City of Sarnia Public Spaces Recycling Pilot Project Report

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Prepared for:
Refreshments Canada, Nestle Waters Canada , the Canadian Bottled Water Association, WDO Continuous Improvement Fund, and the City of Sarnia

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EXECUTIVE SUMMARY

This document is a report on the Public Spaces Recycling Pilot Program in the City of Sarnia, Ontario. The project consists of two components: 1) installation of public space recycling facilities at three parks and three arenas in Sarnia, funded by Refreshments Canada, Nestle Waters Canada, the Canadian Bottled Water Association, Waste Diversion Ontario's Continuous Improvement Fund (CIF) and the City of Sarnia; 2) installation of public space recycling facilities at the eight Mac's Convenience stores in Sarnia, funded by Nestle Waters Canada.

Section I summarizes the planning and implementation steps; describes the project and waste streams utilized, gives a brief overview of the sites selected, and describes the waste audit and data analysis methodology. Several goals and objectives of the pilot program are outlined, including improving recycling performance, increasing public awareness of recycling opportunities, determining current recycling and disposal habits and demonstrating the potential for further material recovery.

Arenas and parks were selected based on size, usage and activities occurring on the premises. Baseline and follow-up audits were conducted at each of the sites prior and subsequent to implementation of the program. Audits occurred in the summer for the parks and in the fall and winter for arenas and Mac's stores. Each audit sorted one week's worth of waste from each site, with each sample classified according to the 92 material categories identified in the Stewardship Ontario waste audit protocol.

Data analysis focused on consolidating these categories to make the data more manageable and averaging the results by venue category to come up with a kilogram/week estimate for each of the consolidated 22 categories. These data were used to generate a series of tables and charts which illustrate the results and were used to project total annual generation if the program was expanded to similar venues.

The public awareness campaign included the use of posters, handouts and public service announcements in the arenas; electronic messaging at Mac's stores and notices in city newsletters and bin labels. Patron surveys conducted pre- and post-implementation at the arenas showed a 19% increase in reported intentions to recycle and a 35% decrease in reported disposal of recyclables into the garbage.

Project results demonstrate that the program was successful at increasing recovery rates of recyclable beverage containers significantly. Beverage container recovery did not average less than 72% at any venue (Parks – 75%; Arenas – 73%; convenience stores – 84%).

The recovery rate for recyclable fibres was very low and the contamination rate in this stream was also low. It should be noted that while contamination rates were low (based on weight of contaminants) the effect of much of the contamination (foodstuffs on the fibre) rendered much of the material unacceptable for the recycling contractor.

Recovery rates ranged from about 2% at the parks to about 65% at the Mac's stores. It is estimated that over 60 tonnes of fibre material is generated annually in similar venues in Sarnia.

The container stream occasionally experienced high contamination rates, an issue that should be addressed when planning program expansion. In parks, the most significant source of contamination was non-recyclable containers, which indicates that visitors were not adequately educated about which containers were acceptable. The container recycling stream also experienced a significant amount of food waste contamination, although it is likely that a majority of the food waste deposited in the recycling stream consisted of liquids in their original containers. The estimated generation of recyclable beverage containers in similar venues across Sarnia exceeds 70 tonnes per year.

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SECTION I: PLANNING AND METHODOLOGY

1. Introduction

The Public Spaces Recycling Project was co-sponsored by Refreshments Canada, the Canadian Bottled Water Association (CBWA), Nestlé Waters Canada and Waste Diversion Ontario's Continuous Improvement Fund (CIF) with cooperation of the City of Sarnia.

Public spaces recycling captures the "last mile" of recyclables – items typically found in Ontario's Blue Box curbside recycling program that are disposed by consumers in parks and recreational facilities such as arenas, convenience stores and gas stations.

Refreshments Canada, the Canadian Bottled Water Association, Nestlé Waters Canada and the CIF funded the purchase of new recycling receptacles in a two-phase pilot project in Sarnia. StewardEdge was contracted to manage the project including site selection, bin number, size, and type selection, Promotion and Education communication, and pre- and post-pilot measurement of the program. The City of Sarnia is responsible for the operating cost of the program.

The two-phase pilot program was three months in duration and was designed and implemented by StewardEdge. The pilot program included strategically placed recycling and waste bins, signage and a public awareness program. When properly implemented, public spaces recycling will help beautify a community and increase participation in curbside recycling.

2. Sarnia Profile and Waste Streams

The City of Sarnia is situated on the south shore of Lake Huron at the headwaters of the St. Clair River; the city has a population of approximately 70,000 people and is noted for its blue water and beautiful parks. Sarnia is one of Canada's principal gateways to the United States. Its modern rail tunnel and twin Bluewater Bridges form an important transportation system for one of the busiest commercial border crossings in the world.

2.1. General Overview

StewardEdge designed and implemented a pilot public spaces recycling program in three arenas, three parks and eight Mac's Convenience Stores in Sarnia, Ontario. The arenas included were Clearwater Arena, Sarnia Arena and the RBC Centre, formerly known as the Sarnia Sports and Entertainment Centre (SSEC). The parks included were Canatara Park, Centennial Park and Veteran's Park. All eight Mac's Stores in the city were part of the second phase of the pilot project. Solid waste audits were conducted before and after bin implementation at each of the sites to measure the effectiveness of the initiative.

Goals

The project goals were to:

- Improve recycling performance;

- Create a simple and attractive recycling system in the targeted parks, arenas and convenience stores;
- Install functional and aesthetically pleasing recycling bins and waste receptacles in the targeted arenas, parks and convenience stores;
- Increase public awareness of the opportunities and convenience of recycling in public spaces.

Objectives

Project objectives included:

- Determine current recycling and disposal habits;
- Assess recycling systems already in place including measurement of current waste diversion rate;
- Expand and improve upon current recycling and disposal systems;
- Demonstrate the potential for recycling;
- Document the implementation and management stages of the project;

Measure the increased rate of recycling achieved by measuring the program performance before and after implementation of the new recycling bins.

3. Site Selection

Parks

Centennial and Canatara Parks were selected because they are two of the most utilized parks in Sarnia.

Centennial Park is located on Sarnia Bay; it features a waterfront pathway, has two boat ramps and is adjacent to a large marina.

Canatara Park is situated on Lake Huron and features 2 kilometres of sandy beaches, large playgrounds and the Children's Animal Farm.

Veteran's Park is a dedicated activity park, including a soccer pitch. It was selected in order to develop some assumptions about the waste generated at recreational parks

Arenas

The RBC Centre (formerly SSEC), is the largest arena in Sarnia, it is home to the Junior A team, the Sarnia Sting.

Clearwater Arena has two ice-pads and community rooms for meetings; it is a popular recreational facility for hockey teams.

Sarnia Arena is the oldest arena in Sarnia; it is home to the Legionnaires, the Junior B team and the Sarnia Figure Skating Association.

4. Waste Audit Methodology

StewardEdge conducted a waste composition study, including waste audits at each site participating in the pilot both prior and subsequent to implementation. The primary objective of the waste composition study was to determine the composition of solid waste disposed and the baseline waste diversion rates in three Sarnia parks and arenas and eight Mac's 's Convenience Stores. The project sites included:

- Canatara Park, Centennial Park, Veteran's Park (Lottie Neeley);
- Clearwater Arena, Sarnia Arena, RBC Centre (SSEC);
- Mac's Convenience Stores (8 Sarnia locations).

In the parks, baseline waste composition studies were conducted from June 17 to 23, 2009; follow-up audits were conducted from July 27 to August 2, 2009.

In the arenas, baseline waste composition studies were conducted from October 28 to November 1, 2009; follow-up audits were conducted from December 14 to 18, 2009.

For Mac's Convenience Stores, the baseline study took place from September 24 to 30, 2009. Follow-up audits took place from December 11 to 17, 2009.

The waste composition studies represent a one-time sampling of the solid waste disposed in public spaces in Sarnia. As these studies represent a "snap-shot" of the solid waste stream, the resultant data may not reflect seasonal variations. However, based on discussions with City of Sarnia and Mac's staff, it is understood that the composition of the waste stream does not vary substantially throughout the year. Given this information, the study data likely provide a fair representation of the composition of the public spaces waste streams in the City of Sarnia and Mac's Convenience Stores.

4.1. Waste Sort Methodology

The following tasks outline the work performed during the solid waste composition study:

4.1.1. Composition Study Set Up

This task required City of Sarnia staff to arrange for access and space to conduct the waste sorting exercise in an inactive area of the works yards at Canatara and Centennial parks and at each of the arenas. The Mac's stores waste was collected daily and sorted off-site.

4.1.2. Waste Sort Categories

To ensure consistency with Stewardship Ontario waste composition data, SE staff used the ninety-two Stewardship Ontario material categories for the waste sort. Table 4.1 provides the material categories utilized during the study.

4.1.3. Sampling

Each sample was hand-sorted into 92 material categories and weighed. The weights of the material categories and the 2009 disposal data (where available) were used to develop a profile of the public spaces waste composition of the three Sarnia parks and arenas and eight Mac's stores.

Parks - The waste generated in the parks was sampled daily for a seven day period. All of the waste and recyclables generated were weighed and hand-sorted to exactly determine the composition of the solid waste stream in each park.

Arenas – The waste generated in the arenas was collected for a seven-day period and sorted all at once.

Mac's Stores – The waste was collected and sorted on a daily basis.

4.2. Data Analysis/Methodology

Baseline and follow-up waste sort data for the arenas, Mac's stores and parks were compiled and summarized by waste stream and then converted to kilogram (kg) per week estimates. The audit team collected and sorted one week's worth of garbage and recycling from each site so few adjustments were necessary to develop the kg per week estimates.

Individual results for each of the park audits, Mac's store audits and arena audits were averaged to determine the average kg per week estimates for the three venues (i.e. parks, Mac's stores and arenas). To make the dataset more manageable and results more meaningful, the original list of material categories was collapsed from 92 categories to 22 categories focusing on recyclable materials accepted in the City of Sarnia blue box recycling program. See Table 4-1 for a list of the categories.

The sort data were used to generate a series of tables and charts summarizing waste composition, generation and recovery, capture rates for the recyclable materials, and the overall diversion rates for the parks, arenas and Mac's stores.

The kg per week estimates were also used to project annual tonnages for recyclable beverage containers and fibres if the public space recycling pilot was expanded to all similar arenas, parks and convenience stores in Sarnia.

In the case of the parks, it was assumed that peak season was from May 1 to September 30 (5 months) and then from October 1 to April 30 (7 months) there would be decreased usage and waste generation would decrease to 10% of what it was during peak season. There are a total of 106 parks in Sarnia, however we assumed only parks above 5 acres would be included in the full public space recycling rollout (i.e. 41 parks including the ones in the study -- Veterans, Canatara and Centennial).

In the case of the arenas, it was assumed the program would be expanded to all four arenas in Sarnia (the three in the study -- Sarnia Arena, Clearwater Arena and RBC Centre -- plus Germain Arena) and that peak season was from October 1 to April 30 (7 months) and then from May 1 to

September 30 (5 months) usage and waste generation would be assumed to decrease to 10% of the peak period amounts.

For the convenience stores an assumption was made that waste generation was constant throughout the year and that the program would be rolled out to 51 stores (the eight Mac's stores in this study plus two 7/11 stores, 31 Independent stores and 10 service stations with stores).

Table 4-1 Waste Audit Sort Categories

Printed Paper	PVC Bottles & Jars	**Glass**
Newspaper – Dailys and Weeklys*	Other Plastic Alcohol Containers 100 ml and Under	Clear Glass Beer*
Newspaper – Other*	Other Bottles, Jars & Jugs	Clear Glass Other Alcohol*
Telephone Books / Directories*	Polystyrene Packaging	Clear Glass Other Beverage*
Magazines & Catalogues*	Wide Mouth Tubs & Lids*	Coloured Glass Beer *
Mixed Fine Paper*	Large HDPE & PP Pails & Lids	Coloured Glass Alcohol*
Books*	Polyethylene PE Retail and Carry-out Bags/Sacks	Coloured Glass Other Beverage Containers*
Other Paper	Polyethylene PE Plastic Bags & Film - Other Packaging	Clear Glass Food Containers*
	Polyethylene Plastic Bags & Film - Non-Packaging	Coloured Glass Food Containers*
Paper Packaging	Laminated Pouches & Bag in Box Liners for Alcoholic Beverages	Other Glass
Corrugated Wine Bag in Box*	Laminated/Other Plastic Film and Bags	
Other Corrugated*		**Household Special Waste**
Kraft Paper*	Other Rigid Plastic Packaging	Batteries
Boxboard / Cores*	Durable Plastic Products	Paint & Stain
Molded Pulp*		Motor Oil
Paper Cups and Paper Ice-Cream Containers	**Metal**	Other HSW liquids
Laminated Paper Packaging	Aluminum Alcoholic Beverage Cans Over 1 L*	Other HSW
Composite Cans	Aluminum Alcoholic Beverage Cans 1 L and Under*	**Organics**
Gable Top Cartons*	Aluminum Beverage Cans*	Food Waste
Aseptic Alcohol Over 630 ml*	Aluminum Food Cans *	Yard Waste
Aseptic Alcohol 630 ml and Under*	Aluminum Foil & Foil Trays	Pet waste
Aseptic Other Containers*	Other Aluminum Containers*	
Tissue/Toweling	Steel Alcoholic Beverage Cans Over 1 L*	**Other Material**
	Steel Alcoholic Beverage Cans 1 L and Under*	Diapers and Sanitary Products
Plastics	Steel Beverage Containers*	Textiles
PET Beer Bottles*	Steel Food Containers *	Carpeting
PET Other Alcohol Bottles Over 630 ml*	Steel Aerosol Cans	Construction & Renovation
PET Other Alcohol Bottles Over 100 ml and Less Than or Equal to 630 ml*	Steel Paint Cans	Computer / IT Equipment
PET Other Alcohol Bottles 100 ml and Under*	Other Metal	Telecom Equipment
PET Water Bottles Over 1 liter*		TV & Audio Equipment
PET Water Bottles 1 litre and Less*		Small Kitchen Appliances
PET Other Beverage Bottles Over 1 litre*		Other Electronics
PET Other Beverage Bottles 1 litre and Less*		Tires and Other Rubber
PET Other Bottles & Jars*		Ceramics
PET Other Packaging		Furniture
HDPE Milk*		Mattresses
HDPE Other Beverage Bottles*		Other Large Bulky Items
HDPE Other Bottles & Jugs*		Other Waste

*** accepted in City of Sarnia Blue Box recycling program**

SECTION II: PROGRAM IMPLEMENTATION

5. Public Awareness Campaign

An important aspect of the Public Spaces Recycling Project in Sarnia was the associated communications program. The communications program was designed to increase public awareness about the new recycling program in Sarnia Parks, Arenas and Mac's Convenience stores. Each of the communications components was developed with the same "look and feel" and utilized pictograms to facilitate greater understanding and program participation.

Educational posters were developed and installed in the arenas. At the Mac's stores electronic messaging was developed for display on their electronic message system. In one store a "back-wall" sign was installed. Electronic messaging was also utilized at the RBC Centre, where an "e-poster" was shown during each game. Public Service Announcements were developed for and communicated during games and events at all three arenas. All of the recycling and waste receptacles were labeled with pictogram based signage. See Appendix D for photos and signage examples.

The following list summarizes the communications tools that were utilized during the public awareness campaign:

- bin labels
- posters
- electronic signage (arenas and Mac's 's stores)
- handouts
- recycling awareness nights at two arenas
- banner ads in electronic newsletters
- "back-wall" signage (Mac's 's store)
- notices in City newsletters (4)
- letter to arenas user groups
- public service announcements

SECTION III: RESULTS

6. Audit Results & Analysis

This section will present the results of the waste audit as they pertain to waste generation, composition, and recovery. **Note: In-depth results, broken down into 22 categories, can be viewed in the tables in Appendix B.**

6.1. Waste Generation Estimates

Parks

Parks are regularly utilized in the Spring and Summer months, roughly the period from May to September. This is the period during which the majority of waste is generated at these sites. Based on conversations with maintenance staff, we have estimated that usage of parks during the off-season (October to April) declines to about 10% of usage during the peak summer period.

Waste generation at the three parks participating in the program was significant, averaging 350 kg/week based on the two waste audits. We suspect that this result actually understates generation at the parks, as several severe thunderstorms were experienced during the week of the follow-up audit, resulting in the cancellation of a number of events in the parks. Table 6-1 below summarizes the waste generated at the parks during each of the audits:

Table 6-1 Waste Generation Summary - Parks

Material Category	Baseline Audit (June 2009)			Follow-Up Audit (July 2009)		
	Garbage Stream	Recycling Stream	Total Waste	Garbage Stream	Recycling Stream	Total Waste
	kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
Recyclable Fibre	37.37	2.03	39.4	58.33	1.62	59.95
Recyclable Beverage Containers	23.74	17.99	41.73	16.96	50.32	67.28
Recyclable Non Beverage Containers	1.99	3.25	5.24	2.01	1.12	3.13
TOTAL RECYCLABLE CONTAINERS	25.73	21.27	47	19.44	51.45	70.9
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	63.1	23.3	86.4	77.78	53.07	130.85
Other Materials (i.e. non-recyclables)	209.17	11.92	221.09	255.93	18.93	274.87
TOTAL	272.27	35.22	307.49	333.71	72	405.72

Subsequent to the implementation of the pilot program, collection of recyclable beverage containers in the recycling stream almost tripled, from 18 kg/week to 50 kg/week. Although there was a corresponding decline in the recyclable beverage containers deposited in the garbage stream, the prime driver of the increased quantity in the recycling stream was the increased waste generation of these containers.

Despite the weather, waste generation during the follow-up audit increased significantly, but we are unable to account for whether the low waste generation during the baseline audit is an anomaly without extending the duration of the waste audit.

Based on these results, it is estimated that Sarnia area parks would generate about 63 tonnes of recyclable beverage containers and 56 tonnes of recyclable fibre a year for a total of almost 120 tonnes of recyclables a year. This is based on the beverage container data from both the garbage and recyclable stream.

Table 6-2 Estimated Annual Generation of Recyclables in Sarnia-area Parks

	Total Waste
	tonnes/yr
PAPER and PAPER PACKAGING	
Gable Top Cartons	0.9
Aseptic Containers	1.2
PLASTICS	
PET Beverage	34.4
HDPE Beverage	0.4
METALS	
Aluminum Beverage Cans	15.5
Steel Beverage Cans	0.0
GLASS	
Glass Beverage Bottles	10.5
TOTAL RECYCLABLE BEVERAGE CONTAINERS	62.9
TOTAL RECYCLABLE FIBRE	56.0
TOTAL	118.9

This estimate is arrived at by multiplying the waste per week figures from the follow-up audit by the number of parks in Sarnia larger than 5 acres (41 parks in total). To account for seasonality, it is assumed that each park operates at 100% capacity for five months of the year (from May 1 to September 30) and at 10% capacity for the rest of the year.

Arenas

Arenas generally experience the highest usage in the fall and winter months, from September to April, with the estimated usage during the Spring and Summer estimated at about 10% of the peak experienced during the Winter.

The arenas in which the pilot program was installed did not previously offer any recycling opportunities to patrons, so the results provide a window into the awareness of the new recycling infrastructure.

Waste audits did show a significant disparity in total waste generated at the arenas during the baseline and follow-up audits, unlike the results from the parks. On average each of the three arenas 91 kg of waste was generated during the baseline audit and 98 kg was generated during the follow-up audit. Table 6-3 below summarizes the amount of waste generated by category and waste stream:

Table 6-3 Waste Generation Summary – Average per Arena

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
	Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
	kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
Recyclable Fibre	14.4	9.66	0.08	2.67	2.75	12.41
Recyclable Beverage Containers	10.7	6.43	17.15	0	17.15	23.58
Recyclable Non Beverage Containers	0.5	1.57	0.33	0	0.33	1.9
TOTAL RECYCLABLE CONTAINERS	11.2	8	17.48	0	17.48	25.48
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	25.6	17.66	17.56	2.67	20.23	37.89
Other Materials (i.e. non-recyclables)	65.57	55.97	4.02	0.19	4.22	60.19
TOTAL	91.17	73.63	21.58	2.86	24.45	98.08

The quantity of recyclable beverage containers generated post-implementation more than doubled. It is possible that some patrons, who would otherwise have held on to their recyclables in order to deposit them at home, deposited them in the bins now provided at the arena; patron surveys carried out by Leger Marketing show only a slight decrease in respondents who took their waste home.

Based on the follow-up audit's kg/week of waste, it is estimated that Sarnia arenas will generate 2.5 tonnes of recyclable beverage containers and 1.3 tonnes of recyclable fibre annually. This includes both material recovered in the recycling streams and disposed of in the garbage.

Table 6-4 Estimated Annual Generation of Recyclables in Sarnia-area Arenas

	Total Waste
	tonnes/yr
PAPER and PAPER PACKAGING	
Gable Top Cartons	0.0
Aseptic Containers	0.0
PLASTICS	
PET Beverage Bottles	1.4
HDPE Beverage	0.0
METALS	
Aluminum Beverage Cans	0.8
Steel Beverage Cans	0.0
GLASS	
Glass Beverage Bottles	0.1
TOTAL RECYCLABLE BEVERAGE CONTAINERS	2.5
TOTAL RECYCLABLE FIBRE	1.3
TOTAL	3.8

This estimate is arrived at by extending the average kg/week of waste (determined from the audit) throughout the year. To account for seasonality, it is assumed that each arena will operate at 100% of

the calculated kg/week for seven months of the year (from Oct 1 to April 30) and at 10% of this average for the rest of the year.

Mac's Stores

The eight Mac's stores involved in the pilot program generated an average of about 13 kg/week per site. On average, sites received a significantly higher amount of waste during the baseline audit than they did during the follow-up audit. Table 6-5 below summarizes the breakdown of waste received by category and stream:

Table 6-5 Waste Generation Summary - Average per Mac's Store

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
	Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
	kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
Recyclable Fibre	5.07	1.21	0.33	2.18	2.51	3.72
Recyclable Beverage Containers	2.59	0.35	1.81	0	1.81	2.16
Recyclable Non Beverage Containers	0.11	0	0.09	0	0.09	0.09
TOTAL RECYCLABLE CONTAINERS	2.69	0.35	1.89	0	1.89	2.24
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	7.76	1.56	2.22	2.18	4.4	5.96
Other Materials (i.e. non-recyclables)	16.74	5.88	3.04	0.1	3.14	9.03
TOTAL	24.5	7.44	5.26	2.28	7.54	14.99

Recyclable beverage container generation remained relatively constant during the two audit weeks. The majority of beverage containers generated post-implementation are being directed into the container recycling stream. The Mac's stores generated little in the way of non-recyclable beverage containers.

Based on these results, it is estimated that Sarnia convenience stores would generate about 6 tonnes of recyclable beverage containers and 10 tonnes of recyclable fibre per year. This includes all beverage containers generated at these stores. See Table 6-6 for a breakdown by container type.

Table 6-6 Estimated Annual Generation of Recyclables in Sarnia-area Convenience Stores

	Total Waste
	tonne/yr
PAPER and PAPER PACKAGING	
Gable Top Cartons	0.1
Aseptic Containers	0.5
PLASTICS	
PET Beverage Bottles	2.5
HDPE Beverage	0.1
METALS	
Aluminum Beverage Cans	1.9
Steel Beverage	0.0
GLASS	

Glass Beverage Bottles	0.6
TOTAL RECYCLABLE BEVERAGE CONTAINERS	5.7
TOTAL RECYCLABLE FIBRE	9.9
TOTAL RECYCLABLES	15.6

The estimate is generated by multiplying the average of waste/week for each recyclable, as determined from the follow-up audit by the number of convenience stores in the area, the breakdown of which is as follows:

Store Type	Count
Mac's 's Convenience Stores	8
7/11 stores	2
Independent Stores	31
Service Stations w/stores	10
totals	**51**

6.2. Waste Composition Analysis

The waste was sorted and classified into 92 material categories. These data were then amalgamated for the purposes of analysis. Waste composition analysis provides insight into the changing recycling behaviour subsequent to implementation of the public space recycling (PSR) pilot and will enable analysis of which materials are best suited for inclusion in an expanded PSR program.

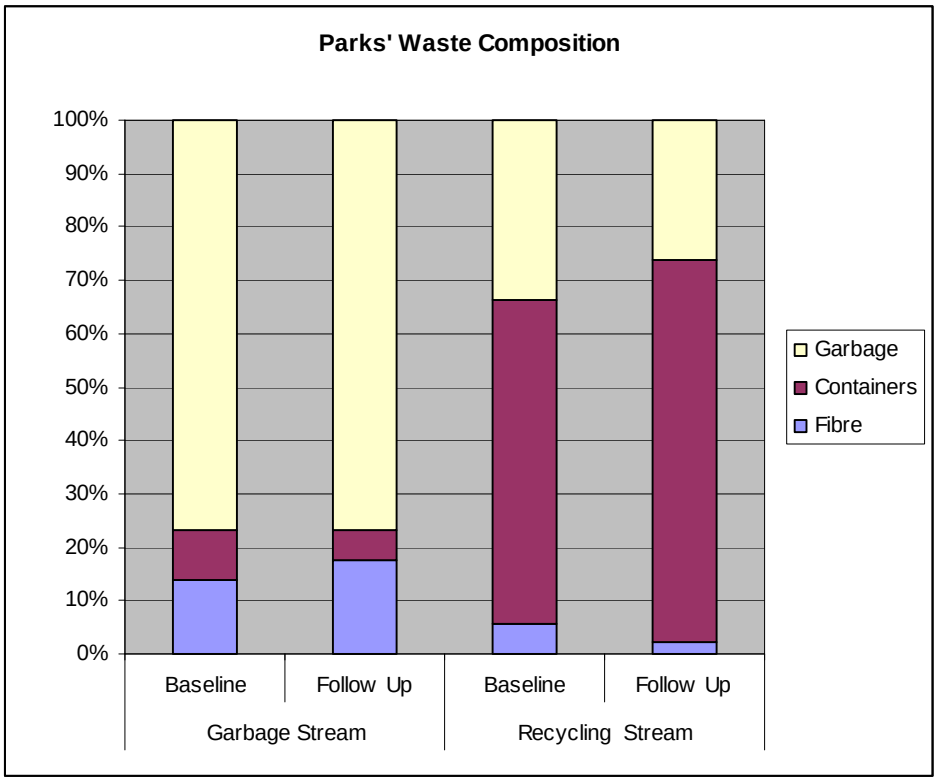
6.2.1. Overall Waste Composition & Contamination

Parks

Recyclable beverage containers are approximately 15% of the parks' waste by weight, averaged over the two audits. In general, recyclables comprise approximately 30% of the total waste generated in Sarnia parks. The proportion of recyclables in the disposal stream remained relatively steady from the baseline audit to the follow-up audit, averaging about 30% of total waste received, although this may have been caused by the inclement weather during the follow-up audit, during which people may have been less discriminating about properly disposing of their waste.

Figure 6.1 below compares the waste composition of each stream during the follow-up audit to the baseline composition:

Figure 6.1 Average Park Waste Composition - Pre- and Post-Implementation



Recyclable beverage containers comprised a plurality of the material in the recycling stream in the parks during both of the audit periods. Of this material category, PET bottles were the greatest single material at about 28 kg/week per park. Aluminum cans and glass bottles were also found in the recycling stream in significant quantities.

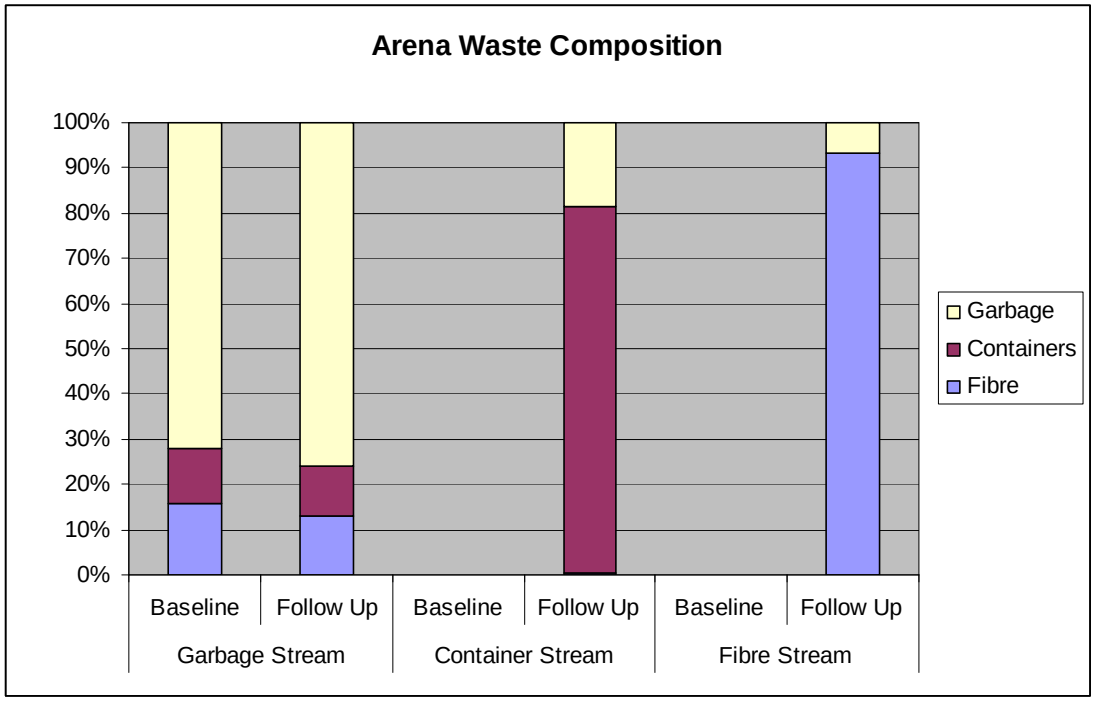
Arenas

Total recyclable beverage containers increased significantly as a percentage of total waste generated during the follow-up audit. A possible explanation for this result has been explored in Section 6.1.

Recyclables made up almost 40% of total waste generated and a quarter of the garbage stream during the follow up audit. This was a slight improvement on the proportions identified during the baseline audit, but leaves room for progress.

As in the parks, PET bottles and aluminum cans comprised the majority of the recyclable beverage containers generated. Figure 6.2 below compares the waste composition of each stream during the follow-up audit to the baseline composition.

Figure 6.2 Average Arena Waste Composition - Pre- and Post-Implementation



Mac's Stores

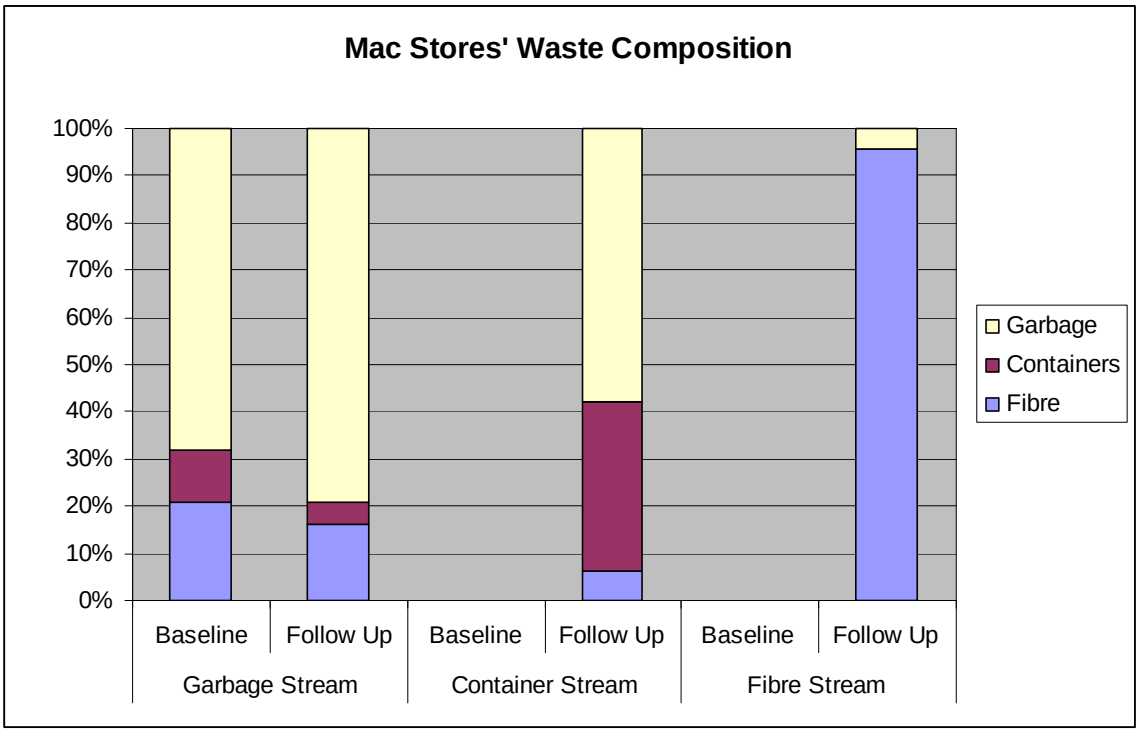
As at the arenas, recyclables comprised 35% of total waste generated at the average Mac's stores audits.

Recyclable beverage containers comprised a much smaller proportion of total waste generated at the average Mac's store than at either the average arena or park. These materials averaged only about an eighth of total waste.

PET bottles and aluminum cans are the most prevalent types of beverage container waste generated. However quantities generated are relatively small; this may be due to the time of year during which the waste audits were conducted, as people are more likely to drive away before consuming their beverages during the winter, rather than staying near the store to finish and dispose of them.

As demonstrated in Figure 6.3, the amount of recyclables as a proportion of the garbage stream decreased by almost 10%, suggesting that Mac's patrons were taking advantage of the newly installed recycling infrastructure to dispose of their waste. In particular, the proportion of containers disposed as garbage fell by half during the follow-up audit.

Figure 6.3 Average Mac's Stores Waste Composition - Pre- and Post-Implementation

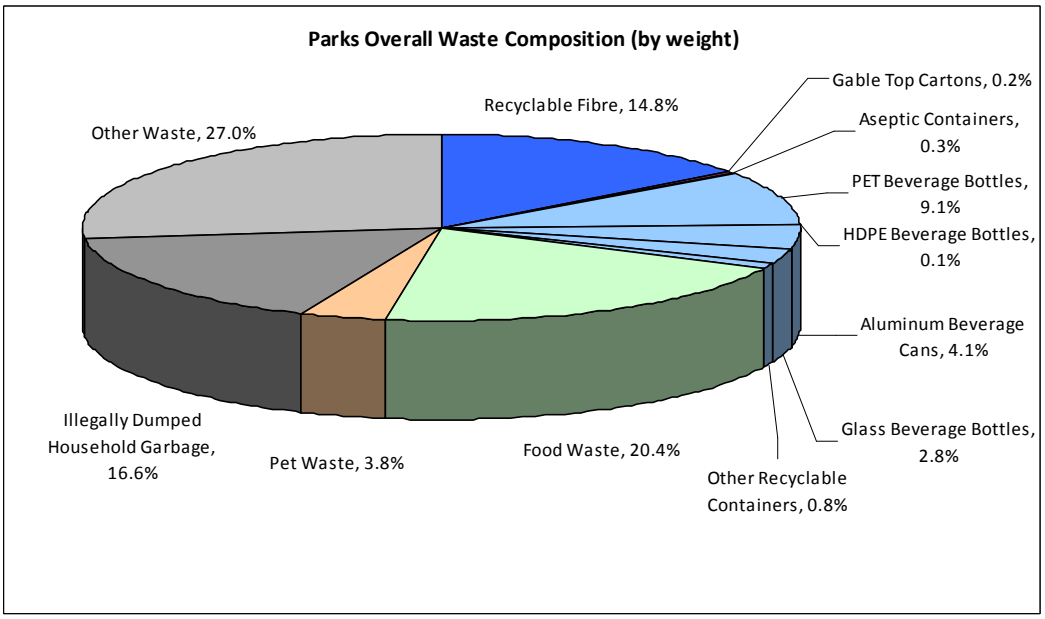


6.2.2. Waste Composition Analysis by Material

Parks

The following Figure 6.4 presents a visual breakdown of total waste generated proportioned by material category (based on the follow-up audit):

Figure 6.4 Overall Composition by Weight - Average Park



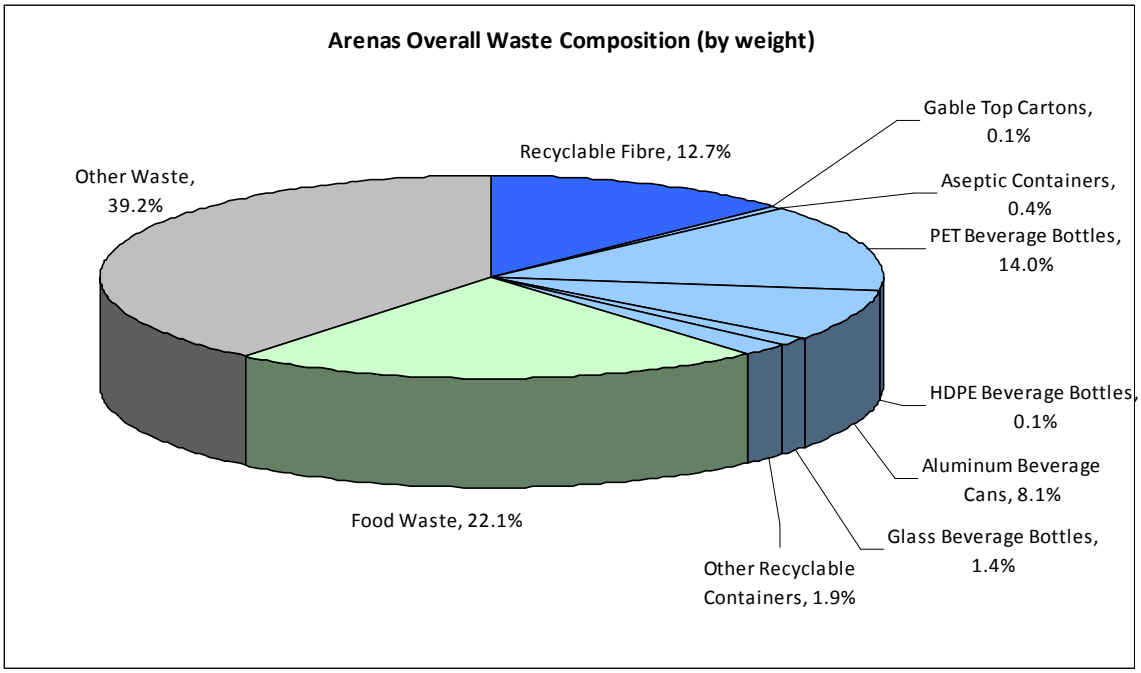
As mentioned, pet waste and illegally dumped household garbage make up a significant portion, almost a quarter of total waste generated, of which some shows up as contamination in the recycling stream (see Section 6.4).

PET bottles are the most significant category of recyclable beverage containers, comprising almost 10% of total waste generated at the average park. All together, recyclable beverage containers account for almost 20% of park wastes.

Arenas

As shown in Figure 6.5, recyclable beverage containers make up close to a quarter of total waste during the follow-up audit, with PET bottles comprising 14% of the total.

Figure 6.5 Total Waste Composition by Material – Average Arena



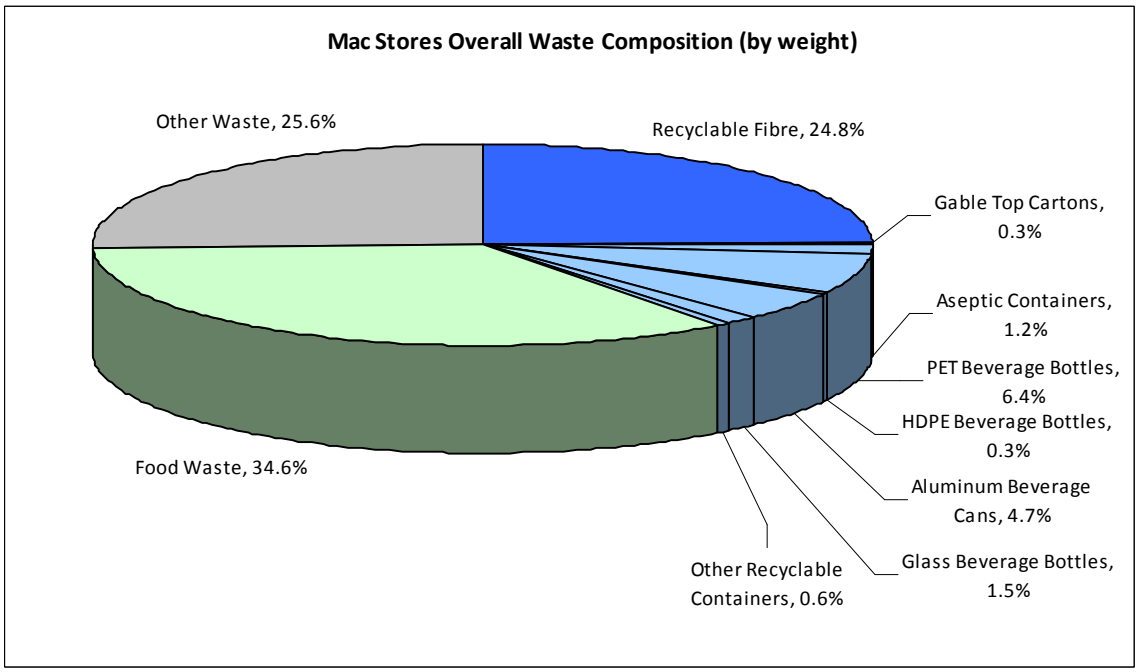
Together with recyclable fibres, recyclable containers make up 39% of the waste generated at the average arena.

Mac's Stores

The average Mac's store, based on the follow-up audit results, receives the smallest proportion of recyclable beverage containers, comprising only 15% of total waste generated. Recyclable fibre generation is a significantly larger portion of total waste than at either the average park or arena. Similarly, food waste also comprises a much larger proportion of waste than at parks or arenas.

The breakdown is presented in Figure 6.6 below:

Figure 6.6 Total Waste Composition by Material - Average Mac's Store



However, as mentioned before, a significant amount of liquid was classified as food waste. If this liquid was removed from the calculation of waste, the proportion of recyclable beverage containers would increase significantly.

6.3. Recyclable Material Recovery Rates

Parks

The implementation of the PSR pilot in Sarnia parks saw mixed results for recyclables. The recovery rates for each material category are presented in Table 6-7 below:

Table 6-7 Material Recovery Rates - Average Park

Material Category	Baseline Audit (Oct 2009) Recovery Rate (%)	Follow-Up Audit (Dec 2009) Recovery Rate (%)	Percent Change
Total Recyclable Fibre	5.20%	2.70%	-47.60%
Total Recyclable Beverage Containers	43.10%	74.80%	73.50%
Total Recyclable Non Beverage Containers	62.00%	35.80%	-42.30%
Total Recyclable Containers	45.20%	72.60%	60.40%
Total Recyclables (Fibre + Containers)	27.00%	40.60%	50.40%

In total the recovery rate for all recyclables increased by 50%, following the introduction of the pilot. Fibre recovery at the average park was very poor, only 3%, which was even lower than the baseline rate

of 5%. As recovery of fibre material was quite small, it is likely that this represents normal variation and is not a significant result. The recovery rate of recyclable beverage containers increased significantly, from 43% to 75%, an increase of 74%.

In particular the beverage container results suggest there is significant scope for extending the program to other parks in Sarnia to improve container recovery rates. However, if fibre recovery remains part of the program the poor performance of fibres must be addressed. Alternatively, the program could focus on beverage container recovery only.

Based on these recovery rates and on the generation estimates presented in Table 6-2, extending the pilot to all parks larger than 5 acres in Sarnia, would recover approximately 47 tonnes of recyclable beverage containers and 1.5 tonnes of recyclable fibres.

Arenas

As the arenas started out without recycling infrastructure, there is no baseline recycling rate to compare the follow-up audit results with. However, this does provide an opportunity to assess how well recycling behaviour took hold at these sites.

In general, the overall recycling rate was very positive, at over 50%. Table 6-8 presents the recovery rates for each material category:

Table 6-8 Material Recovery Rates - Average Arena

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)
	Recovery Rate %	Recovery Rate %
Total Recyclable Fibre	0.00%	22.20%
Total Recyclable Beverage Containers	0.00%	72.70%
Total Recyclable Non Beverage Containers	0.00%	17.40%
Total Recyclable Containers	0.00%	68.60%
Total Recyclables (Fibre + Containers)	0.00%	53.40%

While fibre recovery performed better in comparison to fibre recovery at the parks, the recovery rate was still low, although the fibre stream experienced remarkably little contamination. Recyclable beverage containers had a strong recovery rate of 73% with relatively low contamination.

At these rates, and assuming the annual estimate of recyclables generated (see Table 6-4), extending the pilot throughout the year would recover 1.8 tonnes of recyclable beverage containers and 0.3 tonnes of recyclable fibre annually.

Mac's Stores

Despite the low generation and high contamination of the container stream at Mac's stores, the recovery of containers was very strong at 84%. Fibre recovery was much better than at either the parks or the arenas, with a recycling rate of 67.5%.

Table 6-9 Material Recovery Rates - Average Mac's Store

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)
	Recovery Rate %	Recovery Rate %
Total Recyclable Fibre	0.00%	67.50%
Total Recyclable Beverage Containers	0.00%	83.80%
Total Recyclable Non Beverage Containers	0.00%	100.00%
Total Recyclable Containers	0.00%	84.40%
Total Recyclables (Fibre + Containers)	0.00%	73.90%

In total, recyclables were recovered at an overall average rate of 74% at the Mac's stores.

Based on these recovery rates, and using the estimates of annual waste generated (Table 6-6), it is projected that extending the pilot program to all convenience stores in Sarnia would recover 4.8 tonnes of recyclable beverage containers and 6.7 tonnes of recyclable fibre.

6.4. Contamination in the Recycling Stream

Parks

The primary source of contamination in the container recycling stream was non-recyclable containers, as presented in Table 6-10 suggesting that patrons experienced difficulty in distinguishing which container types were eligible for recycling.

Table 6-10 Contamination in Recycling – Parks

Material Category	Baseline Audit (Oct 2009)			Follow-Up Audit (Dec 2009)		
	Garbage Stream	Recycling Stream	Total Waste	Garbage Stream	Recycling Stream	Total Waste
	% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Recyclable Fibre	13.70%	5.80%	12.80%	17.50%	2.20%	14.80%
Recyclable Beverage Containers	8.70%	51.10%	13.60%	5.10%	69.90%	16.60%
Recyclable Non Beverage Containers	0.70%	9.20%	1.70%	0.60%	1.60%	0.80%
TOTAL RECYCLABLE CONTAINERS	9.50%	60.40%	15.30%	5.80%	71.50%	17.50%
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	23.20%	66.10%	28.10%	23.30%	73.70%	32.30%
Total Other Materials (i.e. non-recyclables)	76.80%	33.90%	71.90%	76.70%	26.30%	67.70%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Contamination Rates:						
Recyclables in Garbage Stream	23.20%			23.30%		
Garbage in Recycling Stream		33.90%			26.30%	

Contamination decreased slightly during the follow-up but remained at a high level, although again, inclement weather may have been a contributing factor to the high contamination.
Notably, recyclable containers decreased as a percentage of the garbage stream post-implementation and increased as a percentage of the recycling stream.

In contrast, fibre collection in the recycling stream was down and increased as a percentage of the garbage stream, suggesting that park patrons were confused about whether fibre was accepted in the recycling stream, and elected to toss fibre products into the garbage instead.

Arenas

Table 6-11 below presents the contamination rates for arenas:

Table 6-11 Contamination in Recycling - Arenas

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
	Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
	% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Recyclable Fibre	15.80%	13.10%	0.40%	93.30%	11.30%	12.70%
Recyclable Beverage Containers	11.70%	8.70%	79.50%	0.00%	70.10%	24.00%
Recyclable Non Beverage Containers	0.50%	2.10%	1.50%	0.00%	1.40%	1.90%
TOTAL RECYCLABLE CONTAINERS	12.30%	10.90%	81.00%	0.00%	71.50%	26.00%
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	28.10%	24.00%	81.40%	93.30%	82.80%	38.60%
Other Materials (i.e. non-recyclables)	71.90%	76.00%	18.60%	6.70%	17.20%	61.40%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Contamination Rates:						
Recyclables in Garbage	28.10%	24.00%				
Garbage and Recyclable Fibre in Container Stream			19.00%			
Garbage and Recyclable Containers in Fibre Stream				6.70%		
Garbage in Recycling Stream			18.60%	6.70%	17.20%	

The comparison shows that there was little cross-contamination between the two recycling streams, as fibre and containers were in most cases deposited in their proper recycling containers. The fibre stream in particular experienced low overall contamination. The results suggest that the messaging was effective especially given the absence of previous recycling infrastructure at each of the sites.

Mac's Stores

As in the arenas, the fibre stream experienced very low contamination rates of only about 5%. However, the container stream at the Mac's stores experienced significant contamination, as presented in
Table 6-12

Table 6-12 Contamination in Recycling - Mac's Stores

Material Category	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
	Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
	% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Total Recyclable Fibre	20.70%	16.20%	6.30%	95.50%	33.30%	24.80%
Total Recyclable Beverage Containers	10.60%	4.70%	34.30%	0.00%	23.90%	14.40%
Total Recyclable Non Beverage Containers	0.40%	0.00%	1.60%	0.00%	1.10%	0.60%
TOTAL RECYCLABLE CONTAINERS	11.00%	4.70%	35.90%	0.00%	25.10%	15.00%
TOTAL RECYCLABLES (FIBRE + CONTAINERS)	31.70%	20.90%	42.20%	95.50%	58.40%	39.80%
Total Other Materials (i.e. non-recyclables)	68.30%	79.10%	57.80%	4.50%	41.60%	60.20%
TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Contamination Rates:						
Recyclables in Garbage	31.70%	20.90%				
Garbage and Recyclable Fibre in Container Stream			64.10%			
Garbage and Recyclable Containers in Fibre Stream				4.50%		
Garbage in Recycling Stream			57.80%	4.50%	41.60%	

The majority of contamination in the container stream was composed of household waste and in particular food waste, which comprised 50% of the container stream by weight. However, liquids in their original containers were classified as food waste, so much of that food waste that is liquid evaporates and does not become permanent landfill material.

7. Structured Observations

Structured observation was conducted post-implementation in City of Sarnia Parks and pre-implementation at the Mac's Convenience Stores. The findings are presented below.

Parks

Subsequent to installation of the new recycling equipment in Canatara Park, structured observation was conducted to assist with identification of the effectiveness of the new equipment including bin signage. The structured observation in Canatara Park took place on Canada Day (July 1, 2009). On that day there were approximately 50,000 people in the park. Two observers sat at a "safe" distance from a set of recycling and waste bins and monitored the behaviour of the crowd. Of the 100 people observed in a 20 minute period, 95 of them used the bins correctly. When asked how they knew what to put in the bins, the interviewees responded that the images on the bins made it quite clear.

Mac's Stores

Structured observation was conducted at the Mac's stores prior to implementation of the recycling program; two hour observation periods were conducted from Thursday September 24 to Monday September 28. Five of the eight stores were monitored; including the two stores with gas-bars. The stores were visited during busy times of day to identify the "typical" disposal needs of Mac's customers.

Of the 439 people observed, 31 used the garbage bin for recyclables (7%). During the study period, three people were observed disposing of recyclable waste paper products (<1%).

7.1. Patron Surveys

For the arenas, Leger Marketing was employed to conduct surveys of visitors to the arenas pre- and post-implementation. In total, 403 patrons were surveyed, 200 prior to the implementation of the program, during the first week of November and 203 after the implementation, during the middle of December. For the full report, see Appendix D.

Of these 403 people, 340 responded that they regularly had items to dispose of at the arena. When asked, prior to implementation, what each did with the materials, 59% deposited them in recycling while 56% threw these items in the garbage (more than one answer was permitted). Subsequent to implementation, 78% said they deposited their items in recycling, an increase of 19%, and 35% fewer people threw their items in the garbage. Post-implementation, 64% of respondents who utilized recycling said they were alerted to the existence of recycling by signage in the arena, compared with only 33% prior to implementation.

Half of all respondents had cups to dispose of, while 41% had food packaging; 35% had bottles and 7% had cans.

Of those respondents who did not recycle, 45% of them post-implementation claimed they did not know of recycling opportunities, while 29% admitted that it was inconvenient for them.

Patron recommendations included using larger bins and putting up more signage in the arena.

Of those surveyed, 80% visit arenas regularly, suggesting that there is a good opportunity to increase recycling knowledge through strong P&E efforts in arenas.

8. Conclusions

Implementation of the Public Spaces Recycling Program has been a success; while there are still challenges to overcome, recycling rates, especially for beverage containers, have improved very significantly at all three venues, parks, arenas, and convenience stores.

The recovery rate for recyclable fibre is very low. Any expansion of the pilot should consider either messaging clarifying what is eligible fibre based packaging or, alternatively, focusing only on beverage container recycling especially in parks and arenas.

Based on the generation during the pilot it is estimated that over 67 tonnes of recyclable fibre is available for diversion from parks, arenas, and convenience stores in Sarnia.

The recovery rate for the container stream is impressive, with no venue recovering less than 73% of total containers generated on average at any venue (Parks – 75%; Arenas – 73%; convenience stores – 84%). This rate was achieved even though the signage and messaging was in place for only a short period of time. Further efforts are required to reduce the contamination within this stream, especially in outdoor areas, where it is most prevalent.

Expanding the PSR pilot to all similar venues has the potential to recover at least 73% of the over 71 estimated tonnes of recyclable beverage containers generated in the Sarnia area. Of particular interest, due to the potential generation and recovery, are the parks in Sarnia, which alone account for 63 tonnes of generation potential per year.

APPENDICES

A. Literature Review

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1 Introduction

People in public spaces – such as streets, parks, baseball fields, sports arenas, and libraries – create a significant amount of waste. In many jurisdictions, however, opportunities to recycle that waste are rarely as comprehensive as the recycling opportunities available at home. A public space recycling (PSR) program provides an important opportunity to decrease litter, enhance a jurisdiction's reputation for environmental stewardship, reinforce at-home recycling behaviour, and, of course, recover valuable resources.

This discussion paper was created to describe the experiences, 'best practices' and recommendations from public space recycling[1] programs operating in Canadian and international jurisdictions. This report understands **public space as an indoor or outdoor area or space that is open and accessible to the general public, in which area the waste management infrastructure is typically owned and managed by or on behalf of a regional or municipal government**. The following locations are good examples of public spaces:

- Sidewalks, concourses and transit shelters in public commercial areas
- Open recreational spaces (parks, sports fields, trails, etc.)
- Public facilities (sports arenas, municipal government buildings, etc.)

Recycling in these spaces could be on a permanent or semi-permanent basis, or it could be a one-time occurrence during special events. Spaces as shopping malls, schools or hospitals, where waste management services are typically arranged through private, non-municipal contracts are not considered public space for the purpose of this report

While this report will attempt to identify best practices, it should be noted that many of the practices recommended in the literature have yet to be sufficiently substantiated by supporting data. Where data are lacking, practices supported in the literature will be referred to as 'recommended practices', while 'best practices' will be reserved to refer to those practices which the authors feel are supported by enough empirical evidence to justify the designation.

There are a number of reasons for a jurisdiction to implement a public space recycling program. Public space recycling programs create an opportunity to recover materials from a waste generation source that contains a significant proportion of commonly-recycled materials, such as beverage containers and newsprint. In fact, a waste audit of street bins in New York City found that their street basket waste stream contained a higher proportion of recyclable material than their residential stream (47% vs. 35%) (New York City, 2007).

The composition of waste in public spaces will be variable, largely based on characteristics of the site. The waste generated by site visitors will depend on the location, near-by commercial establishments and the type of material sold there (e.g. coffee shop vs. newspaper stand), typical activity engaged by the public (e.g. sports activities vs. dog walking vs. shopping), and types of visitors (e.g. tourists vs. residents vs. commuters).

[1] Alternatively referred to as pedestrian recycling, on-street recycling, public place recycling, or away-from-home recycling.

Despite the recovery potential, research suggests that public space recycling may be more important as a tool for educating the public about environmental issues than for actually recovering tonnage (NAPCOR, 2008, p.49). A 2007 pilot project in New York concluded that public space recycling did little to increase overall diversion rates, as the waste from this stream is a relatively small proportion of total waste generated by households (New York City, 2007). However, while direct impact on recovery rate may be minimal, a properly-designed program can reinforce recycling behaviour at home, thereby increasing recovery rates indirectly. As argued by a City of London official, "the public awareness opportunity that this program can generate for recycling will be far more valuable than the amount of actual clean material collected" (Anne Boyd, City of London, as reported in Quinte Waste Solutions, 2006, Appendix C).

In addition to reinforcing the importance of recycling "always and everywhere" (Gaia Environment Inc., 2007), the recovery of recyclable material provides some additional benefits, including the potential to obtain revenue from recyclable material sales (Quinte Waste Solutions, 2006, p.28). Thirdly, a public space recycling program has the potential to enhance a jurisdiction's environmental reputation. Because bins are normally placed in high-traffic, highly-visible locations, a jurisdiction can demonstrate to both residents and tourists that waste diversion is a priority.

While a public space recycling program may not significantly impact overall recovery rates, it is a diversion program with high public visibility, with the potential to cut costs, decrease litter and enhance a jurisdiction's reputation for environmental stewardship while reinforcing at-home recycling behaviour.

Summary

- There are a number of reasons for a jurisdiction to implement a public space recycling program: to increase diversion rates and overall tonnes, to decrease litter, to reinforce at-home behaviour, and to enhance their environmental reputation.
- The composition of waste in public spaces will be variable, depending on the characteristics of the site. Waste composition is affected by nearby uses, commercial activity, season, and the people who use the area

2 Before a PSR Program Starts

The reviewed literature universally stresses the importance of advance planning before the commencement of any public space recycling program. Pre-planning is an essential step in the development of a successful PSR program, before any containers are ordered or installed.

The US EPA (2008) recommends starting with the appointment of a recycling coordinator to oversee the planning and implementation of the program. This position can coordinate projects such as developing the new collection system, identifying communications requirements, and arranging equipment contracts. In addition, a recycling coordinator can address questions and concerns from location managers, staff, and the public, and get each of these stakeholders

involved in the planning process, as it is important to have support for the program at all levels of an agency, from decision-makers to custodial staff (Roumpf, 2002, p. 16).

In addition to establishing a program coordinator, the New South Wales' *Better Practice Guide for Public Place Recycling* (2008) recommended that program managers should perform a comprehensive assessment in four major areas:

1. **Assess current waste collection service** – to identify collection frequency, maintenance techniques, and the capability of expanding or adapting current programs.

2. **Assess staff attitudes** – to identify and overcome any occupational health and safety issues, as well as assess support for any new programs.

3. **Perform a waste audit(s)** – to identify waste and recycling composition, as well as typical weekly (or monthly) waste and recycling volume and weight.
    - To see what you've got, in order to plan for the bins, collection frequency,
    - To characterize waste by volume/weight and frequency
    - To identify locations where recyclables are generated
    - To measure performance of program – baseline for future comparison – recycling rates + any financial impact

4. **Determine the recycling and waste programs in surrounding areas** – to ensure operational and P&E consistency and integration with current programs.

In addition, it is important to consider the profile of a typical user of the bin in a particular area – will they be dog walkers, tourists, and/or employees drawn from the city and surrounding suburbs? What is the expected traffic, and will there be seasonal variations? Are they accustomed to recycle at home?

Furthermore, considerations such as: who will own the equipment? Who will be responsible for its servicing (municipality or industry)? Will any local bylaws need to be changed? must all be assessed before implementing a recycling program.

Summary

- Pre-planning is essential to a successful program
- This stage should involve an assessment in the following areas, at minimum: current waste and recycling programs at the site as well as in the surrounding areas; attitudes of maintenance staff, decision-makers and site users; waste composition via a waste audit; and, budget.

3 Container Function and Design

One of the most important considerations (and costs) of a public space recycling program is container function and design. Containers can be customized, or can be chosen from one of the multitude of options available commercially. The literature on this topic offers a number of suggestions about container function and design considerations.

The pre-planning phase is important to help determine what kinds of bins are required. Will they be stationary or will they need to be moved often? What kind of waste will be accepted for recycling (or not), and how many streams will the waste be separated into? How much money is available to spend on the bins?

1. Determine which materials will be accepted for recycling

First, program managers need to determine which materials will be accepted for recycling. This should be based on waste audit results (to determine expected composition), operational capacity (what kind of trucks are available, processing capabilities, etc.) and compatibility with recycling programs in surrounding businesses, homes and public places (New South Wales, 2008, p. 5).

Waste audit results will help predict what kind of waste should be expected at each location, and therefore what kinds of recycling bins to install (Waste Audit and Consultancy Services, 2008). For example, events and venues will often generate beverage container waste from participants and cardboard waste from vendors, while transportation hubs (such bus stops) will generate large amounts of newsprint (US EPA, 2008).

2. Determine how many streams the material will be separated into

Once the materials to be recycled have been determined, program managers should consider how many streams the material should be divided into within the bins. For example, there could be as many as four separate bins for beverage containers, fibre, organics, and waste. One consideration is that commingled recyclables collection may reduce public confusion (New South Wales, 2008). Commingling of materials also reduces the number and cost of collection containers (Roumpf, 2002). Ultimately, the number of streams should be based on local curbside programs, transportation and storage requirements, operational requirements of the materials recycling facility (MRF), and expected composition of the waste at that site.

3. Choose a bin design

There are many factors to consider when selecting a bin design, examples of which are described in the following list:

1. Will recyclables and waste be collected in the same container, or separate containers?
2. What is the capacity of the bin, and how frequently will it need to be emptied?
    - Will the bin be transparent to enable quick determination of whether it needs to be emptied?
3. How will the bin affect employee health and safety?
    - The larger the capacity, the more the waste will weigh.
    - Will the bin be emptied from the side or from the top? Especially for areas where frequent emptying of the bins is important, side removal of containers is preferable (Roumpf, 2002).
4. Is the bin a safety risk?
    - Closed bins may be perfect hiding places for bomb, hazardous waste or illegal dumping.
5. How easy is it to install (and move later, if necessary)?

6. Can the bins be locked?
    - Locked lids to prevent scavenging by humans and animals, however it will require a separate key or other opening device.
7. How easy are the bins to repair? Be sure to consider the long-term availability of replacement parts.
8. Is the bin design flexible for different locations?
9. What kind of operational materials are required (e.g. bin liners)?
10. How durable is the bin?
    - How will it perform in various weather conditions? (rain in bins, holding up to snow, wind, etc)
    - Are there drain-holes for moisture and liquids?
11. What is the composition of the bin – is it made of recycled material? Locally sourced? Inflammable?
12. How will the bin be incorporated it into the surrounding landscape?
    - Are there opportunities for public participation and art?
    - Does it fit with the overall 'look' of surrounding street furniture and/or branding of city? Ideally the bins should fit the surrounding landscape – especially if containers are purchased as part of a city beautification effort (Roumpf, 2002).
13. Will the bin be able to incorporate other uses if desired, such as a bench, weather shelter, or cigarette disposal?
14. How accessible are the bins for children and people with disabilities? Are the openings easy to reach? Are communications messages easy to see and understand?
15. How easy is it to keep clean, from spills and/or vandalism?
16. How will the bin prevent the following:
    - Illegal dumping;
    - Theft / scavenging;
    - Animals / insects;
    - Smell?
17. How much will each bin cost?
18. How will the bin incorporate promotion and education messages? Consider the ability to replace signage and top slots, to accommodate program changes.

Special design focus: bin opening

A crucial part of the bin design is the format of the bin opening, as it is a key way to encourage participation and help prevent contamination. The following are some points to consider when choosing the type of bin opening (from New South Wales, 2008, p. 4):

- Openings should prevent rain water or snow from entering the bins.
- Openings should be smooth and free of any sharp edges.
- The openings for garbage should be large enough to take the most common garbage item identified in the waste audit, but should be small enough to minimise dumping of bulky commercial and household garbage.
- The opening for the recycling bin should be smaller than the garbage opening, and of a different shape to differentiate it. A London, England recycling manager attributes low contamination of their fibre public recycling bins to the limited size of the container aperture (as reported in City of New York, 2007).

- Similarly, the size and shape of the opening can act as a visual cue of what materials are accepted, such as a round hole to match the shape of most beverage containers, and a rectangular slot for fibre products.
- The openings should be positioned and configured to allow easy use by children and people with disabilities.
- The openings need to restrict access to animals and pests.

In addition, a survey performed in York Region found that in general, park users did not like touching the lids of waste and recycling receptacles, especially if they were sticky or dirty (York Region, 2008, p. 12). Touch free openings, such as a pedal that users step on to open the flaps (see City of Toronto, 2009), are one option. However, if your city experiences heavy snowfall, the pedal may become obstructed and render the bin difficult to use, thus deterring participation.

Designing and installing new bins is an opportunity for creative community participation. For example, in Mears Park, Minnesota, members from the nearby arts community collaborated with the City of Saint Paul and a non-profit recycling group to design creative recycling bins that fit with the surrounding landscape (Eureka Recycling, 2009). The City of Toronto engaged in an extensive three-year public and stakeholder consultation program before finalizing the redesign of their street furniture (including waste and recycling receptacles) (City of Toronto, 2009).

Summary of key findings

- Select materials to recycle based on expected waste composition at the site, as well as current infrastructure available to collect, store and transport collected materials.
- The materials selected for recycling should be consistent with the jurisdiction's broader waste and recycling programs.
- The greater number of streams the recycling is divided into, the greater potential for public confusion.
- There are a number of factors to consider when choosing waste and recycling containers, such as: appearance, capacity, materials accepted, type of openings, operational and maintenance requirements, communications and messaging requirements, durability, cost, flexibility, secondary uses, accessibility for children and people with disabilities, amount of recycled material in the bin materials.
- Bins for temporary events require special considerations: they should be easily moved, and will require storage space (unless they are one-time-use containers).
- Consider involving the surrounding community in the design of the bins.

4 Placing the Bins

In addition to the design, an important consideration for a public space recycling program is where to locate the containers. Although specific placement will depend on the particular site targeted (for example, parks vs. sports arenas), there are a number of general principles.

> *"Don't assume you know where your recyclables are generated and where they are moving to. You need to study your area and learn the patterns of pedestrian behaviour. The most common mistake is assuming that a recycling bin next to a pop machine is effective. Most people do not consume their soda standing at the machine. You need to predict where that soda can is traveling to and where it will be empty – that's where you put the recycle bin*."
> – Maria Kershner, City of Boise, 2008).

Especially in the short term, it will be difficult to establish recycling services in all potential locations. Some potential high-traffic, high performing locations suggested in a guidebook published by New South Wales (2008, p. 7) include:

- Near entrances and exits
- Near tables or picnic grounds, where food is consumed, not necessarily purchased
- Walkways and high traffic areas
- Near toilets or other utilities
- Parking lots

The guidebook also mentioned the importance of serviceability and access to the bins by maintenance staff, especially during peak periods. They also recommend that fire exits and congested pedestrian areas should be avoided.

Additional factors to consider are other maintenance activities that will occur in proximity to the bins. For example, the City of Toronto reported some bin damage during snow removal, as the bins were placed too close to the curb. The City also reported that some cyclists had problems with bin proximity when they were placed too close to the roadway (as discussed in Quinte Waste Solutions, 2006).

In diverse public spaces with commercial operations (such as a main street), Maria Kershner from the City of Boise noted that "the key to a successful pedestrian recycling program is locating recycling centers along pedestrian corridors and near businesses that sell recyclable materials" (Kershner, City of Boise, 2008). Conversely, others recommend keeping bins away from sites that will encourage contamination, such as locations that will generate only trash and not recyclables. For example, if a coffee shop only sells their beverages in non-recyclable cups, avoid putting recycling bins in that area (Wisconsin BeSMART Coalition, 2007).

Once potential locations have been indentified, Australia's Fraser Coast Regional Council (undated) recommended that outdoor bins should be placed on a paved surface for ease of clean-up, in an area graded towards a sewer to catch liquid run-off.

5 Preventing Contamination

When designing a public space recycling program, a major consideration is how to minimize contamination rates. Contamination can be caused by materials placed in the wrong container

(garbage in recycling, and vice versa), or unacceptable materials placed in either container (such as household waste or hazardous waste). According to Quinte Waste Solutions, "contamination is the largest contributor to a program's failure" (2006, Appendix C).

There are a number of possible causes of contamination. As reported by a number of jurisdictions, two major contributing factors are the design and location of the containers.

Another contributing factor to contamination is the anonymity of public space recycling. As reported by waste management official from Barrie, "The idea of being anonymous when recycling in public space allows the public to contaminate the stream worry free; whereas during curbside recycling the recycle truck driver knows who puts out what material. Therefore there is ownership to that material; as a result the material is more likely to be sorted properly" (Tracey Quinn-Straser – City of Barrie, as reported in Quinte Waste Solutions, 2006, Appendix C).

Using bin placement to minimize contamination

Contamination is a serious concern that is partially affected by the location and placement of recycling bins. Jurisdictions have employed a number of methods to reduce contamination.

To avoid contamination, one important best practice is to always pair recycling containers with trash containers (NAPCOR, 2008). In other words, as one jurisdiction advised, "never position a recycling bin on its own" (New South Wales, 2008, p. 4). If recycling containers are not adjacent to a waste receptacle, the recyclables will be contaminated because most users will put their waste in the first bin they encounter (Kershner, City of Boise, 2008). Locating waste bins in close proximity to recycling bins was attributed as part of the reason for low contamination rates in the Borough of Westminster, in London England (as reported in City of New York, 2007, p.1).

Quinte Waste Solutions noted that "side-by-side recycling and garbage containers increased recyclable material capture while reducing cross contamination" (Quinte Waste Solutions, 2006, p. 28). This side-by-side configuration is preferable to a back-to-back placement, in order to prevent one bin from obscuring the other (New South Wales, 2008). New South Wales (2008) recommended a three-bin configuration: two garbage bins on either side of a recycling bin. This is for people who do not intend to separate their waste, and who will place it into the first bin they encounter. They suggest that if a three-bin configuration is not possible, a two-bin configuration should place the garbage receptacle closest to the high traffic area, to capture waste from people who do not separate their waste (p. 5).

Regular maintenance of the bin is also important to prevent contamination. In Seattle, program managers found that contamination rates increased when the litter can paired with the recycling can was full (as reported in City of New York, 2007, p.5).

An additional consideration to prevent contamination is the number and density of bins placed at a site. One source stated that people will not walk more than 12 metres to dispose of their litter in a public place (New South Wales, 2008, p. 9). With that in mind, a Quebec study recommended employing a number of smaller containers instead of fewer, centralized large-format containers, as users are unlikely to carry their recyclables very far, and will often deposit them into the first bin they see (Gaia Environment Inc., 2007). However, the aesthetic effects and the servicing requirements of such a strategy should be considered. More containers may

compromise the aesthetic integrity of the surrounding area. A greater number of smaller containers also increase servicing requirements, as more containers must be serviced more frequently. The operational budget and staff reaction should therefore be considered when evaluating this strategy.

As a general principle to prevent contamination, it should be as easy for the public to recycle as it is to throw something away (US EPA, 2008).

Summary of key findings

- Make the bins easily accessible: generally, people will not walk more than 12 metres to dispose of their litter in a public place
- Place in high-traffic areas where packaging waste is likely to be generated (not necessarily where products are sold)
- Bins must be easily accessible for service staff
- Consider the size of the venue and available storage space when determining how frequently the recyclables must be hauled.
- Regularly monitor how full the recycling container is when it is emptied. If it is only half full, save money by reducing the number of times the material is collected.
- To prevent contamination, always place a waste receptacle beside any recycling receptacle, empty the bins before they become full, and consider employing a number of smaller containers instead of fewer, centralized large-format containers

Preventing illegal dumping of residential or commercial waste in public recycling bins

As a 2006 report from the City of Toronto emphasized, public space recycling is not a substitute or an alternative to residential or commercial waste disposal and recycling services; yet waste from these sources often ends up in public space recycling bins. As illustrated by a 2004-2005 waste audit of New York City's streetside bins, approximately 20.7% of the waste was suspected to have been dumped illegally (13.5% from residential sources, and 7.2% from commercial sources) (New York City, 2007, p.37). A 2006 waste audit of Toronto's parks found illegal dumping in 17% of all baskets sampled (124 out of 742). They found that illegal waste was approximately 13% (by weight) of the waste stream and 1.2% of the recycling stream (City of Toronto, 2006, p. 17 and 26).

To combat illegal dumping, the City of Toronto suggested that ongoing bylaw enforcement[2], targeted outreach, basket removal in problem areas, and restricted-opening basket design may be effective counter measures (2006, p. v). Other tips to prevent the dumping of residential or commercial waste included the following:

- Restrict the size of material that can fit into the bin.
- Make sure the bin lids are not removable or easily opened.
- Consider installing a sign that names the illegal dumping bylaw code.
- As most drop offs happen at night or early morning, make sure the area is well-lit at night (from Quinte Waste Solutions, 2006, Appendix D).

[2] In Toronto, as in other jurisdictions, disposal of household or commercial waste in public bins is illegal, and punishable under municipal bylaws.

6 Storage Considerations

An additional consideration is how and where collected material will be stored. The following is a discussion from the US EPA (2008):

> *Once the materials have been removed from the collection bins, they need to be stored on-site until picked up by a hauler or delivered to a transfer station or materials recovery facility. Consider the following:*
>
> - *Will the materials be stored on-site in a shed or a dumpster?*
> - *Will the hauler provide a compactor as part of its contract?*
> - *If not, is it feasible to invest in a compactor, which will decrease the number of pickups needed for the collected recyclables?*
>
> *Consider the size of the venue and available storage space when determining how frequently the recyclables must be hauled. Remember to take into account seasonal fluctuations in the quantity of recyclables generated (e.g., holidays, baseball season, summer vacations). Regularly monitor how full the recycling container is when it is emptied. If it is only half full, save money by reducing the number of times the hauler collects the materials.*

However, it is important to consider the behavioural effects of reducing bin servicing. Fuller bins deter people from recycling. Coordination

In summary, the amount of storage space will in part determine how frequently the bins need to be serviced, and how often the material will need to be taken to the Materials Recycling Facility (MRF).

7 Event-specific information

Coordinators of specific event recycling programs have an opportunity to emphasize recycling behaviour to all attendees in a more comprehensive way than those running ongoing public space recycling programs. A captive audience, controlled entrances and exits, and greater leverage over vendors are all advantages that event organizers can capitalize to boost recycling rates at their event.

It is useful to consider event recycling in terms of pre-event, during-event and post-event collection and clean-up (see NAPCOR, 2008).

Pre-Event
In many cases, event organizers will directly license vendors at their event or will be able to work with facility owners to exert pressure on vendors to promote recycling behaviour.

The most valuable action is to limit the materials available (e.g. make all vendors use one type of recyclable cup, or allow only compostable packaging and utensils) to improve quality of materials entering the recycling stream (NAPCOR, 2008, p.25). Provisions mandating this can be written into the vendor's contract.

It is also important to convince vendors that recycling is in their best interest. If they are brought on board, vendors can successfully encourage recycling behaviour at the point of sale through emphasis of the recyclability of its packaging and provision of promotional materials such as leaflets.

During the Event

The Department of Ecology in the State of Washington (2008) suggests that a good public recycling system at a public event has the following features:

1. Recycling bins are always placed beside trash bins
2. Recycling bins are placed in high-traffic, high-visibility locations
3. Recycling bins are visually different than other bins, including different colour liners
4. Lid openings should reflect materials accepted (e.g. small circles for beverage containers)
5. If possible, staff the bins at special events, or at least monitor them regularly. Volunteers can help with this
6. Track the results and report the success of the program

Placing bins at entrance and exits can also help to capture all recyclables generated at the event as users will often look to dispose of their waste right before leaving the venue. As they will likely be in a haste to leave, it is important that the bins be clearly marked and distinguished from trash bins, as most users won't take the time to decide.

P&E is also an important element of a successful event recycling program. There are a number of potential places where P&E can be employed at events (from NAPCOR, 2008, p.36):

- Signs on bins, or on poles next to bins
- Posters in suites and food service areas
- Event programs
- Information on electronic scoreboards and other audio/visual on-site devices
- Public address system announcements
- Press releases and other outreach to local news media
- Information/articles in venue newsletter and print items
- Point of sale messaging: t-shirts, pins, stickers, etc.

Post-Event

Much of the recyclable waste generated at events is generated not by attendees but by vendors. Vendors produce a lot of cardboard waste from packing boxes. Event recycling programs can significantly increase the amount recovered by providing easy access to recycling for vendors.

It is important to ensure that you have recycling bins set out in convenient areas for vendors when they are cleaning up after the event (NERC, 2006)

8 Promotion and Education

"Public education is essentially as important an issue as bin choice or placement."
- Quinte Waste Solutions, 2006, Appendix C

Regular, ongoing promotion and education (P&E) about the availability and importance of using public space recycling facilities is an extremely important component of any PSR program. P&E can act as a reminder, educate new users, and can highlight success and provide feedback for the program (New South Wales, 2008).

In designing P&E materials and strategies, it is important to recognize the need to orient these toward existing recycling behaviour and attitudes. First, it is useful to perform an assessment of local recycling attitudes. Such an assessment could include such things as commissioning surveys of visitors to chosen areas, examining local recycling infrastructure, and extrapolating attitudes from the recycling rate and contamination in the surrounding areas. It should also take a look at the rate of litter in the area. If the rate of litter is high, coordinators should attempt to analyze why that is. Is it a service problem: do trash bins regularly overflow? Or is it a behavioural problem: do visitors to the area not take pride in their surroundings? The well-documented "Broken Windows" phenomenon may play a role, as evidence of neglect in other elements of the streetscape may deter recycling efforts.

Second, P&E efforts should endeavour to make recycling easy: as mentioned above, people are rarely inclined to walk more than 12 or 13 metres out of their way to properly dispose of waste. In this context, P&E should aim to make it easy to locate recycling station and dispose of material properly.

Accordingly, the literature recognizes a two-fold purpose to P&E efforts. A general P&E campaign should endeavour to raise the public profile of recycling, and encourage people to recycle regularly and direct visitors toward nearby recycling stations when in public. At the recycling station, container messaging should instruct users in the correct way to recycle, directing them by means of simple and effective messaging which materials should be disposed in which bins, thereby reducing contamination.

In this spirit, York Region used three main types of P&E for their pilot (York Region, 2008, p.8):

- Container Labelling,
- Pilot Information Brochure for the Public,
- Park Signage (e.g. pole and fence banners)

These three types were all elements of a comprehensive strategy: brochures were handed out to the public to promote recycling behaviour, park signage capitalized on increased awareness of recycling opportunities to direct visitors to the nearest station and container labelling instructed users on proper materials to dispose of in each bin.

There are several ways to embark upon a general P&E campaign. In general, an education campaign is the best way to encourage the public to recycle. Use signs, displays, loudspeaker announcements, and/or text to teach:

- WHY they should recycle.
- WHAT they should recycle.
- WHERE they can recycle.
- HOW they can recycle (US EPA, 2008).

Orienting a P&E campaign toward educating children can have a significant payoff. Quinte Waste Solutions gave presentations in classrooms around the jurisdiction, emphasizing public space recycling during the implementation of their program. Kids who are taught the merit of recycling may also have a positive effect on their parents and relatives.

Holding several program launch events can also increase visibility. In New York, the PSR program was launched at several events featuring local politicians and celebrities. Informational booths were set up and manned by waste management staff at a number of locations in order to further raise awareness. Quinte Waste Solutions (?) also suggests coordinating program launch events with popular holidays, such as Canada Day, or Earth Week.

Sites equipped with recycling stations should feature abundant signage to promote increased usage of the facilities. In this endeavour, the literature identified several recommended practices. In general, most of the literature emphasized the importance of consistency in messaging. For instance, standard colours and clear signs across the region are essential (New South Wales, 2008). If possible, all signage should attempt to leverage existing recycling infrastructure, by using symbols and colours associated with the various waste streams. In Ontario, on account of the blue box program, the colour blue is commonly associated with recycling; thus, using the colour blue on signage identifying the location of recycling will assist visitors in making the immediate connection. In order to ensure that signage is not overlooked amidst the bustle of crowds, it is recommended that coordinators employ overhead signs - designed to increase visibility of the bins, especially if the bins are placed in a high-traffic location (New South Wales, 2008).

Once visitors locate the bins, the emphasis should be on reducing contamination in each of the bins. The key element in this prevention policy is affixing specially designed graphics on the bin and around the opening.

York Region developed the following criteria for their container labels:

- Use easy to recognize images
- Use bright colours to attract attention
- Constancy of green, blue and black for organics, recyclables and garbage respectively
- Limit the use of wording

Photographic images of common waste were used on the graphics to clearly show what materials are accepted in the three different streams.

Visitor surveys carried out by York Region also revealed that most visitors had strong preferences about the name of each of the waste streams. They preferred 'Garbage' to 'trash' or 'litter', 'Green Bin' to 'organics' or 'compost' and 'Recycle' to 'Blue Box' or 'Recyclables'. While this study is non-representative and the results will vary by region, it does suggest several interesting possible conclusions:

1) It emphasizes the importance of knowing the audience for the signage. It is therefore a recommended practice to conduct surveys of area visitors to determine the most effective type of signage.
2) Recycling blue box materials has become ingrained as a regular behaviour that is associated with the status of each product, not with the recycling program. Composting of organics, however, is strongly associated with the Green Bin program and thus visitors make associations more quickly if they are led to think of the program.

Coordinators should also intermittently evaluate the effectiveness of signage in reducing various types of contamination. If a problem with a specific kind of contamination emerges, signage can be supplemented or altered to help prevent such usage problems. For example, when York region found that 12% of the weight of the recycling stream was from residual liquids, they recommended that communication be developed for emptying liquids from containers before placing in receptacles (York Region, 2008, p. 17)

9 Costs

To implement a public space recycling program, there are a number of start-up and operating costs to consider.

9.1 Potential start-up costs

Some start-up costs to be expected include the purchase of equipment (containers plus any associated hardware like chains or poles), promotion and education materials, and staff time for planning and development of the program. The table below is an example of the start-up and short-term operating costs from York Region's 3-month pilot project (York Region, 2008, p. 25).

Purchase of Containers	**$**77,180.00	73%
Implementation Costs	**$**7,378.67	7%
Promotion and Education Work	**$**10,406.39	10%
Operation Costs	**$**11,200.00	11%
Total	**$106,165.06**	**100%**

As is common for most pilot projects, the major start-up cost for York Region was the purchase of containers, which cost approximately $77,000. Notably, report authors pointed out that the promotion and education costs (approximately 10% of the total) were "….the most valuable investment in the project". They continued by noting, "The dollars invested in promotion and education for this pilot have resulted in quality marketing materials that can be leveraged by all municipalities in York Region as they rollout their public space three stream programs" (York

Region, 2008, p. 25). In other words, these kinds of initiatives have potential benefits that go beyond the limits of the program.

9.2 Potential Operating Costs

Some operating costs to be expected are detailed in the table below (from NAPCOR, 2008;):

Materials, supplies and services
- Liner bags for bins
- Education and promotional tools
- Health and safety equipment such as gloves
- Vehicles for transportation
- Storage space
- Operation of the Material Recycling Facility (MRF)

Labour
- Servicing of the bins
- Developing and disseminating P&E
- Training
- Program management and administration

Costs vs. Operating a Waste-Only Program

In general, while a public space recycling program will incur extra costs from the additional equipment and labour required to operate (relative to a waste-only program), it may have the potential to reduce overall costs from the revenue generated by the recovered materials. In a 2006 report on Quinte's "Recycle Away" program, the authors concluded that the net cost to operate their public space recycling program was less than half of a waste-only program[3].

The report from Quinte noted that "Costs are transferable from garbage handling to recycling, and further savings may result due to recyclable material sales" (Quinte Waste Solutions, 2006, p.28). This sentiment was echoed by the Wisconsin BeSMART Coalition (2007), who suggested that program managers consider the cost savings from avoiding trash handling and disposal. As part of program monitoring, program managers should compare waste hauling costs before and after program implementation (US EPA, 2008).

Note that in Ontario, municipalities are partially reimbursed for costs to collect recyclables in public space recycling containers that are permanent fixtures only. Material collected in temporary fixtures is not eligible for reimbursement.

10 Monitoring Program Effectiveness

"Ongoing consistent bin maintenance and monitoring by dedicated and trained staff was crucial to the success of the program"
- City of New York, 2007, p. 1.

[3] Over an eight-week period, a waste disposal program was calculated to have a net cost of $17,060.08, and a waste disposal plus recycling program was calculated to have a net cost of $6,219.13, for a savings of approximately 64% The analysis assumed a 30% recovery rate, excluded start-up costs, using 2004 material prices. For more details, see Quinte Waste Solutions (2006, Executive Summary p. 2).

Once a PSR program has been successfully implemented, long-term success relies on constant maintenance and performance monitoring. Regular maintenance ensures that the sites are kept clean and tidy, while providing feedback on program success. Regular monitoring of results provides coordinators with data against which they can calibrate their program to the conditions on the ground. For example (cite Boise)

Staff participation and support is one of the most important elements in the success of a PSR program. Enlisting staff input early and often can help coordinators avoid later pitfalls and give staff a sense of ownership in the program. Because of their regular interaction with each of the recycling stations, staff members are useful in providing immediate feedback on program response and challenges.

Ongoing maintenance of the bin is important, as the overall state of the bin contributes to user response: If any of the bins are full, users will likely not take the trouble to stuff their waste in the right bin, leading to higher contamination rates in whichever bin is more empty; if the bins are dirty, users might prefer to litter instead of coming into contact with other waste; if the signage is obscured, either through vandalism or wear and tear, users will be less likely to take the extra time to determine where their waste should be properly disposed.

On account of this, staff members should be thoroughly trained to ensure that:

- Bins are emptied regularly
- Recyclables aren't mixed with garbage when collected
- Bins are clean and in good condition
- Signage remains visible and clear
- Nearby litter is cleaned promptly

(New South Wales, 2008, p. 11)

In addition, senior staff and program coordinators should periodically inspect recycling and trash bins and observe:

- Contamination levels in recycling bins
- Amount of recyclables thrown in the trash
- Level of fullness of trash cans and recycling bins
- Extent to which free items/giveaways are discarded in trash

(US EPA, 2008). This will allow them to more accurately schedule service runs, thus maximizing the benefits of bin servicing while restraining costs from unnecessary service runs.

Maintenance staff should be regularly consulted on the results of their maintenance efforts. As they deal with the sites on a regular basis, they are in the best position to identify problems early on (New South Wales, 2008, p. 11). Because of the importance of staff, it is important to take into consideration when selecting bins factors that will affect the performance of their job. Such factors include the ease of the bin to service, the ability to quickly and easily determine the need of service, and size of the bin.

Ultimately regular maintenance will improve the performance of the program by ensuring that recycling stations are clean and inviting to use and by allowing coordinators to capitalize on the knowledge of staff on the ground.

Naturally, measuring program success and achievements is important to all stakeholders. Coordinators should take care to publicize successes widely to all stakeholders. Achievements can be used to further promote the program, as positive reinforcement has the potential to increase participation rates. Analysis of program progress will also give coordinators the opportunity to adjust their program to enhance successful sites and identify and overcome challenges at underperforming sites

There are several avenues through which performance can be measured:

1) User surveys – As visitors to the area are the intended target for any P&E campaign, their feedback is useful in gauging which elements of the campaign were most effective and which were least. York Region conducted user surveys which helped them to identify
2) Waste Audits – Many reports strongly recommend conducting follow-up waste audits on a regular basis. Waste audits allow coordinators to measure the rate of return, the levels of contamination and the potential for the site against baseline numbers. Waste audits can be either informal, where senior staff regularly inspect bins for composition, or they can be thorough, where a statistically significant sample is examined and classified. It is recommended that these be undertaken during and at the end of the pilot phase and then on an annual basis.
3) Financial Impact Analysis – Coordinators should continually monitor the cost per recovery at each recycling station. Levels of return, contamination and service are all factors that will affect this calculation. Analyzing the financial impact on a bin-by-bin basis will provide coordinators with a good idea of which bins are efficient and which should perhaps be re-located to improve the program.

Communicating successes to stakeholders will encourage continuing support for the program while identifying challenges and shortcomings will help coordinators to continually improve the efficiency and effectiveness of the program.

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B. Data Tables

Table B-1 Park Generation and Recovery - Average of Three Parks Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)			Follow-Up Audit (Dec 2009)		
		Garbage Stream	Recycling Stream	Total Waste	Garbage Stream	Recycling Stream	Total Waste
		kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
PAPER and PAPER PACKAGING							
Printed Paper	X	12.13	0.33	12.47	24.23	0.20	24.43
Corrugated Cardboard	X	10.57	0.37	10.93	11.57	0.23	11.80
Boxboard / Cores and Kraft Paper	X	5.57	0.50	6.07	11.27	0.70	11.97
Molded Pulp	X	9.10	0.83	9.93	11.27	0.49	11.75
Gable Top Cartons	X	0.80	0.17	0.97	0.61	0.30	0.91
Aseptic Containers	X	2.17	0.33	2.50	0.82	0.48	1.30
Total		40.33	2.53	42.87	59.76	2.40	62.16
PLASTICS							
PET Beverage	X	11.10	8.63	19.73	8.70	28.10	36.80
PET Non Beverage Bottles	X	0.00	2.60	2.60	0.67	0.32	0.98
HDPE Beverage	X	0.57	0.20	0.77	0.13	0.28	0.42
HDPE Non Beverage Bottles	X	0.90	0.00	0.90	1.07	0.20	1.27
Wide Mouth Tubs & Lids	X	0.00	0.03	0.03	0.47	0.02	0.48
Total		12.57	11.47	24.03	11.03	28.92	39.95
METALS							
Aluminum Beverage Cans	X	4.57	4.67	9.23	2.85	13.73	16.58
Aluminum Non-Beverage Cans	X	0.00	0.00	0.00	0.00	0.00	0.00
Steel Beverage Cans	X	0.00	0.00	0.00	0.00	0.00	0.00
Steel Non-Beverage Containers	X	1.00	0.57	1.57	0.20	0.45	0.65
Total		5.57	5.23	10.80	3.05	14.19	17.24
GLASS							
Glass Beverage Bottles	X	4.54	3.99	8.53	3.85	7.42	11.27
Glass Food Jars	X	0.09	0.08	0.17	0.08	0.15	0.23
Total		4.63	4.07	8.70	3.93	7.57	11.50
Other Waste							
Non Recyclable Paper and Paper Packaging		24.87	0.93	25.80	17.03	1.87	18.91
Non-Recyclable Containers and Film		23.30	3.29	26.59	31.57	13.27	44.84
Hazardous and Special Waste		0.33	0.00	0.33	0.37	0.00	0.37
Food Waste		69.83	4.23	74.07	80.53	2.20	82.73
Pet Waste		12.90	0.15	13.05	15.23	0.38	15.62
Household Garbage		50.97	0.00	50.97	67.10	0.17	67.27
Other Waste		26.97	3.32	30.28	44.10	1.04	45.14
Total		209.17	11.92	221.09	255.93	18.93	274.87
Grand Total		272.27	35.22	307.49	333.71	72.01	405.72
Total Recyclable Fibre		37.37	2.03	39.40	58.33	1.62	59.95
Total Recyclable Beverage Containers		23.74	17.99	41.73	16.96	50.32	67.28
Total Recyclable Non Beverage Containers		1.99	3.25	5.24	2.01	1.12	3.13
Total Recyclable Containers		25.73	21.27	47.00	19.44	51.45	70.90
Total Recyclables (Fibre + Containers)		63.10	23.30	86.40	77.78	53.07	130.85
Total Other Materials (i.e. non-recyclables)		209.17	11.92	221.09	255.93	18.93	274.87

Table B-2 Arena Waste Generation and Recovery - Average of Three Arenas Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
PAPER and PAPER PACKAGING							
Printer Paper	X	5.11	5.26	0.01	2.09	2.10	7.36
Corrugated Cardboard	X	5.57	0.95	0.00	0.45	0.45	1.40
Boxboard / Cores and Kraft Paper	X	3.13	2.58	0.01	0.14	0.15	2.73
Molded Pulp	X	0.60	0.87	0.06	0.00	0.06	0.92
Gable Top Cartons	X	0.27	0.12	0.01	0.00	0.01	0.13
Aseptic Containers	X	0.15	0.33	0.02	0.00	0.02	0.35
Total		14.81	10.12	0.10	2.67	2.77	12.89
PLASTICS							
PET Beverage Bottles	X	7.77	3.83	9.89	0.00	9.89	13.71
PET Non-Beverage Bottles	X	0.00	0.00	0.03	0.00	0.03	0.03
HDPE Beverage	X	0.03	0.02	0.06	0.00	0.06	0.08
HDPE Non-Beverage Bottles	X	0.16	1.05	0.23	0.00	0.23	1.28
Wide Mouth Tubs & Lids	X	0.10	0.08	0.01	0.00	0.01	0.10
Total		8.07	4.97	10.22	0.00	10.22	15.20
METALS							
Aluminum Beverage Cans	X	1.62	1.75	6.19	0.00	6.19	7.94
Aluminum Non-Beverage Cans	X	0.24	0.11	0.06	0.00	0.06	0.16
Steel Beverage Cans	X	0.00	0.00	0.00	0.00	0.00	0.00
Steel Non-Beverage Containers	X	0.00	0.00	0.00	0.00	0.00	0.00
Total		1.86	1.86	6.24	0.00	6.24	8.10
GLASS							
Glass Beverage Bottles	X	0.86	0.37	1.00	0.00	1.00	1.37
Glass Food Jars	X	0.00	0.33	0.00	0.00	0.00	0.33
Total		0.86	0.70	1.00	0.00	1.00	1.70
Other Waste							
Non-Recyclable Paper and Paper Packaging		8.20	5.81	0.53	0.02	0.54	6.35
Non-Recyclable Containers and Film		9.63	4.18	1.88	0.15	2.04	6.21
Hazardous and Special Waste		0.00	0.19	0.00	0.00	0.00	0.19
Food Waste		32.88	20.11	1.58	0.00	1.58	21.69
Other Waste		14.87	25.69	0.04	0.03	0.07	25.75
Total		65.57	55.97	4.02	0.19	4.22	60.19
Grand Total		91.17	73.63	21.59	2.86	24.45	98.08
Total Recyclable Fibre		14.40	9.66	0.08	2.67	2.75	12.41
Total Recyclable Beverage Containers		10.70	6.43	17.15	0.00	17.15	23.58
Total Recyclable Non Beverage Containers		0.50	1.57	0.33	0.00	0.33	1.90
Total Recyclable Containers		11.20	8.00	17.48	0.00	17.48	25.48
Total Recyclables (Fibre + Containers)		25.60	17.66	17.56	2.67	20.23	37.89
Total Other Materials (i.e. non-recyclables)		65.57	55.97	4.02	0.19	4.22	60.19

Table B-3 Mac's Stores Waste Generation and Recovery - Average of Eight Mac's 's Stores - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		kg/week	kg/week	kg/week	kg/week	kg/week	kg/week
PAPER and PAPER PACKAGING							
Printed Paper	X	3.42	0.58	0.29	2.02	2.31	2.89
Corrugated Cardboard	X	0.21	0.00	0.00	0.00	0.00	0.00
Boxboard / Cores and Kraft Paper	X	1.30	0.60	0.02	0.16	0.17	0.78
Molded Pulp	X	0.14	0.02	0.02	0.01	0.03	0.05
Gable Top Cartons	X	0.07	0.03	0.02	0.00	0.02	0.05
Aseptic Containers	X	0.03	0.01	0.18	0.00	0.18	0.19
Total		5.18	1.25	0.52	2.18	2.70	3.95
PLASTICS							
PET Beverage Bottles	X	1.16	0.10	0.85	0.00	0.85	0.96
PET Non-Beverage Bottles	X	0.00	0.00	0.02	0.00	0.02	0.02
HDPE Beverage	X	0.03	0.04	0.00	0.00	0.00	0.04
HDPE Non-Beverage Bottles	X	0.08	0.00	0.06	0.00	0.06	0.06
Wide Mouth Tubs & Lids	X	0.02	0.00	0.00	0.00	0.00	0.00
Total		1.29	0.14	0.93	0.00	0.93	1.08
METALS							
Aluminum Beverage Cans	X	0.64	0.07	0.63	0.00	0.63	0.70
Aluminum Non-Beverage Cans	X	0.00	0.00	0.01	0.00	0.01	0.01
Steel Beverage	X	0.00	0.00	0.00	0.00	0.00	0.00
Steel Non-Beverage Cans	X	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.64	0.07	0.63	0.00	0.63	0.71
GLASS							
Glass Beverage Bottles	X	0.65	0.09	0.13	0.00	0.13	0.22
Glass Food Jars	X	0.00	0.00	0.00	0.00	0.00	0.00
Total		0.65	0.09	0.13	0.00	0.13	0.22
Other Waste							
Non Recycbale Paper and Paper Packaging		1.57	0.84	0.12	0.02	0.14	0.98
Non-Recyclable Containers and Film		3.17	1.10	0.07	0.04	0.10	1.21
Hazardous and Special Waste		0.30	0.29	0.23	0.00	0.23	0.53
Food Waste		7.47	2.61	2.58	0.00	2.58	5.19
Other Waste		4.22	1.04	0.04	0.05	0.09	1.13
Total		16.74	5.88	3.04	0.10	3.14	9.03
Grand Total		24.50	7.44	5.26	2.28	7.55	14.99
Total Recyclable Fibre		5.07	1.21	0.33	2.18	2.51	3.72
Total Recyclable Beverage Containers		2.59	0.35	1.81	0.00	1.81	2.16
Total Recyclable Non Beverage Containers		0.11	0.00	0.09	0.00	0.09	0.09
Total Recyclable Containers		2.69	0.35	1.89	0.00	1.89	2.24
Total Recyclables (Fibre + Containers)		7.76	1.56	2.22	2.18	4.40	5.96
Total Other Materials (i.e. non-recyclables)		16.74	5.88	3.04	0.10	3.14	9.03

Table B-4 Park Waste Composition - Average of Three Parks - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)			Follow-Up Audit (Dec 2009)		
		Garbage Stream	Recycling Stream	Total Waste	Garbage Stream	Recycling Stream	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
PAPER and PAPER PACKAGING							
Printed Paper	X	4.5%	0.9%	4.1%	7.3%	0.3%	6.0%
Corrugated Cardboard	X	3.9%	1.0%	3.6%	3.5%	0.3%	2.9%
Boxboard / Cores and Kraft Paper	X	2.0%	1.4%	2.0%	3.4%	1.0%	2.9%
Molded Pulp	X	3.3%	2.4%	3.2%	3.4%	0.7%	2.9%
Gable Top Cartons	X	0.3%	0.5%	0.3%	0.2%	0.4%	0.2%
Aseptic Containers	X	0.8%	0.9%	0.8%	0.2%	0.7%	0.3%
Total		14.8%	7.2%	13.9%	17.9%	3.3%	15.3%
PLASTICS							
PET Beverage	X	4.1%	24.5%	6.4%	2.6%	39.0%	9.1%
PET Non Beverage Bottles	X	0.0%	7.4%	0.8%	0.2%	0.4%	0.2%
HDPE Beverage	X	0.2%	0.6%	0.2%	0.0%	0.4%	0.1%
HDPE Non Beverage Bottles	X	0.3%	0.0%	0.3%	0.3%	0.3%	0.3%
Wide Mouth Tubs & Lids	X	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%
Total		4.6%	32.6%	7.8%	3.3%	40.2%	9.8%
METALS							
Aluminum Beverage Cans	X	1.7%	13.2%	3.0%	0.9%	19.1%	4.1%
Aluminum Non-Beverage Cans	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Steel Beverage Cans	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Steel Non-Beverage Containers	X	0.4%	1.6%	0.5%	0.1%	0.6%	0.2%
Total		2.0%	14.9%	3.5%	0.9%	19.7%	4.2%
GLASS							
Glass Beverage Bottles	X	1.7%	11.3%	2.8%	1.2%	10.3%	2.8%
Glass Food Jars	X	0.0%	0.2%	0.1%	0.0%	0.2%	0.1%
Total		1.7%	11.5%	2.8%	1.2%	10.5%	2.8%
Other Waste							
Non Recyclable Paper and Paper Packaging		9.1%	2.6%	8.4%	5.1%	2.6%	4.7%
Non-Recyclable Containers and Film		8.6%	9.3%	8.6%	9.5%	18.4%	11.1%
Hazardous and Special Waste		0.1%	0.0%	0.1%	0.1%	0.0%	0.1%
Food Waste		25.6%	12.0%	24.1%	24.1%	3.1%	20.4%
Pet Waste		4.7%	0.4%	4.2%	4.6%	0.5%	3.8%
Household Garbage		18.7%	0.0%	16.6%	20.1%	0.2%	16.6%
Other Waste		9.9%	9.4%	9.8%	13.2%	1.4%	11.1%
Total		76.8%	33.9%	71.9%	76.7%	26.3%	67.7%
Grand Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Recyclable Fibre		13.7%	5.8%	12.8%	17.5%	2.2%	14.8%
Total Recyclable Beverage Containers		8.7%	51.1%	13.6%	5.1%	69.9%	16.6%
Total Recyclable Non Beverage Containers		0.7%	9.2%	1.7%	0.6%	1.6%	0.8%
Total Recyclable Containers		9.5%	60.4%	15.3%	5.8%	71.5%	17.5%

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)			Follow-Up Audit (Dec 2009)		
		Garbage Stream	Recycling Stream	Total Waste	Garbage Stream	Recycling Stream	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Total Recyclables (Fibre + Containers)		23.2%	66.1%	28.1%	23.3%	73.7%	32.3%
Total Other Materials (i.e. non-recyclables)		76.8%	33.9%	71.9%	76.7%	26.3%	67.7%
Percent Recyclable		23.2%	66.1%	28.1%	23.3%	73.7%	32.3%
Contamination Rates:							
Recyclables in Garbage Stream		23.2%			23.3%		
Garbage in Recycling Stream			33.9%			26.3%	

Table B-5 Arena Waste Composition - Average of Three Arenas - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
PAPER and PAPER PACKAGING							
Printer Paper	X	5.6%	7.1%	0.1%	72.9%	8.6%	7.5%
Corrugated Cardboard	X	6.1%	1.3%	0.0%	15.5%	1.8%	1.4%
Boxboard / Cores and Kraft Paper	X	3.4%	3.5%	0.1%	4.8%	0.6%	2.8%
Molded Pulp	X	0.7%	1.2%	0.3%	0.0%	0.2%	0.9%
Gable Top Cartons	X	0.3%	0.2%	0.0%	0.0%	0.0%	0.1%
Aseptic Containers	X	0.2%	0.5%	0.1%	0.0%	0.1%	0.4%
Total		16.2%	13.7%	0.5%	93.3%	11.3%	13.1%
PLASTICS		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PET Beverage Bottles	X	8.5%	5.2%	45.8%	0.0%	40.4%	14.0%
PET Non-Beverage Bottles	X	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%
HDPE Beverage	X	0.0%	0.0%	0.3%	0.0%	0.3%	0.1%
HDPE Non-Beverage Bottles	X	0.2%	1.4%	1.1%	0.0%	0.9%	1.3%
Wide Mouth Tubs & Lids	X	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%
Total		8.8%	6.8%	47.4%	0.0%	41.8%	15.5%
METALS		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Aluminum Beverage Cans	X	1.8%	2.4%	28.7%	0.0%	25.3%	8.1%
Aluminum Non-Beverage Cans	X	0.3%	0.1%	0.3%	0.0%	0.2%	0.2%
Steel Beverage Cans	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Steel Non-Beverage Containers	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		2.0%	2.5%	28.9%	0.0%	25.5%	8.3%
GLASS		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Glass Beverage Bottles	X	0.9%	0.5%	4.6%	0.0%	4.1%	1.4%
Glass Food Jars	X	0.0%	0.4%	0.0%	0.0%	0.0%	0.3%
Total		0.9%	1.0%	4.6%	0.0%	4.1%	1.7%
Other Waste		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Non-Recyclable Paper and Paper Packaging		9.0%	7.9%	2.4%	0.5%	2.2%	6.5%
Non-Recyclable Containers and Film		10.6%	5.7%	8.7%	5.3%	8.3%	6.3%
Hazardous and Special Waste		0.0%	0.3%	0.0%	0.0%	0.0%	0.2%
Food Waste		36.1%	27.3%	7.3%	0.0%	6.4%	22.1%
Other Waste		16.3%	34.9%	0.2%	0.9%	0.3%	26.3%
Total		71.9%	76.0%	18.6%	6.7%	17.2%	61.4%
Grand Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Total Recyclable Fibre		15.8%	13.1%	0.4%	93.3%	11.3%	12.7%
Total Recyclable Beverage Containers		11.7%	8.7%	79.5%	0.0%	70.1%	24.0%
Total Recyclable Non Beverage Containers		0.5%	2.1%	1.5%	0.0%	1.4%	1.9%
Total Recyclable Containers		12.3%	10.9%	81.0%	0.0%	71.5%	26.0%
Total Recyclables (Fibre + Containers)		28.1%	24.0%	81.4%	93.3%	82.8%	38.6%
Total Other Materials (i.e. non-recyclables)		71.9%	76.0%	18.6%	6.7%	17.2%	61.4%
Contamination Rates:							
Recyclables in Garbage		28.1%	24.0%				
Garbage and Recyclable Fibre in Container Stream				19.0%			
Garbage and Recyclable Containers in Fibre Stream					6.7%		
Garbage in Recycling Stream				18.6%	6.7%	17.2%	

Table B-6 Mac's Stores Waste Composition Results - Average of eight Mac's 's stores - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
PAPER and PAPER PACKAGING							
Printed Paper	X	13.9%	7.8%	5.6%	88.4%	30.6%	19.3%
Corrugated Cardboard	X	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%
Boxboard / Cores and Kraft Paper	X	5.3%	8.1%	0.3%	6.8%	2.3%	5.2%
Molded Pulp	X	0.6%	0.3%	0.4%	0.3%	0.4%	0.4%
Gable Top Cartons	X	0.3%	0.4%	0.3%	0.0%	0.2%	0.3%
Aseptic Containers	X	0.1%	0.1%	3.3%	0.0%	2.3%	1.2%
Total		21.1%	16.8%	9.9%	95.5%	35.8%	26.4%
PLASTICS							
PET Beverage Bottles	X	4.7%	1.4%	16.2%	0.0%	11.3%	6.4%
PET Non-Beverage Bottles	X	0.0%	0.0%	0.3%	0.0%	0.2%	0.1%
HDPE Beverage	X	0.1%	0.5%	0.0%	0.0%	0.0%	0.3%
HDPE Non-Beverage Bottles	X	0.3%	0.0%	1.2%	0.0%	0.9%	0.4%
Wide Mouth Tubs & Lids	X	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		5.3%	1.9%	17.8%	0.0%	12.4%	7.2%
METALS							
Aluminum Beverage Cans	X	2.6%	1.0%	11.9%	0.0%	8.3%	4.7%
Aluminum Non-Beverage Cans	X	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
Steel Beverage	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Steel Non-Beverage Cans	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		2.6%	1.0%	12.0%	0.0%	8.4%	4.7%
GLASS							
Glass Beverage Bottles	X	2.7%	1.3%	2.5%	0.0%	1.7%	1.5%

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)				
		Garbage Stream	Garbage Stream	Container Stream	Fibre Stream	Total Recycling	Total Waste
		% Comp	% Comp	% Comp	% Comp	% Comp	% Comp
Glass Food Jars	X	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total		2.7%	1.3%	2.5%	0.0%	1.7%	1.5%
Other Waste							
Non Recycbale Paper and Paper Packaging		6.4%	11.3%	2.3%	0.9%	1.9%	6.5%
Non-Recyclable Containers and Film		13.0%	14.8%	1.2%	1.6%	1.3%	8.0%
Hazardous and Special Waste		1.2%	3.9%	4.4%	0.0%	3.1%	3.5%
Food Waste		30.5%	35.0%	49.0%	0.0%	34.2%	34.6%
Other Waste		17.2%	14.0%	0.8%	2.0%	1.1%	7.5%
Total		68.3%	79.1%	57.8%	4.5%	41.6%	60.2%
Grand Total		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total Recyclable Fibre		20.7%	16.2%	6.3%	95.5%	33.3%	24.8%
Total Recyclable Beverage Containers		10.6%	4.7%	34.3%	0.0%	23.9%	14.4%
Total Recyclable Non Beverage Containers		0.4%	0.0%	1.6%	0.0%	1.1%	0.6%
Total Recyclable Containers		11.0%	4.7%	35.9%	0.0%	25.1%	15.0%
Total Recyclables (Fibre + Containers)		31.7%	20.9%	42.2%	95.5%	58.4%	39.8%
Total Other Materials (i.e. non-recyclables)		68.3%	79.1%	57.8%	4.5%	41.6%	60.2%
Contamination Rates:							
Recyclables in Garbage		31.7%	20.9%				
Garbage and Recyclable Fibre in Container Stream				64.1%			
Garbage and Recyclable Containers in Fibre Stream					4.5%		
Garbage in Recycling Stream				57.8%	4.5%	41.6%	

Table B-7 Park Recovery Rates - Average for Three Parks - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)	Percent Change
		Recovery Rate %	Recovery Rate %	
PAPER and PAPER PACKAGING				
Printed Paper	X	2.7%	0.8%	-69.4%
Corrugated Cardboard	X	3.4%	2.0%	-41.0%
Boxboard / Cores and Kraft Paper	X	8.2%	5.8%	-29.0%
Molded Pulp	X	8.4%	4.1%	-50.6%
Gable Top Cartons	X	17.2%	33.1%	91.9%
Aseptic Containers	X	13.3%	37.1%	178.1%
Total		5.9%	3.9%	-34.6%
PLASTICS				
PET Beverage	X	43.8%	76.4%	74.5%
PET Non Beverage Bottles	X	100.0%	32.2%	-67.8%
HDPE Beverage	X	26.1%	68.0%	160.7%
HDPE Non Beverage Bottles	X	0.0%	15.8%	Na
Wide Mouth Tubs & Lids	X	100.0%	3.4%	-96.6%
Total		47.7%	72.4%	51.7%

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)	Percent Change
		Recovery Rate %	Recovery Rate %	
METALS				
Aluminum Beverage Cans	X	50.5%	82.8%	63.9%
Aluminum Non-Beverage Cans	X	-	-	-
Steel Beverage Cans	X	-	-	-
Steel Non-Beverage Containers	X	36.2%	69.4%	91.8%
Total		48.5%	82.3%	69.9%
GLASS				
Glass Beverage Bottles	X	46.7%	65.8%	-40.8%
Glass Food Jars	X	46.7%	65.8%	-40.8%
Total		46.7%	65.8%	-40.8%
Total Recyclable Fibre		5.2%	2.7%	-47.6%
Total Recyclable Beverage Containers		43.1%	74.8%	73.5%
Total Recyclable Non Beverage Containers		62.0%	35.8%	-42.3%
Total Recyclable Containers		45.2%	72.6%	60.4%
Total Recyclables (Fibre + Containers)		27.0%	40.6%	50.4%

Table B-8 Arena Recovery Rates - Average of Three Arenas - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)
		Recovery Rate %	Recovery Rate %
PAPER and PAPER PACKAGING			
Printer Paper	X	0.0%	28.5%
Corrugated Cardboard	X	0.0%	31.9%
Boxboard / Cores and Kraft Paper	X	0.0%	5.5%
Molded Pulp	X	0.0%	6.1%
Gable Top Cartons	X	0.0%	3.9%
Aseptic Containers	X	0.0%	4.8%
Total		0.0%	21.5%
PLASTICS			
PET Beverage Bottles	X	0.0%	72.1%
PET Non-Beverage Bottles	X	0.0%	100.0%
HDPE Beverage	X	0.0%	77.7%
HDPE Non-Beverage Bottles	X	0.0%	18.1%
Wide Mouth Tubs & Lids	X	0.0%	12.3%
Total		0.0%	67.3%
METALS			
Aluminum Beverage Cans	X	0.0%	77.9%
Aluminum Non-Beverage Cans	X	0.0%	33.4%
Steel Beverage Cans	X	0.0%	-
Steel Non-Beverage Containers	X	0.0%	-
Total		0.0%	77.0%
GLASS			
Glass Beverage Bottles	X	0.0%	72.7%
Glass Food Jars	X	0.0%	0.0%
Total		0.0%	58.5%
Total Recyclable Fibre		0.0%	22.2%
Total Recyclable Beverage Containers		0.0%	72.7%

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)
		Recovery Rate %	Recovery Rate %
Total Recyclable Non Beverage Containers		0.0%	17.4%
Total Recyclable Containers		0.0%	68.6%
Total Recyclables (Fibre + Containers)		0.0%	53.4%

Table B-9 Mac's Stores Recovery Rates - Average of Eight Stores - Fall 2009

Material Category	Recyclables Accepted in City of Sarnia Recycling Program	Baseline Audit (Oct 2009)	Follow-Up Audit (Dec 2009)
		Recovery Rate %	Recovery Rate %
PAPER and PAPER PACKAGING			
Printed Paper	X	0.0%	80.0%
Corrugated Cardboard	X	0.0%	-
Boxboard / Cores and Kraft Paper	X	0.0%	22.2%
Molded Pulp	X	0.0%	54.3%
Gable Top Cartons	X	0.0%	35.9%
Aseptic Containers	X	0.0%	94.4%
Total		5.176	68.4%
PLASTICS			
PET Beverage Bottles	X	0.0%	89.2%
PET Non-Beverage Bottles	X	0.0%	100.0%
HDPE Beverage	X	0.0%	0.0%
HDPE Non-Beverage Bottles	X	0.0%	100.0%
Wide Mouth Tubs & Lids	X	0.0%	-
Total		0.0%	86.7%
METALS			
Aluminum Beverage Cans	X	0.0%	89.8%
Aluminum Non-Beverage Cans	X	0.0%	100.0%
Steel Beverage	X	0.0%	-
Steel Non-Beverage Cans	X	0.0%	-
Total		0.0%	89.9%
GLASS			
Glass Beverage Bottles	X	0.0%	58.4%
Glass Food Jars	X	0.0%	-
Total		0.0%	58.4%
Total Recyclable Fibre		0.0%	67.5%
Total Recyclable Beverage Containers		0.0%	83.8%
Total Recyclable Non Beverage Containers		0.0%	100.0%
Total Recyclable Containers		0.0%	84.4%
Total Recyclables (Fibre + Containers)		0.0%	73.9%

C. Collection Bins

The following are images of the bins used at each of the sites:

Parks

Arenas

Mac's Stores