support increased diversion will support City diversion goals and objectives.
Financial Implications	General range of potential operating and capital costs that may apply to the implementation of a scenario (collection and processing). Considers potential improvements to system efficiencies.	System must be financially feasible. Capital and operating cost implications for both collection and processing will be considered as well as identification and consideration of revenue streams where applicable.
Collection Costs		
Effects on Recycling Processing Infrastructure		
Effects on Organics Processing Infrastructure		
Effects on Transfer/Haul Infrastructure		
Environmental Impacts	Potential for reduced emissions (GHG etc.) from collection and disposal.	The collection system should minimize effect on environmental and social health. Generally systems with a smaller collection fleet and/or more efficient use of the time per stop, result in lower direct GHG and other emissions. Systems that recover additional recyclable and organic materials result in lower indirect GHG and other emissions.
Degree of Flexibility	Degree of flexibility in addressing issues that could arise following approval of any changes to the Waste Diversion Act and Blue Box Program Plan.	System must be flexible enough to be able to respond to changes in the Waste Diversion Act. In particular, consideration should be given to the capital cost and financing cost that may be borne by the municipality. There is greater risk in making a more significant capital investment in recycling, should the funding or other provisions of the provincial Blue Box Program Plan (BBPP) change.
Potential General Implementation Requirements and/or Barriers	Interactions with other waste management system components, including the current split between public and private sector service provision for collection.	System must not unduly impact other waste management components. Some systems may be associated with significant changes in processing approaches and/or significant public P&E approaches. Also, the City currently splits service provision, with public sector forces currently collecting all garbage and Green Cart organics in the A zones, private sector forces currently collecting garbage and Green Cart organics in B zones, and private sector forces collecting recycling in all zones. Any scenario that would result in significant changes in the support services required for collection will have an effect on internal service consumption.

The long-list of collection service scenarios identified in Table 4-1, were evaluated through the identification of advantages and disadvantages based on the criteria developed for the study. A range of potential effects were considered from a comparative standpoint: major advantages; advantages; neutral; disadvantages; and, major disadvantages to better represent the

significance of some of the impacts and therefore the differences between the scenarios. The following relative differences were established to constitute the difference between a major advantage and a major disadvantage and those that fall in between. Table 4-8 below summarizes these differences and provides a practical example of their application.

Table 4-8 Differentiation between Advantages and Disadvantages

Ranking	Description
MAJOR ADVANTAGE	Description: The option would have minimal impact based on the criteria/indicator being applied and/or in most cases a net benefit would result. Example: An option that had significant potential to increase diversion rates would be considered to have a major advantage.
ADVANTAGE	Description: The option would have manageable impact based on the criteria/indicator being applied and/or in most cases a net benefit would result. Example: An option that had some potential to increase diversion rates would be considered to have an advantage.
NEUTRAL	Description: The option would have no potential benefits or impacts based on the criteria/indicator being applied. Example: An option that had no potential to increase diversion rates would be considered to have a neutral effect.
DISADVANTAGE	Description: The option would have some negative impacts based on the criteria/indicator being applied. Example: An option that resulted in a minor decrease in diversion rates would be considered disadvantaged.
MAJOR DISADVANTAGE	Description: The option would have a significant impact based on the criteria/indicator being applied. Example: An option that resulted in a significant decrease in diversion rates would be considered to have a major disadvantage.

4.2.2 Results of Evaluation

The following Table 4-9 presents the results of the evaluation considering the above criteria and the discussion of the considerations applicable to each of the collection scenarios discussed in Table 4-1.

Table 4-9 Evaluation of Long-Listed Systems

Criteria	System A (Status Quo)	System B	System C	System D	System E	System F	System G	System H	System I
Garbage	Weekly, Co-Collected with Green Cart	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with SS Recycling	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Alternating with LYW
Recyclables	Weekly, Two-Stream, Co-Collected	Weekly, SS, Co-Collected with Green Cart	Weekly, SS, Separate Collection	Weekly, Two-Stream, Co-Collected	Bi-Weekly, SS, Co-Collected with Green Cart	Weekly, SS, Co-Collected with Garbage	Bi-Weekly, SS	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with Garbage	Weekly, Co-Collected with SS Recycling	Weekly, Separate Collection	Weekly, Separate Collection	Weekly, Co-Collected with Garbage/Recycling	Weekly, Co-Collected with LYW	Weekly, Co-Collected with LYW	Weekly, Co-Collected with LYW	Weekly, Separate Collection
LYW	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with Green Cart	Bi-Weekly, Alternating with Garbage
Number of Truck Passes/Week	2 Truck Passes/Week (plus seasonal LYW)	1.5 Truck Passes/Week (plus seasonal LYW)	2.5 Truck Passes/Week (plus seasonal LYW)	2.5 Truck Passes/Week (plus seasonal LYW)	1 Truck Pass/Week (plus seasonal LYW)	2 Truck Passes/Week	2 Truck Passes/Week	2.5 Truck Passes/Week	3 Truck Passes/Week
Implications on Public Acceptability	ADVANTAGE Likely high level of acceptability to residents given performance of current system.	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience.	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience.	DISADVANTAGE Bi-weekly garbage may be perceived as a reduction in service to some residents.	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience.	ADVANTAGE SS recycling tends to be more acceptable than two-stream recycling due to the increased level of convenience.	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience.	NEUTRAL to DISADVANTAGE Bi-weekly garbage may be perceived as a reduction in service to some residents.	DISADVANTAGE Bi-weekly garbage and bi-weekly LYW collection would both likely be perceived as a reduction in service to some residents.
Potential Effects on Diversion	**DISADVANTAGE** **The potential for additional diversion would be limited.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some (lower) potential for increased diversion of recyclables.**	**DISADVANTAGE** **The potential for additional diversion would be limited.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some (lower) potential for increased diversion of recyclables.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables.**	**ADVANTAGE** **Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables.**
Financial Implications									
Effect on Collection Costs	NEUTRAL Costs should remain relatively unchanged. Minimal opportunity for additional costs savings.	ADVANTAGE Would require reduced collection fleet, thus likely reducing overall collection costs.	DISADVANTAGE Would require increased collection fleet, thus likely increasing overall collection costs.	DISADVANTAGE Would require increased collection fleet, thus likely increasing overall collection costs.	ADVANTAGE Would require reduced collection fleet, thus likely reducing overall collection costs.	NEUTRAL Would require slight reduction in collection fleet, thus likely decreasing overall collection costs.	NEUTRAL Would require slight reduction in collection fleet, thus likely decreasing overall collection costs.	DISADVANTAGE Would require increased collection fleet, thus likely increasing overall collection costs.	DISADVANTAGE Would require increased collection fleet, thus likely increasing overall collection costs.
Effect on Recycling Processing Infrastructure	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned.	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned.	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned.	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned.	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned.	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned.	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned.	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned.	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned.

Criteria	System A (Status Quo)	System B	System C	System D	System E	System F	System G	System H	System I
Garbage	Weekly, Co-Collected with Green Cart	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with SS Recycling	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Alternating with LYW
Recyclables	Weekly, Two-Stream, Co-Collected	Weekly, SS, Co-Collected with Green Cart	Weekly, SS, Separate Collection	Weekly, Two-Stream, Co-Collected	Bi-Weekly, SS, Co-Collected with Green Cart	Weekly, SS, Co-Collected with Garbage	Bi-Weekly, SS	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with Garbage	Weekly, Co-Collected with SS Recycling	Weekly, Separate Collection	Weekly, Separate Collection	Weekly, Co-Collected with Garbage/Recycling	Weekly, Co-Collected with LYW	Weekly, Co-Collected with LYW	Weekly, Co-Collected with LYW	Weekly, Separate Collection
LYW	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with Green Cart	Weekly, Co-Collected with Green Cart	Bi-Weekly, Alternating with Garbage
Number of Truck Passes/Week	2 Truck Passes/Week (plus seasonal LYW)	1.5 Truck Passes/Week (plus seasonal LYW)	2.5 Truck Passes/Week (plus seasonal LYW)	2.5 Truck Passes/Week (plus seasonal LYW)	1 Truck Pass/Week (plus seasonal LYW)	2 Truck Passes/Week	2 Truck Passes/Week	2.5 Truck Passes/Week	3 Truck Passes/Week
Effect on Organics Processing Infrastructure	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium. Will not address CCF capacity issues.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium. Will not address CCF capacity issues.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium. Will not address CCF capacity issues.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium. Will not address CCF capacity issues.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium. Will not address CCF capacity issues.	ADVANTAGE Would provide opportunity to divert LYW from CCF to composting pad. Will address CCF capacity issues.	ADVANTAGE Would provide opportunity to divert LYW from CCF to composting pad. Will address CCF capacity issues.	ADVANTAGE Would provide opportunity to divert LYW from CCF to composting pad. Will address CCF capacity issues.	NEUTRAL Would provide some opportunity to divert LYW from CCF to composting pad. Will address some CCF capacity issues.
Effect on Transfer/Haul Infrastructure	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Would require minimal change in use of transfer stations.	NEUTRAL Would require minimal change in use of transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.	NEUTRAL Requires no change from current use of existing transfer stations.
Environmental Impacts	NEUTRAL Little potential for change in direct or indirect GHG or other emissions.	ADVANTAGE Potential reduction in direct air emissions due to decrease in size of collection fleet. Some potential for decrease in indirect air emissions.	DISADVANTAGE Potential increase in air emissions due to increase in size of collection fleet. Some potential for decrease in indirect air emissions.	DISADVANTAGE Potential increase in air emissions due to increase in size of collection fleet. Some potential for decrease in indirect air emissions.	ADVANTAGE Potential reduction in direct air emissions due to decrease in size of collection fleet. Minimal change in indirect air emissions.	NEUTRAL Potential slight reduction in direct air emissions due to slight decrease in size of collection fleet. Minimal change in indirect air emissions.	NEUTRAL Potential slight reduction in direct air emissions due to slight decrease in size of collection fleet. Some potential for decrease in indirect air emissions.	DISADVANTAGE Potential slight increase in air emissions due to slight increase in size of collection fleet. Some potential for decrease in indirect air emissions.	DISADVANTAGE Potential increase in air emissions due to increase in size of collection fleet. Some potential for decrease in indirect air emissions.
Degree of Flexibility	ADVANTAGE Somewhat flexible to changes to WDA and minimal additional investment in system required.	DISADVANTAGE Somewhat less flexible to WDA due to significant investment in recycling processing infrastructure.	DISADVANTAGE Somewhat less flexible to WDA due to significant investment in recycling processing infrastructure.	ADVANTAGE Somewhat flexible to changes to WDA and minimal additional investment in system required.	DISADVANTAGE Somewhat less flexible to WDA due to significant investment in recycling processing infrastructure.	DISADVANTAGE Somewhat less flexible to WDA due to significant investment in recycling processing infrastructure.	DISADVANTAGE Somewhat less flexible to WDA due to significant investment in recycling processing infrastructure.	ADVANTAGE Somewhat flexible to changes to WDA and minimal additional investment in system required.	ADVANTAGE Somewhat flexible to changes to WDA and minimal additional investment in system required.
Potential General Implementation Requirements and/or Barriers	MAJOR ADVANTAGE No change in implementation requirements and/or barriers. Would accommodate current public/private service level split.	DISADVANTAGE Increase in P&E. Would not accommodate current public/private service level split.	NEUTRAL Increase in P&E. Would accommodate current public/private service level split.	NEUTRAL Increase in P&E. Would accommodate current public/private service level split.	DISADVANTAGE Increase in P&E. Would not accommodate current public/private service level split.	DISADVANTAGE Increase in P&E. Would not accommodate current public/private service level split.	DISADVANTAGE Increase in P&E. Would not accommodate current public/private service level split.	NEUTRAL Increase in P&E. Would accommodate current public/private service level split.	NEUTRAL Increase in P&E. Would accommodate current public/private service level split.
Overall Result	**MAJOR ADVANTAGE**	**NEUTRAL to DISADVANTAGE**	MAJOR DISADVANTAGE	NEUTRAL to DISADVANTAGE	NEUTRAL TO DISADVANTAGE	MAJOR DISADVANTAGE	NEUTRAL to DISADVANTAGE	**MAJOR ADVANTAGE**	**NEUTRAL**

4.2.2.1 Short-List of Collection System Scenarios

The short-list of collection system scenarios, resulting from the qualitative evaluation of the long – list of scenarios set out in Table 4-1 are highlighted in Table 4-10 below.

Table 4-10 Results of Evaluation

Scenario	Description	Overall Results
System A (Status Quo)	Garbage – Weekly, Co-collected with Green Cart	Major Advantage (highest ranked)
	Recyclables – Weekly Two-stream, Co-collected	
	Green Cart – Weekly, Co-collected with garbage	
	LYW – Bi-weekly (Spring and Fall), separate collection	
System B	Garbage – Bi-weekly, separate collection	Neutral to Disadvantaged
	Recyclables – Weekly SS, Co-collected with Green Cart	
	Green Cart – Weekly, Co-collected with SS Recycling	
	LYW – Bi-weekly (Spring and Fall), separate collection	
System C	Garbage – Bi-weekly, separate collection	Major Disadvantage
	Recyclables – Weekly SS, separate collection	
	Green Cart – Weekly, separate collection	
	LYW – Bi-weekly (Spring and Fall), separate collection	
System D	Garbage – Bi-weekly, separate collection	Neutral to Disadvantaged
	Recyclables – Weekly two-stream, co-collected	
	Green Cart – Weekly, separate collection	
	LYW – Bi-weekly (Spring and Fall), separate collection	
System E	Garbage – Bi-weekly, co-collected with Green Cart	Major Disadvantage
	Recyclables – Bi-weekly SS, co-collected with Green Cart	
	Green Cart – Weekly, co-collected with Garbage/Recycling	
	LYW – Bi-weekly (Spring and Fall), separate collection	
System F	Garbage – Weekly, co-collected with SS Recycling	Major Disadvantage
	Recyclables – Weekly SS, co-collected with garbage	
	Green Cart – Weekly, co-collected with LYW	
	LYW – Weekly, co-collected with Green Cart	
System G	Garbage – Biweekly alternating with SS Recycling	Major Disadvantage
	Recyclables – Bi-Weekly SS, alternating with Garbage	
	Green Cart – Weekly, co-collected with LYW	
	LYW – Weekly, co-collected with Green Cart	
System H	Garbage - Bi-weekly	Major Advantage

Scenario	Description	Overall Results
	Recyclables – Weekly Two-Stream	(second highest ranked)
	Green Cart – Weekly, co-collected with LYW	
	LYW – Weekly, co-collected with Green Cart	
System I	Garbage - Bi-weekly, alternating with LYW	Neutral (third highest ranked)
	Recyclables – Weekly Two-Stream	
	Green Cart – Weekly	
	LYW – Bi-weekly, alternating with Garbage	

Stantec recommended that the three top-ranked two-stream recycling scenarios (A, H, and I) and the top-ranked single-stream recycling scenario (B) be carried forward for detailed evaluation.

The top ranked two-stream recycling scenarios include both weekly and bi-weekly collection of garbage. Proceeding with a detailed analysis of these scenarios allowed the study team to determine the potential cost savings and increased diversion performance associated with each of these three approaches, and to determine if the savings and increased diversion associated with bi-weekly garbage collection is sufficient to offset the implementation challenges and public reaction to such a change.

The top ranked single-stream recycling scenario ranked behind the best two-stream recycling scenarios after the long-list evaluation. The single-stream approach, however, offers the use of one of the smallest overall collection fleets, allowing for one of the lowest overall collection costs. Detailed analysis was needed to determine if the potential decrease in collection costs for this scenario were sufficient to offset the potential increase in processing costs, particularly considering any potential loss of revenues.

5 EVALUATION OF SHORT-LISTED SYSTEM OPTIONS

5.1 Introduction

The evaluation of the long-list of curbside collection systems resulted in the identification of a short-list of systems which ranked higher than others based on the consideration of social, technical, environmental, and financial criteria. As noted above, it was recommended that the three top-ranked two-stream recycling scenarios (A, H, and I) and the top-ranked single-stream recycling scenario (B) be carried forward as the short-list of collection system options to be evaluated in more detail.

The following table (Table 5-1) summarizes the short-list of curbside collection systems carried forward for detailed evaluation:

Table 5-1 Short-List of Collection Systems

Scenario	Description
System A (Status Quo)	Garbage – Weekly, Co-collected with Green Cart
	Recyclables – Weekly Two-stream, Co-collected
	Green Cart – Weekly, Co-collected with garbage
	LYW – Bi-weekly (Spring and Fall), separate collection
System B	Garbage – Bi-weekly, separate collection
	Recyclables – Weekly SS, Co-collected with Green Cart
	Green Cart – Weekly, Co-collected with SS Recycling
	LYW – Bi-weekly (Spring and Fall), separate collection
System H	Garbage - Bi-weekly
	Recyclables – Weekly Two-Stream
	Green Cart – Weekly, co-collected with LYW
	LYW – Weekly, co-collected with Green Cart
System I	Garbage - Bi-weekly, alternating with LYW
	Recyclables – Weekly Two-Stream
	Green Cart – Weekly
	LYW – Bi-weekly, alternating with Garbage

5.2 Methodology

5.2.1 Step 1 – Collection System Modeling

Collection system modeling was completed on each of the short-listed systems to estimate the potential collection fleet size and associated collection costs that would apply for each system. A summary of the collection system modeling exercise is provided in Section 5.3 of this report.

5.2.2 Step 2 – Evaluation of Short-Listed Systems

Following the completion of collection system modeling, Stantec proceeded to complete the evaluation process and identify the preferred scenario(s)/option(s) considering both the results of the modeling (collection fleet size and costs) as well as additional criteria including:

- Assessment of potential residential behavior changes and attitudes towards diversion, and the potential effect of these changes and attitudes on the performance of specific scenarios;
- A detailed diversion assessment based on the potential changes in material capture rates for the various residential groups associated with each scenario; and,
- Inclusion of environmental criteria (potential change in GHG emissions and other key indicators) based on the outcome of the collection system modeling. Application of

environmental criteria was based on the use of data generated by generally accepted Life Cycle Analysis models and approaches.

A complete listing and description of the criteria utilized to evaluate the short-list of systems can be found in Section 0 below.

5.2.3 Step 3 – Examination of Variations for the Preferred Collection System Option(s)

The last step in Task 4 was assessing variations for the preferred collection system option (or options). Variations that were assessed included the effect of:

- The use of different container types for collection for recyclables (cart-based, blue box, bag based);
- The type of collection containers used for garbage, including allowance (or lack thereof) for use of rigid containers;
- Adjusting the approach used to address "Special considerations" for material collection;
- Adjusting the approach for bulk waste collection (call-in program etc.); and,
- Changes in operating hours (and number of shifts) for collection services.

The outcome of Step 3 is discussed in Section 6 of this report.

5.3 Collection System Modeling

The following sections of the report provide the results of the collection system modeling exercise.

5.3.1 Assumptions Used in the Model

5.3.1.1 General

The collection model developed by Stantec requires that a number of key parameters be defined and applied in order to calculate the vehicle requirements required for each collection system. Key parameters included items such as truck capacity, waste compaction, time per stop, average set out rates, and distance between houses etc. Most of this information was obtained from City staff, while some data was calculated based on other studies previously completed by Stantec and other consultants.

The following table (Table 5-2) provides an example of some of the key data input to Stantec's collection system model.

Table 5-2 Example of Inputs for the Collection System Model

Collection Zone A1		
Waste Stream	**Garbage & Organics Co-collection**	
Truck type	Rear Packer	
Capacity of Truck (yd^3)	25	
Capacity Used in Modeling (m^3)	19.11	
Compaction Ratio	3.5 (garbage)	1.0 (organics)
Collection Weeks for Stream	52	
Collections Per Year	52	
Percentage of Truck Capacity	60% (garbage)	40% (organics)
Time per Stop (sec)	9.8	10.3
Average set out rate (%)	90%	40%
Dumping time (mins)	10	
Avg. Distance between houses (m)	24	
Avg. On-route Speed (km/hr)	15	
Avg. Off-route Speed (km/hr)	50	
Number of Households on Route	54,984	54,984
Distance to Transfer Stn/Facility (km)	10.88	4.9
Collection Operating Hours/Day	10	10

Initially, Stantec completed modeling of the current (Status Quo) system, and adjusted key parameters in order to ensure that the model would generate a total fleet size for the Status Quo system that is consistent with the actual fleet used to service the curbside collection programs. By ensuring that the model calculates the same number of trucks being actually used, Stantec could move forward in modeling other collection systems using the same key parameters knowing that the number of trucks required for these systems was reasonable and comparable to Status Quo values.

Note: currently the average collection operating hours per day ranges from between 6 to 7.5 hours per day. For the purpose of the model, it was assumed that collection services would begin at 7 a.m. and proceed to 5 p.m., for a 10 hour operating day.

Both 'low' and 'high' fleet size estimates were generated by the model. The 'low' estimates resulted from the application of the critical performance parameters as noted above. For the 'high' estimates, the fleet size was escalated by 10% to reflect some variability in the number of spare vehicles that may be proposed.

5.3.1.2 Material Quantities

In order to estimate the quantity of material requiring collection by each system during the next collection contract (2013-2018), the waste projections developed during Task 2 of the project were used. These projections assumed that waste generation rates would remain steady, but that population (and number of households) would increase from year to year. Stantec assumed that set-out rates for each material stream would remain steady at 2009 values.

5.3.1.3 Vehicles

Although no manufacturer of vehicles was specified, a general size and design of truck was assumed for modeling purposes. After discussions with City staff at the December 10th, 2010 meeting, it was assumed that for the next collection contract (for modeling purposes) that all trucks would be rear packers sized at 32 yd^3 , except for the more densely populated A1 zone where the use of smaller 25 yd^3 rear packers was assumed.

Rear packers were chosen as this type of vehicle offers greater flexibility for collection of differently sized materials, provides the flexibility of being able to handle bulk waste along with bagged materials, and as this design allows for more effective compaction and discharge of compacted materials. By assuming that rear packers would be used in each of the four short-listed collection systems, they could be compared in an 'apples-to-apples' manner.

5.3.1.4 Facilities

For modeling purposes, it was assumed that the current facilities would continue to be utilized under the terms of the new collection contract, being the three CRCs/Transfer Stations and the Resource Recovery Centre (RRC – being the MRF and CCF). Waste is unloaded at the Transfer Stations, while organics and recyclables are unloaded at the RRC.

5.3.2 Results of Modeling

5.3.2.1 Fleet Size Comparison

Table 5-3 presents a summary of the results of the modeling exercise. Note: for the purpose of providing an appropriate basis of comparison, the 'Status Quo' collection approach was modeled, assuming the curbside methodology would remain the same, but that there would be an increase in the number of households serviced and tonnes managed.

As displayed in the table, not surprisingly, System B (the single-stream recycling scenario with bi-weekly garbage) was identified as being the most efficient system from a truck number respective (requiring 53 (low) to 58 (high) trucks plus 6 extra trucks dedicated to collecting LYW and/or bulk waste throughout the year). Of the three two-stream recycling systems, System H

was identified as being the most efficient (requiring 69 (low) to 76 (high) trucks plus 2 extra for handling seasonal peak LYW production and 4 extra trucks for the separate collection of bulk waste material).

Table 5-3 Results of Collection System Modeling – Fleet Size Comparison

	Status Quo (2013-2018)		System B		System H			System I		
	Garbage/Green Cart	Two-Stream Recycling	Garbage	Green Cart and Single-Stream Recycling	Garbage	Green Cart	Two-Stream Recycling	Garbage	Green Cart	Two-Stream Recycling
	Weekly Co-Collected	Weekly Co-Collected	Bi-Weekly Separate	Weekly Co-Collection	Bi-Weekly Separate	Weekly Co-Collected with LYW	Weekly Co-Collected	Bi-Weekly Separate Alternating with LYW	Weekly Separate	Weekly Two-Stream Co-Collected
Zone A1	11	8	4	10	4	4	8	6	4	8
Zone A2	3	3	1	3	1	2	3	2	2	3
Zone A3	5	4	2	5	2	3	4	3	3	4
Zone B1	11	9	3	12	3	6	9	5	5	9
Zone B2	4	3	2	4	2	2	3	2	2	3
Zone B3	8	4	2	5	2	7	4	6	7	4
Number of Trucks	42	31	14	39	14	24	31	24	23	31
Number of Trucks plus 10%	46	34	15	43	15	26	34	26	25	34
Total Fleet Size	**73 to 80 +6 for LYW/Bulk**		**53 to 58 +6 for LYW/Bulk**		**69 to 76 +2 for Seasonal Peak LYW +4 for Separate Bulky Collection**			**78 to 86 +2 for Seasonal Peak LYW +4 for Separate Bulky Collection**		

5.3.3 Financial Implications

The following subsections discuss assumptions made in regards to financial implications of each system and summarize the estimated annual collection and processing costs associated with each system.

5.3.3.1 Collection (Vehicle) Cost Assumptions

Capital costs for various collection vehicles currently available on the market have been determined through market research undertaken earlier in 2010. The capital costs were set at 2013$ to represent the capital costs that would be incurred at the beginning of the term of the new collection contract, and vary from $170,000 to $234,000, with generally the larger vehicle sizes costing slightly more overall, but less in regards to cost per capacity. To determine the annual capital costs that would have to be recovered through the term of the next collection contract, it was assumed that the capital cost would be amortized over a seven (7) year period, at an interest rate of 5%.

In regards to the annual operating costs, it was assumed that rear packers would be manned by two (2) staff at a base rate of approximately $22/hour for private sector labour and $27/hour for public sector labour. Operating cost assumptions included: labor and benefits, maintenance, fuel, insurance and licensing and a reasonable profit margin. The profit margin for private collection services in the 'B' zones was set at a reasonable rate for the 'low' cost estimates, and a higher rate for the 'high' cost estimates.

In addition, costs for fleet management and support services were estimated based on the 2010 Collections budget for the City.

The operating cost estimates for labour, benefits, maintenance, insurance and licensing and fleet management/support services, were escalated by 2% per annum to the mid-point of the collection contract (2016) which would represent the average operating cost over the term of the contract. Fuel costs were escalated by 15% per annum over the same period, to ensure that the average operating costs estimates reflected reasonable provisions for the volatility of fuel prices.

5.3.3.2 Processing Cost Assumptions

For those scenarios which included two-stream recycling (Systems A, H, and I), it was assumed that there would be minimal to no capital investment for recycling processing beyond that which is already planned. In order to determine processing costs, the actual processing costs per tonne (contract processing cost only) observed in 2008 and 2009 was averaged resulting in a processing cost per tonne of $45.50 used in the modeling exercise. To determine revenues per

tonne, the revenues observed during 2008 and 2009 were averaged resulting in revenue per tonne of $102.57. These costs were escalated by 2% per annum to determine the processing costs as of 2016.

The outcome of the upcoming MRF review may indicate some need for capital investment in the current MRF, to allow for continued operation over the next contract term. The cost assumptions will be revisited once this review is complete.

For System B, which included single-stream recycling, it was assumed that significant capital investments would need to be made beyond that which is already planned. Capital costs for a new single-stream MRF (70,000 tpy) were based upon vendor submissions received by the City during the RFP process completed in 2006, and were escalated to 2013$ based on 2% CPI. Costs used reflected the lowest proposed cost received by the City. Estimated capital costs for the new single-stream MRF were $14,820,721 (2006$) equivalent to $18.2 million (2013$), which takes into account both design and construction phase costs. It was assumed that the capital costs would be amortized over a 15 year period at an interest rate of 5%.

In order to accommodate the construction of a single stream plant in a separate area of the current MRF building, along with a new tipping floor and other required features, the Collection Operations in the current MRF building would be displaced. Therefore, in addition to the direct MRF capital costs, it was also assumed that an additional $2,100,000 (2013$) would be required in order to move the collection fleet from the MRF to a new location. The $2,100,000 includes the cost to construct a new facility capable of housing the fleet as well as moving the fleet to a temporary location while the new facility is being constructed, as timelines do not allow the facility to be constructed before the start of the next collection contract.

Recycling processing costs for System B were also based on vendor submissions received by the City during RFP process completed in 2006 escalated to 2016$ based on 2% CPI. Single-stream processing costs were estimated at $62.24 per tonne (2006$) or $74 per tonne (2016$). This processing cost assumed the MRF would be processing between 4,000 and 4,999 tonnes of material per month with a residue rate between 8% and 11%. The residue rate seems reasonable based on the residue rates observed in municipalities which currently operate single-stream recycling systems. To determine revenues per tonne for System B, previous research conducted by Stantec was consulted which shows that, on average, revenue received for single-stream material tends to be approximately 3% lower than revenue received for two-stream material (reflecting higher contamination rates). Revenues per tonne for System B were calculated to be approximately $110 (2016$).

5.3.3.3 Financial Implications Summary

The following table (Table 5-4) summarizes some of the key collection and processing costs determined for each of the short-listed systems based on the results of the collection system modeling exercise, and compares these results to the 2010 budget for the same services.

Collection cost estimates were based on the size and type of collection fleet, considering the capital costs (amortized over seven years), labour costs (driver and thrower as applicable) and other variable vehicle costs (e.g. fuel).

The processing costs identified for the Status Quo, and Systems H and I reflect operating costs associated with two-stream recycling based on costs observed at the current MRF in years 2008 and 2009, while System B uses capital and operating costs for a new single-stream recycling estimated based upon the results of the 2006 RFP process.

Table 5-4 Summary of Annual Curbside Collection and Processing Costs (2016$)

	System A Status Quo (New Contract) 2016$	System B 2016$	System H 2016$	System 2016$	Current (2010 Budget)
Fleet Size (not including LYW/Bulk Waste Trucks)	73 to 80	53 to 58	69 to 76	78 to 86	
LYW and Bulk Waste Trucks	6	6	6	6	
Collection Cost (annual capital and operating)	$26.2 to $27.8 million	$20.0 to $21.2 million	$25.0 to $26.5 million	$27.8 to $29.5 million	$24.8 million
Processing Cost (annual capital and operating cost)	$2.1 million	$5.8 million	$2.3 million	$2.3 million	$2.8 million
Estimated Annual Revenues	($4.5) million	($5) million	($4.8) million	($4.8) milliion	($4.5) million
Net Annual Cost (rounded)	$23.7 to 25.3 million	$20.6 to 21.8 million	$22.4 to 24 million	$25.2 to 26.9 million	$23.2 million

Overall, Systems B and H have the lowest estimated annual costs of all the scenarios, with estimated net costs for both systems being extremely close, and less than or equivalent to the combined value of the current collection and processing contracts.

This analysis does not include all potential cost implications associated with each of the Systems, just the key elements. For example, the potential reduction in composting processing

costs associated with the redirection of LYW from the CCF in Systems H and I have not been addressed in these estimates. The potential cost of purchasing and delivering new recycling carts, which could be the preferred approach for implementing single stream recycling in System B also has not been included in these estimates.

5.4 Evaluation of Short-Listed Systems

Based on the results of the collection system modeling and other analysis, the evaluation of the short-listed systems was completed. The following subsections describe the evaluation process.

5.4.1 Potential Effects on Diversion

Each of the alternative collection systems (other than the Status Quo) presents opportunities for increased diversion of waste from disposal in comparison to the current system. System H and I include a move to bi-weekly garbage which tends to increase residents' participation in both recycling and organics diversion programs while System B includes a move to bi-weekly garbage collection and single-stream recycling. A shift to single-stream recycling tends to increase recycling capture rates for recyclable material even further.

In general the following assumptions concerning diversion increases were made:

- A move to bi-weekly garbage collection (Systems H and I) would result in an increase in capture rate of 7% for recyclables.
- A move to bi-weekly garbage collection in Systems B, H and I would increase the capture rate by 9% for organics such as compostable paper fibre and 13% for food waste.
- The shift to single-stream recycling (System B) would result in an increase in recyclable material capture rates (14% across the board for acceptable materials).

Overall, it is estimated that Systems H and I will results in an overall diversion rate increase of 5.7%, increasing the curbside diversion rate to approximately 60%. System B will result in an overall diversion rate increase of 7.6%, increasing the overall curbside diversion rate to approximately 62%.

5.4.2 Environmental Impacts

Environmental impacts were assessed by determining the emissions (GHG etc.) from collection and disposal associated with each of the systems. Both direct and indirect emissions associated with each system were determined. Direct air emissions were calculated based on the size of a system's collection fleet. Indirect emissions were determined in general, based upon a system's ability to recover additional recyclable and organic material.

5.4.2.1 Collection Fleet Size – Direct Emissions

The size of each collection fleet plays a major part in determining the environmental impact of a system. Generally, the more trucks a system places on the road, the greater the amount of direct air emissions generated as a result of the system's operation.

In order to quantify the emissions associated with each system's collection fleet, Stantec referenced the following report: "Emission Reduction Options for Heavy Duty Diesel Fleet Vehicles in the Lower Fraser Valley Final Report," prepared by Levelton Consultants, October 2005. Based on the information found in this report, Stantec developed emissions per truck operating hour for various environmental contaminants including carbon dioxide, nitrogen oxides, sulphur oxides, and particulate matter. These parameters were selected because they are smog precursors and Hamilton already has a fairly taxed airshed. The emissions per truck hour calculation represent a reasonable profile for a heavy duty diesel waste collection vehicle.

The following table outlines the assumed quantity of various emissions emitted by a heavy duty diesel truck per hour.

Table 5-5 Collection Fleet Direct Emissions – Per Truck

Parameter	Kg Emitted per Hour of Operation
Carbon Dioxide (CO_2)	47.4
Nitrogen Oxides (NO_X)	0.00741
Sulphur Oxides (SO_X)	0.000195
Particulate Matter (PM_{10})	0.00039

5.4.2.2 Material Diversion – Indirect Emissions

The indirect emissions associated with each system were assessed based upon increases in material diversion. Generally, systems that recover additional recyclable and organic materials (i.e. divert these materials from landfill) result in lower indirect air emissions. In regards to the emissions reductions associated with recycling, the energy required to convert recyclables (e.g. aluminum) to new products is significantly less than the energy required to manufacture products from virgin materials. Carbon dioxide equivalents (CO_2e) are a unit of measurement that allows the effect of different greenhouse gases (GHG) and other factors to be compared using carbon dioxide as a standard unit for reference. It refers to the amount of carbon dioxide that would give the same warming effect as the effect of the greenhouse gas or greenhouse gases being emitted. Different models can be used to predict GHG emissions reductions, expressed in CO_2 equivalents; and although results may vary according to the model, all models indicate GHG emissions reductions associated with recycling. For example, the IWM model developed by the University of Waterloo, indicates GHG emissions reductions of around 1.7

tonnes of CO_2e per tonne of mixed paper recycled, 4.5 tonnes for each tonne of plastic recycled and 8 tonnes per tonne of aluminum recycled.[19]

In regards to organics diversion, the reduction in emissions of GHG relates to the diversion of decomposable material from landfill disposal and the resulting methane emission reductions. The net reduction in GHG emissions from recycling each tonne of food scraps (accounting for all GHG emissions from processing the materials) versus landfill disposal is approximately 800 kg for each tonne of food diverted.[20]

5.4.3 Evaluation Criteria

The criteria and indicators used in the short-list evaluation are outlined below (Table 5-6). These criteria were verified in discussion with City staff at a meeting held on November 22, 2010.

Table 5-6 Proposed Short-List Evaluation Criteria

Criteria	Indicator	Rationale
Public Acceptability	Experience from other municipalities.	Systems with greater public acceptance will be easier to implement, and generally would incur lower P&E and general support costs. The system chosen must be perceived as being equivalent or an improvement in level of service and must provide "value for money".
Potential Effects on Diversion	Range of percentage increase in diversion.	Collection systems that can encourage/support increased diversion will support City diversion goals and objectives.
Financial Implications	General range of potential operating and capital costs that may apply to the implementation of a scenario (collection and processing). Considers potential improvements to system efficiencies.	System must be financially feasible. Capital and operating cost implications for both collection and processing will be considered as well as identification and consideration of revenue streams where applicable.
Collection Costs		
Effects on Recycling Processing Infrastructure		
Effects on Organics Processing Infrastructure		

[19] Integrated Waste Model, University of Waterloo, updated 2005.
[20] Data taken from ICF Consulting report entitled "Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions: 2005 Update" submitted to Environment Canada and Natural Resources Canada on October 31, 2005

Criteria	Indicator	Rationale
Environmental Impacts	Potential for reduced emissions (GHG etc.) from collection and disposal.	The collection system should minimize effect on environmental and social health. Generally systems with a smaller collection fleet and/or more efficient use of the time per stop, result in lower direct GHG and other emissions. Systems that recover additional recyclable and organic materials result in lower indirect GHG and other emissions.
Potential Implementation Requirements and/or Barriers	Degree of flexibility in addressing issues that could arise following approval of any changes to the Waste Diversion Act and Blue Box Program Plan. Interactions with other waste management system components, including the current split between public and private sector service provision for collection.	System must be flexible enough to be able to respond to changes in the Waste Diversion Act. In particular, consideration should be given to the capital cost and financing cost that may be borne by the municipality. There is greater risk in making a more significant capital investment in recycling, should the funding or other provisions of the provincial Blue Box Program Plan (BBPP) change. System must not unduly impact other waste management components. Some systems may be associated with significant changes in processing approaches and/or significant public P&E approaches. Also, the City currently splits service provision, with public sector forces currently collecting all garbage and Green Cart organics in the A zones, private sector forces currently collecting garbage and Green Cart organics in B zones, and private sector forces collecting recycling in all zones. Any scenario that would result in significant changes in the support services required for collection will have an effect on internal service consumption.
General		
Recycling Processing		
Organics Processing		

The advantages and disadvantages of each of the short-listed scenarios/options were identified and the various 'trade-offs' were discussed in the identification of the preferred option. The following relative differences were established to constitute the difference between a major advantage and a major disadvantage and those that fall in between. Table 5-7 below summarizes these differences and provides a practical example of their application.

Table 5-7 Differentiation between Advantages and Disadvantages

Ranking	Description
MAJOR ADVANTAGE	Description: The option would have minimal impact based on the criteria/indicator being applied and/or in most cases a net benefit would result. Example: An option that had significant potential to increase diversion rates would be considered to have a major advantage.
ADVANTAGE	Description: The option would have manageable impact based on the criteria/indicator being applied and/or in most cases a net benefit would result. Example: An option that had some potential to increase diversion rates would be considered to have an advantage.
NEUTRAL	Description: The option would have no potential benefits or impacts based on the criteria/indicator being applied. Example: An option that had no potential to increase diversion rates would be considered to have a neutral effect.
DISADVANTAGE	Description: The option would have some negative impacts based on the criteria/indicator being applied. Example: An option that resulted in a minor decrease in diversion rates would be considered disadvantaged.
MAJOR DISADVANTAGE	Description: The option would have a significant impact based on the criteria/indicator being applied. Example: An option that resulted in a significant decrease in diversion rates would be considered to have a major disadvantage.

5.4.4 Results of Evaluation

Table 5-8 presents the results of the evaluation of the short-list of systems, considering key criteria and indications discussed previously.

Table 5-8 Summary of Evaluation of Short-Listed Systems

Criteria	System A (Status Quo)	System B	System H	System I
Garbage	Weekly, Co-Collected with Green Cart	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Alternating with LYW
Recyclables	Weekly, Two-Stream, Co-Collected	Weekly, SS, Co-Collected with Green Cart	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with Garbage	Weekly, Co-Collected with SS Recycling	Weekly, Co-Collected with LYW	Weekly, Separate Collection
LYW	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Bi-Weekly, Alternating with Garbage
Number of Truck Passes/Week	2 Truck Passes/Week (plus seasonal LYW/call-in bulk)	1.5 Truck Passes/Week (plus seasonal LYW/call-in bulk)	2.5 Truck Passes/Week (plus seasonal call-in bulk)	3 Truck Passes/Week (plus seasonal call-in bulk)
PUBLIC ACCEPTABILITY	ADVANTAGE Likely high level of acceptability to residents given performance of current system. Current service: - Is convenient (weekly collection of all three major streams of materials) - Is less likely to cause odour in the home - Has minimal issues relative to material storage	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. SS recycling may offset some impacts due to increase in convenience. Change in service: - May be found to be inconvenient by some residents, in regards to garbage collection - Is more likely to cause odour in the home - Has the potential to have issues relative to garbage storage - Is likely to be found convenient in regards to recycling collection	NEUTRAL Bi-weekly garbage may be perceived as a reduction in service to some residents. Weekly collection of LYW may offset some impacts due to increase in convenience. Change in service: - May be found to be inconvenient by some residents, in regards to garbage collection - Is more likely to cause odour in the home - Has the potential to have issues relative to garbage storage - Is likely to be found more convenient in regards to LYW collection (weekly, year round)	DISADVANTAGE Bi-weekly garbage and separate bi-weekly collection of LYW may be perceived as a reduction in service to some residents. Change in service: - May be found to be inconvenient by some residents, in regards to garbage collection - Is more likely to cause odour in the home - Has the potential to have issues relative to garbage storage
POTENTIAL EFFECTS ON DIVERSION	DISADVANTAGE The potential for additional diversion would be limited.	MAJOR ADVANTAGE Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables. Estimated 7.6% Increase in Residential Curbside Diversion up to 62% 5,300 tpy of additional recyclables 5,600 tpy of additional organics (mostly food)	ADVANTAGE Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables. Estimated 5.7% Increase in Residential Curbside Diversion up to 60% 2,600 tpy of additional recyclables 5,600 tpy of additional organics (mostly food)	ADVANTAGE Potential for increase in diversion of organics due to reduction in garbage collection. Some potential for increased diversion of recyclables. Estimated 5.7% Increase in Residential Curbside Diversion up to 60% 2,600 tpy of additional recyclables 5,600 tpy of additional organics (mostly food)
FINANCIAL IMPLICATIONS				
Effect on Collection Costs (2016$, equivalent to average cost over new 2013 to 2020 contract)	DISADVANTAGE 73 to 80 Truck Fleet - $22.8 to 24.2 million Plus 6 LYW & Bulky - $1.8 to $2 million Collection Support - $ 1.6 million **Annual Collection Cost of $26.2 to 27.8 million**	MAJOR ADVANTAGE 53 to 58 Truck Fleet - $16.6 to $17.6 million Plus 6 LYW & Bulky - $1.8 to $2 million Collection Support - $1.6 million **Annual Cost of $20 to $21.2 million**	ADVANTAGE 69 to 76 Truck Fleet - $21.6 to 23 million Plus 2 Peak LYW & 4 Bulky - $1.8 to $2 million Collection Support - $1.6 million **Annual Cost of $25 to 26.5 million**	DISADVANTAGE 78 to 86 Truck Fleet – $24.4 to 26.0 million Plus 2 Peak LYW & 4 Bulky - $1.8 to $2 million Collection Support - $1.6 million **Annual Cost of $27.8 to 29.5 million**

Criteria	System A (Status Quo)	System B	System H	System I
Garbage	Weekly, Co-Collected with Green Cart	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Alternating with LYW
Recyclables	Weekly, Two-Stream, Co-Collected	Weekly, SS, Co-Collected with Green Cart	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with Garbage	Weekly, Co-Collected with SS Recycling	Weekly, Co-Collected with LYW	Weekly, Separate Collection
LYW	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Bi-Weekly, Alternating with Garbage
Number of Truck Passes/Week	2 Truck Passes/Week (plus seasonal LYW/call-in bulk)	1.5 Truck Passes/Week (plus seasonal LYW/call-in bulk)	2.5 Truck Passes/Week (plus seasonal call-in bulk)	3 Truck Passes/Week (plus seasonal call-in bulk)
Effect on Recycling Processing Infrastructure (2016$ representing operating costs at mid-point of the collection contract)	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned. To be confirmed in MRF Review. Estimated Operating Cost of $49.7/tonne or $2.1 million, based on current contract costs Estimated Annual Revenue of ($113)/tonne or ($4.5) million **Net Annual Processing Cost of ($2.4) million**	MAJOR DISADVANTAGE Significant capital investment for recycling processing would be required beyond that which is already planned. Estimated Capital Equipment Cost (2013$) of $18.2 million for new MRF and $2 million for relocation of City Collection Fleet. Estimated Annual Operating Cost of $74/tonne or $5.8 million, based on proposed prices from last MRF RFP Estimated Annual Revenue of ($109.5)/tonne or ($5) million **Net Annual Processing Cost of $0.7 million.**	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned. To be confirmed in MRF Review. Estimated Operating Cost of $50.2/tonne or $2.3 million based on current contract costs Estimated Annual Revenue of ($113)/tonne or ($4.8) million **Net Annual Processing Cost of ($ 2.6) million.**	ADVANTAGE Likely minimal to no capital investment for recycling processing would be required beyond that which is currently planned. To be confirmed in MRF Review. Estimated Operating Cost of $50.2/tonne or $2.3 million based on current contract costs Estimated Annual Revenue of ($113)/tonne or ($4.8) million **Net Annual Processing Cost of ($ 2.6) million.**
Net Financial Implications	Net Annual Cost: $23.7 to 25.3 million	Net Annual Cost: $20.6 to $21.8 million	Net Annual Cost: $ 22.4 to $24 million	Net Annual Cost: $25.2 to $26.9 million
Effect on Organics Processing Infrastructure	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium cost.	DISADVANTAGE Large proportion of LYW would continue to be processed at CCF at a premium cost.	ADVANTAGE Would provide opportunity to divert LYW from CCF to composting pad, processing some materials at a lower cost.	NEUTRAL Would provide opportunity to divert LYW from CCF to composting pad, processing some materials at a lower cost.
ENVIRONMENTAL IMPACTS	DISADVANTAGE Highest fleet requirements and thus highest potential fleet emissions. GHG Emissions: 7,600 tonnes Smog Precursors: 1,800 kg No additional diversion.	MAJOR ADVANTAGE Highest potential for reduction in direct air emissions as has the lowest fleet requirements and lowest number of truck passes. GHG Emissions: 5,500 tonnes Smog Precursors: 1,300 kg Highest potential for decrease in indirect air emissions based on increased diversion of recyclables and organics.	ADVANTAGE Second highest potential for reduction in direct air emissions as has the lowest fleet requirements and lowest number of truck passes. GHG Emissions: 7,200 tonnes Smog Precursors: 1,700 kg Second highest potential for decrease in indirect air emissions based on increased diversion of recyclables and organics.	NEUTRAL Highest potential fleet requirements and highest number of truck passes, thus highest potential fleet emissions. GHG Emissions: 8,200 tonnes Smog Precursors: 1,900 tonnes Second highest potential for decrease in indirect air emissions based on increased diversion of recyclables and organics.
POTENTIAL IMPLEMENTATION REQUIREMENTS AND/OR BARRIERS				
General	ADVANTAGE No change in implementation requirements and/or barriers. Would accommodate current public/private service level split. Would not require shift in bulky collection approach.	DISAVANTAGE Will require increased efforts with P&E. Would require shift in public/private service level split. Would not require much change in current bulky waste collection approach (both SFD and MFD).	DISADVANTAGE Will require increased efforts with P&E. Would not require shift in public/private service level split. Would require change in current bulky waste collection approach (both SFD and MFD).	DISADVANTAGE Will require increased efforts with P&E. Would not require shift in public/private service level split. Would require change in current bulk waste waste collection approach (both SFD and MFD).

Criteria	System A (Status Quo)	System B	System H	System I
Garbage	Weekly, Co-Collected with Green Cart	Bi-Weekly, Separate Collection	Bi-Weekly, Separate Collection	Bi-Weekly, Alternating with LYW
Recyclables	Weekly, Two-Stream, Co-Collected	Weekly, SS, Co-Collected with Green Cart	Weekly, Two-Stream, Co-Collected	Weekly, Two-Stream, Co-Collected
Green Cart	Weekly, Co-Collected with Garbage	Weekly, Co-Collected with SS Recycling	Weekly, Co-Collected with LYW	Weekly, Separate Collection
LYW	Bi-Weekly (spring and fall), Separate Collection	Bi-Weekly (spring and fall), Separate Collection	Weekly, Co-Collected with Green Cart	Bi-Weekly, Alternating with Garbage
Number of Truck Passes/Week	2 Truck Passes/Week (plus seasonal LYW/call-in bulk)	1.5 Truck Passes/Week (plus seasonal LYW/call-in bulk)	2.5 Truck Passes/Week (plus seasonal call-in bulk)	3 Truck Passes/Week (plus seasonal call-in bulk)
Recycling Processing	ADVANTAGE Unlikely to accommodate regional MRF concept. Not likely to require extension in processing contract beyond 2013. Somewhat flexible to changes in WDA and minimal additional investment in system required.	DISADVANTAGE Could accommodate regional MRF concept. May require extension in processing contract beyond 2013 to provide enough time for new single-stream capacity to be developed. Somewhat less flexible to changes in WDA and minimal additional investment in system required.	ADVANTAGE Unlikely to accommodate regional MRF concept. Not likely to require extension in processing contract beyond 2013. Somewhat flexible to changes in WDA and minimal additional investment in system required.	ADVANTAGE Unlikely to accommodate regional MRF concept. Not likely to require extension in processing contract beyond 2013. Somewhat flexible to changes to WDA and minimal additional investment in system required.
Organics Processing	DISADVANTAGE Bulk of LYW still combined with green cart materials, using CCF capacity that would otherwise be available for expansion of the green cart program to other City sectors and/or to accommodate increases in SSO capture rates for SFD and MFD.	DISADVANTAGE Bulk of LYW still combined with green cart materials, using CCF capacity that would otherwise be available for expansion of the green cart program to other City sectors and/or to accommodate increases in SSO capture rates for SFD and MFD.	ADVANTAGE Bulk of LYW collected separately from green cart materials, freeing up CCF capacity needed for expansion of the program to other City sectors and to accommodate increases in SSO capture rates for SFD and MFD.	ADVANTAGE Increases CCF capacity available for expansion of Green Cart program to other City sectors and/or increases in SSO capture rates for SFD and MFD. Increases CCF capacity available to meet existing contracts/commitments.
Overall Result	**NEUTRAL**	**NEUTRAL**	**MAJOR ADVANTAGE**	**ADVANTAGE**

Based upon the analysis presents above, System H offers the most advantages, in regard to the potential social, environmental, and financial effects of the systems and is the preferred two-stream approach recommended for inclusion in the next collection RFP.

System B was found to have a neutral ranking based on the consideration of all of the criteria, however, it does offer advantages with increased diversion and the lowest overall potential collection costs. System B could be carried forward as the preferred single-stream approach. System B would require significant capital investment.

System A (Status Quo) was the only system carried forward for detailed analysis which included weekly garbage collection. It was the best-ranked system with weekly garbage collection following evaluation of the long-list, but does not offer any significant advantages to the City except in regards to public acceptability.

System I was not carried forward as System H offered a better bi-weekly garbage collection and two-stream recycling scenario.

6 THE PREFERRED COLLECTION SYSTEM OPTION

6.1 Description of the Preferred System

The following table (Table 6-1) provides a detailed overview of the preferred collection system option (System H) and also provides a description of the single-stream collection system (System B).

Table 6-1 Description of the 'Top Ranked' Two-Stream and Single-Stream Recycling Systems

	System H (Preferred Two-Stream System)	System B (Single-Stream System)
Collection Approach	• Garbage – Bi-Weekly Separate Collection • Recycling – Two-Stream Co-Collected • Green Cart – Weekly Co-Collected with LYW • LYW – Weekly Co-Collected with Green Cart • Bulk Waste – Bi-Weekly Call-In Collection	• Garbage – Bi-Weekly Separate Collection • Recycling – Weekly Co-Collected with Green Cart • Green Cart – Weekly Co-Collected with SS Recycling • LYW – Bi-Weekly Seasonal Separate Collection • Bulk Waste – Bi-Weekly Call-In Collection
Processing Requirements	• Recycling: 45,500 tpy requiring processing (average from 2013-2018). • Recyclables processed at current MRF. Minimal capital investment needed, pending outcome of MRF review. • Larger portion of LYW can be directed away from the CCF to the Glanbrook composting area	• Recycling: 48,400 tpy requiring processing (average from 2013-2018). • Processed at new MRF installed at existing RRC location. • Limited ability to direct LYW away from the CCF, during non-peak season.
Potential Effect on Diversion	• Estimated 5.7% increase in residential curbside diversion in comparison to status quo o 2,600 tpy additional recyclables o 5,600 tpy additional organics	• Estimated 7.6% increase in residential curbside diversion in comparison to status quo o 5,300 tpy additional recyclables o 5,600 tpy additional organics
Estimated Annual System Costs (2016$)	• Collection Costs – $25 to 26.5 million • Recyclables Processing (Net) – ($2.6 million)	• Collection Costs - $20 to 21.2 million • Recyclables Processing(Net) - $700,000
Implementation Requirements	• Promotion & Education campaign required. Focus on Bi-weekly garbage and change in collection for bulky materials. • Collection Operations RFP, required for new collection system. • MRF Operations RFP required. Focus on existing operations.	• Promotion & Education campaign required. Focus on Bi-weekly garbage as well as change to single stream recycling.. • Collection Operations RFP, required for new collection system. • MRF Operations RFP required. Significant change to processing and capital investment required.

Table 6-2 summarizes the anticipated quantities of the various materials that would be managed through the curbside collection system under System H, considering the potential increase in material capture rates for organics and recyclables, anticipated if bi-weekly garbage collection is implemented. This approach is expected to reach a curbside diversion rate of almost 60%.

Table 6-2 System H: Projected Amount of Curbside Waste Diverted (2013-2018) (tonnes)

Year	Total Waste Generated (Curbside)	Recycling (Curbside)	Green Cart (Curbside)	Seasonal LYW (Curbside)	Garbage (Curbside)	Bulk Waste (Curbside)
2013	156,658	44,358	44,196	6,530	59,388	2,186
2014	158,082	44,761	44,597	6,590	59,928	2,206
2015	159,506	45,164	44,999	6,649	60,468	2,225
2016	160,930	45,568	45,401	6,709	61,008	2,245
2017	162,354	45,971	45,803	6,768	61,547	2,265
2018	163,778	46,374	46,204	6,827	62,087	2,285

Table 6-3 summarizes the anticipated quantities of the various materials that would be managed through the curbside collection system under System B, considering the potential increase in material capture rates for recyclables. This approach is expected to achieve a curbside diversion rate of almost 62%.

Table 6-3 System B: Projected Amount of Curbside Waste Diverted (2013-2018) (tonnes)

Year	Total Waste Generated (Curbside)	Recycling (Curbside)	Green Cart (Curbside)	Seasonal LYW (Curbside)	Garbage (Curbside)	Bulk Waste (Curbside)
2013	156,658	47,024	44,196	6,530	56,722	2,186
2014	158,082	47,451	44,597	6,590	57,238	2,206
2015	159,506	47,879	44,999	6,649	57,753	2,225
2016	160,930	48,306	45,401	6,709	58,269	2,245
2017	162,354	48,734	45,803	6,768	58,785	2,265
2018	163,778	49,161	46,204	6,827	59,300	2,285

6.2 Variations for the Preferred Collection System Option

The last step of Phase 1 of the study involved looking at variations to the preferred collection system option (System H).

Several different variations to the preferred collection system option were assessed. Each of these variations is discussed in detail in the following subsections.

6.2.1 Container Types for Recyclables

As mentioned previously in this report, blue boxes are currently the primary recycling container in the City's two-stream recycling collection system. Although the residents primarily use blue boxes, there are several different container types that are commonly used to collect recyclable material including bags (usually tinted blue or transparent) and carts.

A discussion concerning the advantages and disadvantages associated with each container type is presented below.

6.2.1.1 Blue Boxes

As noted above, the City currently operates a blue box based two-stream recycling collection system. Residents place paper fibre materials in one blue box and containers in another box and on their collection day, place both boxes at the curbside. Collection crews are responsible for collecting both blue boxes and ensuring that papers and containers are emptied into the appropriate side of the split-compartment recycling truck.

The preferred collection system for the next collection contract also includes two-stream recycling, so it would be reasonable for the City to continue using blue boxes as their preferred recycling collection container during the next collection contract. The current blue box based system has been in operation for several years and residents are familiar with how it functions. With the shift to the one-container limit for garbage in 2010, it is likely that residents will have already sourced additional blue boxes if needed. Based on waste audit results, resident participation in the system is high and capture rates for recyclable material are quite high suggesting that the current system is functioning well.

The City currently supplies in the order of 35,000 blue boxes each year, at a cost of around $10 per box for the box itself, and $1.60 per box in administrative costs. Overall, the City can spend up to $400,000 each year to supply blue boxes.

Table 6-4 outlines various advantages and disadvantages associated with a blue box based recycling collection program.

Table 6-4 Advantages and Disadvantages Associated with Blue Box Based Recycling Collection

Advantages	Disadvantages
• Residents are familiar with system – would not require a behavioural shift and associated P&E campaign costs.	• There is a capital cost associated with the replacement of broken blue boxes by the City. Annual costs of $400,000 for purchase and supply of blue boxes.

Advantages	Disadvantages
• Participation in the current recycling system is relatively high.	• Blue boxes are not ergonomically ideal. It can be difficult for some residents and collection crews to manage (especially heavy) materials.
• Capture rates achieved by current recycling system are relatively high.	• Blue boxes tend to lead to increased litter levels in comparison to carts or bags which can be sealed.
• Box-based system allows collection crews to easily inspect recycling contamination and sticker non-compliant residents.	• Recyclable material is 'open to the elements' which at times can significantly increase the weight of the material and/or degrade the value of paper.
• Residents are likely to have sufficient blue boxes to address their needs	• Blue boxes allow scavengers to easily steal valuable recyclable material. A move to bags or carts would likely reduce scavenging.

6.2.1.2 'Blue' Bags[21]

The City could consider allowing residents to place recyclable materials in a bag (translucent or clear) in addition to using blue boxes (i.e., for overflow material) or could move to an entirely 'bag-based' recycling system.

Notwithstanding that the City currently collects primarily with blue boxes, the container processing line at the current processing plant has been set up to allow for breaking of bags and removal of plastic film. Some bags are currently managed on the paper fibre line, however, modifications would likely be required if the facility were to accept additional bagged material.

One of the drawbacks to using bags as recycling collection containers is that it would require the City to retrofit the paper fibre line at the MRF with a bag-breaker which would require some capital investment. A retrofit at the MRF may not be feasible with the current two-stream system configuration. The MRF review which is currently underway, will determine the feasibility of this retrofit, and will also examine the costs associated with a bag-based system for single stream recycling.

That being said there are several advantages associated with moving to a bag-based system:

- Bag-based systems tend to be more efficient for collection, with much less time required per stop to load recyclable materials then either blue boxes or carts.[22]

[21] Some of the points raised in this section were adapted from the following article: Jim Alderden. 1992. Bag-based recycling: a solution for the collection blues?. Resource Recycling.
[22] City of Saskatoon, Blue Bag Business Case Study, VisionQuest, March 2011.

- Collection costs for a bagged based system can be up to $10 per household/stop/per annum less than blue box based systems.[23]

A move to a bag-based system could be considered should the City choose to implement the single-stream collection approach in System B, as the new sorting lines could be designed to accommodate a bag-breaker.

The following table (Table 6-5) presents some of the advantages and disadvantages associated with the City moving to a bag-based recycling collection system.

Table 6-5 Advantages and Disadvantages Associated with Bag-Based Recycling Collection

Advantages	Disadvantages
• City would no longer be responsible for capital costs associated with replacing blue boxes (up to $400,000 per year savings).	• Would require purchase of bag-breaker for MRF (capital cost). Would also increase operating costs at the MRF (additional labour).
• Would reduce potential for litter in comparison to a blue box based system.	• Residents would be required to purchase bags. • Could cost up to $20 annually per household, assuming each home uses two blue bags each week and based on 2011 retail prices.
• Would protect recyclable material from the elements. Less snow and water would be present in the materials sent to the MRF and to market.	• Potential increased P&E costs with a switch from blue boxes to bags.
• Ergonomically preferable for both residents and collection crews.	• May lead to increased contamination rates. It is more difficult for collection crews to inspect recyclables in bags as compared with blue boxes.
• Less storage issues as bags are less bulky than boxes or carts. Bags provide a flexible storage option for all types of residential accommodations.	• May be perceived as adding additional waste to the recycling stream (unless the bags can be recycled in the process).
• Would reduce scavenging of valuable recyclable materials which could increase revenues received for the City.	
• Could reduce recycling collection costs.	

There are municipalities in Ontario who operate two-stream recycling systems that currently use bags as recycling collection containers. For example, the City of London operates a two-stream recycling system similar to Hamilton's in which residents are permitted to use blue boxes and bags (clear or translucent blue bags) to place their recyclable material at the curb. It is

[23] City of Saskatoon, Blue Bag Business Case Study, VisionQuest, March 2011.

interesting to note that the City of London does not provide residents with blue boxes or bags; residents are required to purchase these materials from retail outlets such as hardware stores.[24]

If the City of Hamilton does at some point move to single-stream recycling, it could be reasonable to move to a bag-based recycling collection system. There are several municipalities in Canada that operated single-stream recycling programs which utilize a bag-based collection system. For example, the City of Edmonton currently operates a single-stream recycling system in which only blue bags are accepted as collection containers.[25] The City of Guelph also operates a bag-based single-stream recycling collection program. In Guelph, wet waste (organics) is placed in a translucent green bag, dry recyclables (single-stream recycling) are placed in a translucent blue bag, and garbage is placed in a transparent clear bag. [26]

6.2.1.3 Recycling Carts

Recycling carts are more often used in programs (e.g. City of Toronto) where single stream recyclables are collected. Should the City proceed with a single-stream recycling system, recycling carts would be an option.

The City could also consider moving to a split-cart based collection system for two-stream recycling (in which papers and containers are placed in the same large wheeled cart, separated by a plastic wall). However, the performance of split carts is relatively unproven. Moreover, there is little rationale for moving to such an approach, and considerable capital investment would be incurred for cart purchase and distribution. In addition, if the City ever did decide to move to a single-stream based recycling collection system, the split carts would be obsolete (i.e., no need to separate single stream recyclables).

Another possible option is to distribute two recycling carts to each household: one for paper and one for containers. This, however, would lead to even higher costs for the City and residents would be forced to find a storage location for two additional large carts. For this reason, moving to a 'two cart' system will not be considered further.

The following table (Table 6-6) presents some of the advantages and disadvantages associated with the City moving to a cart-based recycling collection system.

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[24] Obtained from http://www.london.ca/d.aspx?s=/Recycling_and_Composting/Recycling_FAQs.htm on January 20,2011.
[25] Obtained from http://www.edmonton.ca/for_residents/garbage_recycling/blue-bag-recycling.aspx on January 20, 2011.
[26] Obtained from http://guelph.ca/living.cfm?subCatID=902&smocid=1487 on January 20, 2011.

Table 6-6 Advantages and Disadvantages Associated with Cart-Based Recycling Collection[27]

Advantages	Disadvantages
• Would protect recyclable material from the elements. Less snow and water would be present in the materials sent to the MRF and to market.	• Significant capital investment associated with the purchase and distribution of carts. Capital costs can be in the order of $50 per cart based on current market prices, which would be in the order of $8 to $9 million to purchase and deliver carts across the City.
• Would reduce scavenging of valuable recyclable materials which could increase revenues received for the City.	• Split carts would be obsolete if the City ever moved to a single stream collection system.
• Would reduce potential for litter in comparison to a blue box based system.	• Some residents will likely find carts difficult to store and manoeuvre (especially in the snow).
• May lead to increased collection efficiency (automated collection) compared to blue boxes, however, studies have indicated that bag based collection is more efficient.	• Split carts are unlikely to fill evenly, with bulky paper fibre blocking the use of some capacity.
	• Very difficult for drivers to screen and remove any contaminants, thus residual waste quantities and material contamination likely to increase.
	• Cart based collection can cost significantly more than either blue box or blue bag programs.

There are municipalities in North America which do use a split cart based recycling system. For example, the City of Berkeley California recently switched from blue boxes to split carts in 2010.[28]

If the City at some point in the future does decide to move to single-stream recycling, the City should assess the advantages and disadvantages associated with moving to an automated cart-based recycling system. Many municipalities find that moving to a cart-based system is the most efficient and economical when operating a single stream collection system. The City of Toronto currently operates a automated cart single-stream recycling collection system.

6.2.1.4 Recommended Approach

Based on the above and discussions with City staff it was determined that there could be benefits to the City if use of bags for recyclables was encouraged:

[27] Office of the City Manager. 2010. Contract No. 8219 Amendment: Ecology Center for Split Cart Residential Recycling Program. Obtained from http://www.ci.berkeley.ca.us/uploadedFiles/Clerk/Level_3_-_City_Council/2010/06Jun/2010-06-29_Item_13b_Contract_No._8219_Amendment__Ecology_Center_for_Split_Cart_Residential_Recycling_Program.pdf on January 20, 2011

[28] http://www.ci.berkeley.ca.us/contentdisplay.aspx?id=5644

- Ceasing distribution of blue boxes could save approximately $400,000 in blue box purchase and distribution costs annually. The City already has some infrastructure at the MRF to handle film plastic. The MRF review that is currently underway will identify if any additional infrastructure (i.e. bag breaker on the fibre line) is needed to support transition to bagged recyclables. The capital cost of adding another bag- breaker would be around $100,000 to $160,000. The City already incurs operating costs to break and handle bags.
- Bag based collection systems tend to cost less. While some additional operating costs may be required for processing it is expected that there could be annual savings for the City.
- The use of bags for recyclables will reduce litter, reducing costs incurred for litter collection and improving the aesthetics of the streetscape.
- The use of bags for recyclables will improve material quality, keeping paper and other materials dry during inclement weather. This will improve MRF operations and can increase revenues.

6.2.2 Container Types for Garbage

Currently, the City has a weekly one rigid container limit for curbside garbage customers (except for the weeks following Victoria Day, Thanksgiving Day, and New Year's Day when there is a three container limit). Garbage containers must have a volume of less than 135 litres and not exceed 23 kg in weight. The following sections discuss some of the advantages and disadvantages associated with allowing the use of rigid garbage containers or requiring that waste be set out at the curb in garbage bags.

6.2.2.1 Rigid Garbage Containers

The preferred collection system entails a move to bi-weekly garbage collection. Discussion to-date indicates that the City would implement a bi-weekly two container limit.

Rigid containers typically hold the equivalent of two or three standard size garbage bags. If the City moved to a bi-weekly two container limit, this would be the equivalent of the City setting a bi-weekly four to six bag limit, which is unlikely to be sufficiently stringent to drive higher diversion rates. The City and its contractors would continue to be responsible for the appropriate handling of these rigid containers at the curb, which does involve some additional effort (i.e., added time) and issues for the City.

Table 6-7 presents some of the advantages and disadvantages associated with using rigid garbage containers.

Table 6-7 Advantages and Disadvantages Associated with Rigid Garbage Containers

Advantages	Disadvantages
• Residents are currently allowed to use containers at the curb.	• Ergonomically more difficult to handle than bags for collection crews especially in adverse weather conditions.
• Residents may have some cost savings: one time purchase vs. continual purchase of garbage bags, if they place materials loosely in their containers.	• Storage issues. Rigid containers tend to take up a lot more space than bags.
• Slightly less garbage (volume and weight) would be sent to landfill (fewer garbage bags).	• Increased litter potential at landfill due to lack of containment bags.
	• A two-container limit provides capacity for four to six bags of garbage every two weeks, which may be insufficiently stringent to increase diversion rates.
	• Additional time and cost associated with the pick-up and replacement of rigid containers at the curb.

6.2.2.2 Garbage Bags

Instead of maintaining the current rigid container based garbage collection system, the City could consider moving to a bag only garbage collection system and set a limit such as a bi-weekly two bag limit per customer. This more stringent approach is likely to facilitate the increase in diversion rates. It would also reduce container handling issues at the curb.

The Town of Whitby currently collects garbage on a bi-weekly basis and has a bi-weekly four bag limit per household (equivalent to a weekly two bag limit). Whitby only accepts garbage bags in their program (no containers). Residents who place more than four bags of waste at the curb are required to purchase bag tags ($1.50 each) and place one on each additional bag.[29] Hamilton could consider implementing a bi-weekly four bag limit similar to Whitby, but this type of limit is not as likely to result in significant increases in waste diversion above current levels.

The following table (Table 6-8) presents some of the advantages and disadvantages associated with using garbage bags was waste collection containers.

[29] Obtained from http://www2.whitby.ca/asset/pw-community_residualwastecollectioninformation.pdf on January 21, 2011.

Table 6-8 Advantages and Disadvantages Associated with Garbage Bags

Advantages	Disadvantages
• Easier for collection crews to manage (ergonomically) as usually less weight and different motion used to toss into the truck. • Generally the time to load bags is less than the time required to empty containers.	• Slightly more garbage at landfill (additional bags)
• Less issues with litter at landfill.	• May require a change in resident behaviour for those residents used to setting materials out loosely in containers.
• Likely to encourage increased diversion if stringent bag limit set.	• Potential for scavenging by animals and birds.
• Reduced time and expense associated with handling the containers (pick-up and replacement at the curb), including issues with lost or damaged containers.	• Residents must purchase garbage bags.

Clear Bags

There is growing interest in North America in the use of clear bags for garbage to encourage the diversion of material from the garbage stream.

The use of clear bags supports diversion efforts in several ways, including:

- Motivating people to remove divertible material from the garbage stream due to social pressure (i.e., neighbours can see what you are throwing in the garbage);
- Serving as a prompt as they consistently remind people of what they are throwing out and encourage residents to reflect on their waste disposal habits; and,
- Assisting collectors monitor for compliance with existing waste management regulations.[30]

[30] Quinte Waste Solutions and Stewardship Ontario. 2008. The Use of Clear Bags for Garbage as a Waste Diversion Strategy: Background Research on Clear Garbage Bag Programs across North America.

Clear bag-based garbage systems have been used by numerous municipalities throughout North America. Over 20 municipalities in Ontario currently have programs in place and several municipalities in Nova Scotia have been operating clear bag programs for several years. Based on studies that have been completed, clear garbage bag programs have been shown to increase the capture of divertible material and further, have led to a decrease in waste management costs. A study completed on 13 municipalities in Nova Scotia showed that a clear garbage bag program (programs had been in place for two years) assisted these municipalities in reducing residential waste by 41%, increasing residential recycling by 35%, and increasing residential organics by 38%.[31]

One of the main concerns raised by residents concerning clear garbage bag programs is that of privacy. These issues need to be addressed prior to implementing a clear bag program. Most municipalities permit an opaque bag(s) of some sort, which is commonly referred to as a "privacy bag" where residents can dispose of their more personal items. In order to encourage the success of clear garbage bag programs, proper enforcement is necessary. Non-compliant bags (i.e., those containing divertible materials) should be rejected at the curbside.

Pending review of program performance during the new collection contract, the City could assess the applicability of this option as a mechanism to both increase recyclable and organic materials captured at the curb.

6.2.2.3 Recommended Approach

It was assumed that the transition to bi-weekly garbage would involve setting a bi-weekly two-container limit for curbside garbage customers. However, there are some disadvantages to setting a two-container limit that were reviewed being:

- A bi-weekly two-container limit is the equivalent of setting a bi-weekly four to six garbage bag limit. This is generous and may not encourage diversion.
- It takes longer to pick-up and empty garbage containers. Setting a bag-limit could improve collection efficiency.

[31] Quinte Waste Solutions and Stewardship Ontario. 2008. The Use of Clear Bags for Garbage as a Waste Diversion Strategy: Background Research on Clear Garbage Bag Programs across North America.

It is recommended that the City examine diversion performance after the transition to bi-weekly garbage collection, and that if diversion performance was not meeting expectations, that the City could either move to a bag-limit and/or consider requiring clear bags for collection.

6.2.3 Special Considerations

The preferred collection system option includes a move from weekly to bi-weekly garbage collection. As discussed previously in this report, a move to bi-weekly garbage collection may be perceived by some residents to be a decrease in level of service due to issues with odour, especially in the summer months, and storage capacity (residents will need to store their garbage for two weeks instead of one). As it is not considered possible to expand the Green Cart program to accept materials such as pet waste and diapers (which are responsible for much of the odour issues), the City will likely need to continue to provide special considerations to certain types of households.

6.2.3.1 Current Policy

Currently, eligible Hamilton residents are able to apply for special considerations which allow them to place up to three containers of garbage out for collection each week (rather than only one). Up to 1,500 households in the City are currently provided with special considerations. Residents eligible to apply for special considerations include:

- Households where a resident has a medical condition.
    - On the application, residents must acknowledge that they have a medical condition that generates excessive waste.
- Households with three or more children under the age of five.
    - On the application, residents are required to enter the years of birth of each of the three children under the age of five.
- Agricultural properties.
    - On the application, residents are required to provide a Farm Business Registration Number. Approved residences are able to set out up to four containers.
- Home daycare providers.
    - On the application, residents are required to enter a Provincial Child Care License number or provide documentation that proves that income is generated through onsite child care.

Residents are required to renew their application on an annual basis.

6.2.3.2 Potential Alternatives

There are several options that the City can consider concerning special considerations as they transition to the preferred collection system. The City may choose to continue with the current special considerations policy but may need to make certain adjustments. If the City chooses to provide weekly collection of up to three garbage containers, the City would arrange for a collection vehicle to collect materials on the 'off week' of normal garbage collection to service households receiving special considerations. This would place an additional vehicle on the road and slightly reduces the benefit associated with moving to bi-weekly garbage collection (e.g., financial and environmental benefits).

Alternatively, the City could change their special considerations policy to a bi-weekly six container limit. This would eliminate the need for the City to send out garbage collection trucks on 'off weeks' which would likely be environmentally and financially preferable. That being said, it would force residents receiving special considerations to store the material over a two-week period.

If the City moves to a garbage bag-only collection system (as discussed in section 6.2.2.2), they will need to determine an appropriate bag limit for those households which fall under a special consideration category.

Several other municipalities in Ontario also operate special considerations programs for eligible residents. The City of Hamilton may want to consider these programs when developing their own policy for the next collection contract. One such policy is discussed below in the following section.

Region of Niagara

On February 28, 2011, the Region of Niagara will be establishing new garbage limits for residential collection. Single family homes will be limited to placing one container at the curbside per week for collection. If a household wishes to place additional garbage out for collection, they must purchase bag tags for each additional bag. Similar to Hamilton, Niagara has also implemented a special considerations policy for certain types of households. The following types of residents can apply for exemptions to the one container limit:

- Households with two or more children under the age of four in diapers.
    - Households with two children under the age of four in diapers may set out one additional **clear** bag of diapers without garbage tags weekly in addition to the standard one container limit. The application must be renewed annually and proof of children must be provided.

- Households with three or more children under the age of four in diapers may set out two additional **clear** bags of diapers without garbage tags weekly in addition to the standard one container limit. The application must be renewed annually and proof of children must be provided.

- Households which operate home-based daycares.
  - May place up to two additional **clear** bags of diapers without garbage tags weekly in additional to the standard one container limit. These households must prove that they operate a daycare in their households (either licensed or proof of income from daycare activities). The application must be renewed annually.
- Households where a person lives with a specific medical condition.
  - May place one or two additional bags of garbage at the curbside affixed with bag tags which are provided by the Region. The application form requires that the resident have a physician sign the form proving the existence of the medical condition. The application must be renewed annually and a doctor's signature is required once every three years.

Each of the special considerations applications, which Niagara provides via their waste management website, includes language that if signed, forces the resident to participate in the green bin and blue/grey box recycling programs.[32]

6.2.3.3 Recommended Approach

Based on the above discussion, Stantec recommends that the City continue with their current special considerations policy but modify it slightly by moving it to a bi-weekly, six container (or bag) limit for eligible properties. By moving to bi-weekly collection for special considerations, the City will maximize the financial and environmental benefits associated with moving to bi-weekly garbage collection by minimizing the number of hours trucks spend on the road.

The City could consider adopting some of the strategies used by the Region of Niagara including ensuring that additional bags of diapers from eligible households are placed in clear bags to ensure that households aren't just throwing regular garbage (or organics or recyclables) in these bags.

6.2.4 Bulk Waste Collection

6.2.4.1 Current Policy

Currently, for curbside customers, the City operates a seasonal call-in bulk waste collection program during periods when the LYW collection program is not in effect. The City currently operates a fleet of six collection vehicles dedicated to collecting bulk waste and LYW material

[32] Obtained from http://www.niagararegion.ca/living/waste/collection-changes-2011.aspx on January 20, 2011.

depending on which program is in effect. In total the bulk waste collection program currently operates for 18 to 24 weeks out of the year (for the curbside collection customers). Residents are limited to four items per collection (weight limit of 200 lbs/90 kg)

These trucks, however, also service the multi-residential sector which is currently provided with call-in bulk waste collection service year-round. Any change made to bulk waste collection service will have to take into account the level of service change facing the multi-residential sector.

The preferred collection system involves a move from seasonal LYW collection to year-long weekly LYW collection (co-collected with the Green Cart). The system includes an additional two (2) trucks that will be dedicated to the collection peak LYW in the spring and fall. For modeling purposes, Stantec assumed that the City will continue with the seasonal call-in bulk waste collection schedule (18 to 24 weeks per year) currently in effect and estimated that an additional four trucks would be required (in addition to the two LYW trucks) to maintain the current level of service.

6.2.4.2 Potential Alternatives

It is possible that the City could move to providing a year-round call-in bulk waste collection program and that this increased level of service could be accommodated by the four trucks dedicated to managing bulk waste material. That being said, during times of peak LYW production (particularly in the fall), some of the bulk waste trucks may need to be used for collecting LYW material which would result in the bulk waste collection program being underserviced. The additional demand for call-in bulk waste collection could be partially accommodated through the separate garbage fleet if rear-packers are used, as these trucks could accommodate some of the bulk waste materials.

In addition to the above, the City may want to consider changing the overall philosophy of how they manage bulk waste collection. Several other municipalities in Ontario also have bulk waste collection programs that are maintained in a slightly different manner. Two other ways of managing bulk waste are discussed below:

City of Guelph

Guelph operates a year-round user-pay Bulky Item Collection Program. In order for residents to have bulky material collected at the curbside they have to purchase a bulky item ticket from one of five municipal locations. Once the ticket is purchased, the resident calls the Waste Resource

Innovation Centre and schedules a pick-up with their ticket in hand. Each ticket is costs $20 and is good for one item. Each additional item per pickup costs $15.[33]

The following items are included in the Bulky Waste Collection Program:

- Large items such as appliances (doors and lids removed for safety reasons), metal goods, furniture, and mattresses.

Region of Niagara

The Region of Niagara operates a year-round call-in large item/appliance collection program. Niagara does not limit the number of times a resident living in a single family home, semi-detached, duplex, townhouse, or apartment building with 5 units or less can call for pick-ups. Collection is restricted to large household items and appliances only, not extra garbage generated from household clean-out etc. Niagara does not limit the number of items a resident can place at the curbside per pick-up.[34]

The following items are included in the large item/appliance collection program:

- Appliances, carpet, and refrigeration units. For refrigeration units, residents are required to purchase a CFC removal sticker from an authorized store for $20.00 prior to having their unit collected.

6.2.4.3 Recommended Approach

Based on the above discussion, it is recommended that the City continue with a call-in type bulk waste collection system and offer the service on a bi-weekly basis throughout the year during the weeks when regular garbage is collected. This will make it easy for residents to remember when the bulk waste collection program is in effect (i.e., during regular garbage collection week) and will ensure things run smoothly logistically speaking. It is recommended that bulk waste continues to be separated from the 'normal' garbage stream as it provides opportunities to divert bulk material while also keeping potentially hazardous wastes (e.g., CFC containing refrigerant units) out of the landfill.

At some point the City may want to consider implementing a more 'user-pay' approach to bulk waste collection in which, alike to Guelph, residents are required to pay for bulk waste collection when they use it. This is likely to discourage unnecessary use of the program but could potentially result in increased levels of illegal dumping and resident frustration.

[33] Information obtained from http://www.guelph.ca/living.cfm?subCatID=1288&smocid=1871 on January 20, 2011.
[34] Information obtained from http://www.niagararegion.ca/living/waste/large-items.aspx on January 20, 2011.

6.2.5 Change in Collection Operating Hours

6.2.5.1 Current Operating Hours

The collection system model developed and used for this study originally assumed an 8.5 hour collection day (one-shift) for regular curbside collection during the next collection contract. Although this length of shift is similar to the shifts currently used by City collection crews, the City examined the reasonable collection operating hours based on assuming collection begins at 7 a.m. and considering that most City facilities 'close' at 6 p.m., and determined that a 10 hour collection day could be accommodated.

6.2.5.2 Potential Alternatives

The City could consider moving to a multiple-shift collection operation in the A-zones under a 10 hour collection day. By changing their operating hours, the City may be able to reduce the size of their collection fleet further and same additional money and reduce environmental impacts associated with a larger fleet.

If the City decides to move to a two-shift option that would result in approximately 10 hours being available each day for regular curbside collection, significant reductions in fleet size could result. There are several other municipalities which operate different and longer collection shifts than Hamilton. For example, in Windsor garbage and recycling are collected on 10 hour shifts (6:30 am – 4:30 pm) or until complete.

6.2.5.3 Recommended Approach

Review of collection and facility operating hours indicated that collection could take place over 10 hours each day (7 a.m. to 5 p.m.). This would accommodate the current facility operating schedules as the scale houses at most of the City's facilities close at 6 p.m. to haulers.

7 CLOSURE

This discussion paper has been prepared for the benefit of the City of Hamilton. The paper may not be used by any other person or entity without the express written consent of the City of Hamilton and Stantec. Any use of this report by a third party, or any reliance on decisions made based on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

The information and conclusions contained in this report are based on work undertaken by trained professional and technical staff in accordance with generally accepted practices at the time the work was performed.

Respectfully Submitted,

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