# 2006 Parks Waste Audit – Final Report


**City of Toronto Parks, Forestry and Recreation**
**Parks Standards and Innovation**
**December 2006**

*Waste Diversion Program*

TORONTO Parks, Forestry & Recreation

***For more information on Parks, Forestry and Recreation waste diversion initiatives, please visit: http://www.toronto.ca/parks/wastediversion/index.htm.***

# Executive Summary

The main purpose of the 2006 parks waste audit was to generate detailed information about waste composition in City of Toronto parks, in support of efforts to reach the Parks, Forestry and Recreation waste diversion goal of 60% in 2007.

A small-scale parks waste audit conducted in late 2002 estimated that basket litter consisted of 10% recyclables, 25% pet waste, 25% parks litter, and 40% illegally dumped household waste. Since this time, recycling has been introduced in parks city-wide and illegal dumping bylaws have been enforced by dedicated staff. In addition, changes in City waste management policies, practices, and bylaws have increased management interest in obtaining detailed information on parks waste composition, particularly about recyclables, illegally dumped materials, and fast food waste contributors to parks waste.

Consequently, in July and August of this year, almost three metric tonnes of waste was audited from 585 litter and 157 recycling baskets in 126 parks across the city. Parks were selected randomly, with all areas of the city and all four park types represented. Waste contained in locked, in-ground receptacles and loose surface litter were not included in this study.

The composition of the parks **litter stream** (approximately 5100 t annually) was found to be 24-28% recyclables, 23-27% pet waste, 35-40% other litter (mainly organics, non-recyclable plastics and non-recyclable paper), and 10-15% illegally dumped materials. Thus, while this year's estimate for pet waste in the litter stream matches that made in 2002, estimates for recyclables are considerably higher and for household waste considerably lower.

The composition of the **recycling stream** (approximately 68 t annually) was found to be 59-66% recyclables, 17-21% other organics, and 18-20% other non-recyclables. Recycling baskets that were twinned with litter baskets and with lid stickers indicating acceptable materials were on average 25% less contaminated with non-recyclables than

recycling baskets that were neither twinned nor labelled. Areas that had fewer recycling baskets, such as the West district, had notably poorer stream quality. Very little illegal dumping was found in recycling baskets, likely due to bin design and visibility of waste.

Replacing litter baskets with recycling baskets, as well as twinning and labelling all baskets, is expected to improve overall recyclables captured and recycling stream quality. Increased public education about recycling in parks, through more advertising and outreach activities, is also likely to help. Diverting only three-quarters of the recyclables currently in the litter stream could increase the overall Parks and Forestry waste diversion as much as 12% (i.e., from the 2005 rate of 39% to over 50%).

In turn, diverting only three-quarters of the pet waste from the litter stream, on top of three-quarters of the recyclables, could push the divisional diversion rate past its 2007 target of 60%. However, diversion of materials such as pet waste (and other organics) from the parks litter stream is more problematic than diverting recyclables.

Several options exist for the diversion of pet waste from the parks litter stream, including source-separation in parks and/or requiring park users to carry pet waste out of parks. Source-separation could entail either a green-bin type system which includes other organics, diapers, and some paper products, or a pet-waste-specific collection system. Requiring parks users to carry pet waste home, preferably to be disposed of in their green bins, may require intensive education and/or enforcement efforts. All these options require further assessment, in particular because a SWMS-operated green bin system is not currently available in parks nor in all Toronto residences.

Illegal dumping was found in more than half the parks surveyed, almost exclusively in litter rather than recycling baskets. Illegally dumped materials formed approximately 10-15% of the litter stream, and even more in smaller parks in residential areas. This may still be an underestimate due to the particular methods used in this study, including the exclusion of surface litter (e.g., materials dumped down ravines). Nonetheless, there is some evidence that illegal dumping may be decreasing due to bylaw enforcement which

began in 2005. Ongoing bylaw enforcement, targeted outreach, basket removal in problem areas, and restricted-opening basket design are likely effective means of continuing to reduce illegal dumping in parks.

The main fast food waste products in the parks litter and recycling stream were Tim Horton's coffee cups and lids. These items, as most other fast food waste in parks baskets, are non-recyclable. Quantifying costs associated with fast food waste disposal in parks may be a useful add-on to future audits.

Since this was the first year a parks waste audit has been conduced on this scale in Toronto, additional detailed suggestions are made in the body of this report with respect to other possible design modifications.

# Acknowledgements

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Last but not least, the 2006 audit field team - Justin Chin, Aileen Rapson, Fiona Street, Charlotte Ueta and Xiaohua Rachel Yang – braved extreme heat, maggots, dog waste and data entry, all for the sake of science… and the environment. Thank you.

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# 1. Introduction

## *Purpose*

The main goal of the 2006 waste audit was to generate detailed information about waste composition in City of Toronto parks. Of particular interest were the amount of recyclables, illegal dumping, and the main fast food waste contributors in parks waste.

The information collected during the 2006 waste audit was intended to support ongoing Parks, Forestry, and Recreation waste diversion initiatives, in particular the achievement of the divisional 60% waste diversion goal for 2007.

## *Background*

### Current Waste Management Practices and Issues in City Parks

There are approximately 1,500 parks in the City of Toronto, ranging in size from 0.1 to 485 acres. Spread across four districts (Etobicoke York (West), North York (North), Toronto and East York (South), and Scarborough (East)), these parks are classified in five categories:

- *Destination Parks*: attracts citizens from across Toronto and/or is a tourist destination spot. Often have numerous facilities including pools, playgrounds, sportsfields, picnic areas, etc.;
- *Regional Parks*: attracts visitors from across the City for special events and sports. Often have numerous facilities including pools, playgrounds, sportsfields, picnic areas, etc.;
- *Neighbourhood Parks*: primary users are people from the local neighbourhood. They have playgrounds, wading pools/splash pads;
- *Parkettes*: defined by limited size and limited or no amenities; and
- *Traffic Islands/Boulevards/Road Allowances*.

Waste collection receptacles are provided in most City parks, with the exception of some parkettes and most traffic islands, boulevards and road allowances. The collection of waste in City parks is undertaken in order to prevent surface littering and protect public health and safety by containing potentially hazardous waste.

Parks waste collection is not intended as a substitute for, nor an alternative to, residential and commercial waste collection. In fact, it is currently illegal (under municipal bylaw 548) to place residential or commercial waste of any sort in parks collection receptacles. Eight parks bylaw enforcement officers have investigated and prosecuted cases of suspected illegal dumping since March 2005. If caught and convicted, fines are up to $10,000 for individual offenders and $50,000 for commercial offenders.

Operational responsibility for parks waste collection and receptacle maintenance is handled by twenty-six area supervisors. Supervisors have considerable discretion with respect to managing local collection variables, such as where to distribute collection receptacles, how many to place in a given park, when and how often to empty them, etc. Nonetheless, common operational practices do exist and are outlined below.

Parks waste is collected in two source-separated streams: litter and recycling. The recycling stream includes all materials currently collected through residential blue/grey box recycling programs in the City of Toronto. Litter includes all other waste generated in the park, with the exception of leaf and yard waste produced by parks maintenance activities. These organic materials are either left in the park (e.g., grass clippings left on parks turf) or collected and processed into compost. There is no additional source-separated organics program for parks waste comparable to the green bin program available in single-family residences. However, a green bin pilot is presently underway in four parks (one per district).[1]

[1] One organics collection receptacle (green bin) was placed in Berczy, Earl Bales, Cruikshank, and Nielson Parks in August 2006. Preliminary results (fall 2006) indicated that contamination with non-green bin materials was significant. The pilot will continue in spring 2007.

Litter is collected in several types of receptacles, the most common being a black or dark green steel mesh basket (Photos 1 and 2, Appendix E), some with a metal liner box. Steel drums (Photo 3) are also used to collect litter in some parks, particularly in the west district. These types of receptacles may or may not also have a black plastic garbage bag. Other litter collection receptacles include animal proof "V-Quip" receptacles in picnic areas and large in-ground litter containers. The number of litter baskets ranges from 1 to 250 per park, with an estimated city-wide total of more than 5,000.

Most litter is collected by a fleet of 28 packers (16 side packers and 12 rear packers) dedicated to parks waste. Many of the packers are shared between area supervisors according to a weekly schedule of designated routes. A particular park may be scheduled for daily waste collection, or less than once per week, according to the local supervisor's judgment on how often collection is required at a given time of year.

Recycling is a relatively new initiative in parks. First launched in 2004, recycling in parks followed from city-wide waste diversion initiatives aimed at reducing the amount of City waste being sent to landfill. City Agencies, Boards, Commissions and Divisions are required to meet diversion targets mandated by City Council. The current diversion target for Parks, Forestry and Recreation is 60% in 2007.

The main model of parks recycling containers is a blue steel mesh basket covered by a clasped lid with a single, round 6"diameter hole that permits passage of most beverage containers as well as paper (including rolled newspaper) (Photo 4). Transparent plastic bags are placed inside most of these baskets. At a small number of parks, there are larger, in-ground, opaque recycling bins (Photo 5) and large blue toters (Photo 6), which are also used on a limited basis for special event. A graphic identifier is placed on the side of the blue mesh baskets. In addition, two sticker labels (one blue and one grey) showing all acceptable materials were printed for placement on top of recycling basket lids (Photo 7).

Data available to parks management prior to the 2006 parks waste audit indicated that there were approximately 2,350 recycling baskets distributed in one-third of City parks.[2]

Unlike litter receptacles, recycling containers are typically installed in parks on a seasonal basis, for the peak season between June and September. Baskets are removed in the fall-winter season due to reduced parks use as well as reduced staffing levels.[3] While in the parks, most recycling baskets are emptied by ground crews in pick-up trucks rather than packers, due to lighter weight and smaller volumes.[4] While some parks have designated recycling collection schedules, most recycling receptacles are emptied on an 'as-needed' basis.

Litter and recyclables are both brought to one of the seven City transfer stations. Each truckload is weighed at the transfer station, and total weights tracked by stream on an annual basis. In 2005, approximately 5,144 tonnes of general waste (litter) and 68 tonnes of recyclables, in addition to 3,238 tonnes of yard waste, were brought to transfer stations from parks.[5] Including yard waste, this represents a Parks and Forestry diversion rate of 39%.

From the transfer stations, litter is trucked to the state of Michigan for disposal in the Carleton Farms Landfill. Michigan law prohibits various materials from being present in cross-border waste shipments, including recyclables. This resulted in changes to City of Toronto transfer station bylaws, which have complied since October 2004 with Michigan requirements. Thus, if a parks litter load contains considerable recyclable material, it can (and sometimes will) be turned away at the City transfer stations.

Recyclables are taken to one of the City's two Material Recovery Facilities. Recyclables loads can also be rejected for excess contamination with non-recyclables. Rejected recyclables loads are typically sorted and disposed of by a private contractor, and the cost

[2] An additional 1,500 recycling baskets were purchased for installation throughout 2006.
[3] Some supervisors place recycling in parks on a year-round basis. This practice is being encouraged (PF&R Waste Diversion Subcommittee minutes, July 2006).
[4] There are also 2 packers dedicated to recycling, bringing the total number of PF&R packers to 30.
[5] Source: 2005 weigh scale data for Parks, Forestry and Recreation.

borne by the area supervisor who sent the load to the transfer station. These restrictions have made parks waste composition a subject of considerable recent interest to parks supervisors and managers.

## Previous and Current Parks Waste Assessment Activities

Previous parks waste composition assessment activities conducted by the City have included a 2002 visual inspection of the contents of some park litter baskets (Clarke 2002) and a 2004 study of park surface litter done in conjunction with the city-wide litter study (MGM Management 2004).

Based on a visual analysis of litter in baskets in a small number of selected parks in November of 2002, Clarke estimated that the baskets contained, on average, 40% household waste, 25% dog feces, 25% parks litter, and only 10% recyclables by weight. Alternatively, in the MGM study, recyclables were found to form major components of the parks surface litter load, with paper products making up more than 30% of the large litter pieces, and beverage containers at 11.5% (half of which were plastic water bottles). In addition, the authors of the 2004 study noted little evidence of illegal dumping of household waste, with household garbage bags observed in litter baskets at only 8% (17) of the 204 sites surveyed.

Both of these studies have their limitations. The 2002 study occurred at only a small number of sites, while the 214 sites for the 2004 study were selected in a non-representative fashion.[6] Furthermore, the percentage weight estimates generated in the 2002 study are based on a visual inspection, rather than measurement, while the 2004 study focused on counting the number of pieces of surface litter, rather than examining in-container materials.

Beyond these City of Toronto studies, there appears to be relatively little published information on parks waste composition or management that might help better inform

[6] The sites were nominated by Parks supervisors because they were known to have a notable 'litter problem' (MGM 2004, p.11).

decisions with respect to parks waste diversion initiatives.[7] One recent exception is a Stewardship-Ontario-funded study of public space waste management in eastern Ontario municipalities (McLeod 2006). Based on before-and-after sampling of waste and recycling collection receptacles at parks, arenas, and sports fields in Quinte West and Belleville, McLeod found that recyclables made up 30% of the waste surveyed,[8] and that pairing of recycling and litter collection receptacles reduced stream contamination. He also suggested that recyclables capture increased quite rapidly over a single summer in response to an aggressive public outreach program. While relevant to this study, it should be noted that McLeod's conclusions were based on a very small number of samples in municipalities with significantly different waste management practices from those in Toronto (see note 8, below).

Given this relative lack of detailed, directly related information on urban parks waste, the main goal of this study was to obtain an in-depth portrait of parks waste composition in the City of Toronto. This portrait was to include quantitative information on the amount of recyclables and illegally dumped materials in parks baskets. Secondary goals included identifying which basket management strategies (such as twinning recyclable and litter baskets) might increase recyclables capture and/or decrease illegal dumping in parks. Finally, a third priority was to identify main fast food contributors to parks waste, who may be considered partly responsible for public space waste generation.

[7] Dr. John Jackson and Dr. Phil Byers, personal comm., spring 2006; literature search, August 2006.
[8] It should be noted that this 30% does not include paper fibres nor glass, due to methodological considerations particular to McLeod's study. Using current Toronto recycling standards, there would have been a considerably higher percentage of recyclables.

# 2. Methods

## *General Approach*

The general approach selected for this study was to sample waste in all accessible litter and recycling baskets in randomly selected parks across the City. Waste in each basket was sorted according to a categorization based on what is currently recyclable in the City of Toronto, and then weighed according to these categories. Detailed methods are given below.

## *Site Selection*

Parks were randomly selected from a January 2006 list of all City parks. Waste management information required for auditing purposes (number of litter and recycling baskets and scheduled collected day) was provided in a spreadsheet form by area supervisors in April 2006. Where no information was provided, supervisors were contacted individually to obtain the required information on selected parks prior to sampling.

Approximately 15% of the selected parks had no collection receptacles and were therefore not sampled. These were typically parkettes or traffic islands with few or no facilities, and in some cases, parks where supervisors had removed collection receptacles due to excessive illegal dumping. A small number of additional parks were not sampled due to various other prohibitive circumstances.[9]

Each selected park was visited once between July 5, 2006 and August 18, 2006. The visit was timed to occur on the weekday preceding the park's scheduled litter collection day. For example, if a park had a reported once-weekly litter collection day of Monday, it was sampled on a Friday; if it had a twice-weekly litter collection on Tuesday and Thursday,

[9] These included: park under construction (Victoria Memorial Square), unable to locate park (Cabana Park), park waste collected by private contractor and Solid Waste Management Services as well as PF&R (Ontario Science Centre), etc..

it was sampled on Monday.[10] This timing was chosen in order to audit waste at the point of maximum waste accumulation while allowing sufficient time for sampling prior to collection.

## *Basket selection and documentation*

In order to avoid selection bias and increase efficiency, waste from all baskets (both recycling and litter) in a selected park was sampled during the same site visit whenever possible.[11] This included mesh baskets, steel drums, and other similar-sized, readily accessible parks waste baskets. This did not include large in-ground containers (Moloks), other locked or bulk bins, or collection receptacles placed in parks only for special events. In addition, baskets which were suspected to contain illegally dumped materials on first inspection were not sampled but rather reported to bylaw enforcement staff to permit prosecution of offenders. Surface litter was not sampled.

For each park, the number of baskets of each type, twinning, signage, location and model were documented on the Basket Data Sheet and sketch map (see **Appendix A**). Basket documentation was undertaken even if waste in the baskets were not actually audited, in order to generate total basket counts for each park.

## *Waste auditing*

Upon arrival at a litter or recycling basket, the contents were first visually inspected for evidence of illegal dumping and/or hazardous waste. If evidence of illegal dumping was observed, this was documented and reported to Bylaw Enforcement personnel by email or radio. If evidence of hazardous waste was observed, appropriate handling and disposal procedures were followed.[12]

[10] Note that since very few parks had scheduled recycling pick-up days, sampling visits were timed according to litter rather than recycling collection schedules.
[11] In a few cases, field audit staff were unable to sample all the baskets in a park prior to collection, usually because the number of baskets actually in the park largely exceeded the number reported by area supervisors (e.g., Humber Bay West (25 baskets reported, actual 59).
[12] Sharps and biohazards such as needles, knives, and latex examination gloves were placed in biohazard containers carried in the field. Batteries and lighters were placed in Ziploc bags. Local parks supervisors

If no evidence of either illegal dumping or hazardous waste was initially observed, waste in the basket was audited as follows. Contents were first weighed in bulk (if contained in a bag) on a 30- or 50-lb capacity Berkley digital fishing scale with a hook (Photo 8). Following visible inspection, the contents of the bag or baskets were carefully removed onto a plastic tarp spread on the ground next to the basket. For bags or baskets where contents were readily visible, materials were removed by gently tipping out contents onto the tarp. For bags or baskets where contents were not readily visible (e.g., very full bags), bags were cut open with an Exacto knife on the tarp or, if the bag could not be lifted out of the basket, waste was picked out with tongs bit by bit and placed on the tarp.

Materials were sorted on the tarps using stainless steel tongs or, where the waste was evidently non-hazardous, by hand (Photo 9). (Audit personnel were wearing puncture-resistant PVC gloves at all times). Materials were sorted into the categories given in **Table 1**, below. This categorization made a basic division between recyclable and non-recyclable materials, based on what was acceptable as recyclable in the City of Toronto as of June, 2006.[13] Further classification was based on general material type (paper, plastic, etc.). [14]

For reasons of efficiency, illegally dumped waste was not sorted further into material categories, but rather weighed as a single item and described. The same method was used for hazardous waste.

While sorting, the following practices were observed:

- non-recyclable bottle lids (plastic and metal-composite) were separated from recyclable (plastic and glass) bottles;
- non-recyclable (plastic) coffee cup lids were separated from paper cups;

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were requested to handle other hazardous waste such as discarded propane tanks. All hazardous waste was eventually brought to hazardous waste depots at transfer stations.

[13] Changes to the City's recycling program in July 2006 saw composite (spiral-wound) cans and plastic bottle lids become acceptable materials. However, in order to maintain consistency, these materials were still considered non-recyclable for the duration of the audit.

[14] More detailed categorizations such as the one recommended by Stewardship Ontario for residential waste audits were considered too complex and time-consuming for current parks management information needs.

- liquids were poured out of beverage bottles and weighed with organics waste;
- where possible, food waste was separated from packaging;
- dog waste was not separated from plastic bags due to health and safety considerations; and
- fine materials (fines) were sorted according to the Stewardship Ontario residential waste audit method, that is, they were allocated by approximate percentages to their constituent categories.

**Table 1 Waste Sorting Categories**

| **Recyclables** | ***Description*** |
|---|---|
| Glass | Beverage bottles (juice, beer, alcohol) |
| Paper | Newspapers, magazines, flyers, cardboard, unsoiled boxboard, envelopes, office paper, paper bags (including lightly waxed), gable-top containers, tetrapaks/ juice boxes |
| Plastic | PET bottles and containers (water and juice), HDPE containers, wide-mouth tubs and lids, yogurt containers |
| Metal | Aluminum and steel cans, rigid aluminum trays and plates, empty aerosol cans |
| **Non-Recyclables** | |
| Paper | Coffee cups, napkins, soiled boxboard and paper plates, composite spiral-wound cans |
| Plastic | Polystyrene, plastic bags, straws, plastic utensils, plastic film and laminated packaging, coffee cup lids, bottle lids, durable items (toys, rigid packaging, empty cigarette lighters, etc.) |
| Metal | Aluminum foil, metal bottle lids |
| Textiles | Discarded clothes, scrap cloth |
| Pet Waste | Dog waste including plastic bag |
| Other Organic Waste | Food waste, all liquids including water and juice from beverage containers, parks plant matter (e.g., leaves, weeds, pine needles), sticks, popsicle sticks and chopsticks |
| Diapers | Disposable diapers |
| Illegally Dumped Waste | Kitchen waste, bathroom waste, yard waste, construction or renovation waste, etc. |
| Hazardous Waste | Batteries, needles, condoms, latex gloves, propane tanks, lighters with fuel in them, BBQ lighter fluid, other chemicals |
| Other | Items not included above (typical items included cigarettes, dirt, sweepings, umbrellas, kites, tennis rackets, etc.) |

Once the waste was sorted into the categories in **Table 1** above, the major fast food waste contributor was documented. Fast food waste was determined to be 'brand-name' waste

from fast food chain restaurants such as Tim Horton's, McDonald's, Coffee Time, Burger King, etc.. It did not include brand-name product waste from vending machines, convenience or grocery stores (such as Nestle chocolate bar wrappers or Doritos chips bags) nor fast food waste without any visible brand names (such as plain polystyrene take-out containers). The top contributor for a given basket was estimated visually by weight and major items described.

To weigh the waste, the digital fishing scale was zeroed (using a tare function) to the weight of an empty 15-20 L plastic bucket with a handle. Sorted waste was then placed, by category, in the pail and weighed by suspending the pail from the scale hook. (Photo 10). Weights were recorded in kilograms on the Waste Composition field datasheet (**Appendix A**).

Where the weight of a particular category was below the scale detection limit then the individual items were described on the datasheet. Where the volume of waste in a given category exceeded the volume of the bucket, the waste was weighed in several installments and results added for a total weight per category. After all waste was weighed, the total from all categories was roughly calculated and compared to the original bulk weight to ensure that no major categories were missed or weighed twice.

After weighing, waste was returned to the original basket, except where stream contamination was observed and it was possible to place waste in the correct stream. For example, where recyclables were found in a litter basket twinned with a recycling basket, these recyclables were placed in the recycling basket after auditing was complete for both baskets.

Where recycling sticker labels were not present on a recycling basket lid, the lid was cleaned and stickers applied. Any blown litter from auditing activities was picked up prior to leaving the area.

## *Health and Safety*

A number of precautions were taken to ensure the health and safety of audit staff in addition to those already mentioned.

Staff worked in teams of two (minimum) at all times. All staff members were certified in Standard First Aid and CPR-C, able to lift 25 kg, able to work in all weather conditions, and immunized against tetanus. Staff members were required to wear long pants and closed-toe shoes and provided with puncture-resistant, liquid-proof PVC gloves, disposable examination gloves, safety goggles, organic vapour and dust masks, hand-sanitizer, soap, stainless steel tongs, First Aid kits and AR masks, a radio with 911 capability and a list of emergency radio contacts. Staff members were also trained in divisional workplace safety and emergency procedures, use of personal protective equipment, lifting procedures, and handling procedures for hazardous waste.

## *Public Interactions*

Field staff were trained to respond to queries and concerns from the general public and parks personnel with respect to audit activities and other parks waste issues such as illegal dumping. All staff members carried an information flyer on illegal dumping and parks recycling for distribution as warranted.

## *Data Entry and Analysis*

Data from the Basket and Waste Composition field data sheets were entered into Excel spreadsheets on a rolling basis. Descriptions of illegally dumped or hazardous materials, as well as description of items that weighed less than the scale detection limit, were entered as comments.

### Scale detection limits

For items which were commonly found in baskets but weighed less than the scale detection limit, a representative weight was generated by weighing a single item on a kitchen scale (see **Appendix B**). For example, a single empty pop can was found to have

a mass of 0.014 kg on the kitchen scale. Therefore, if "two pop cans" was recorded on the basket datasheet under recyclable metals, a value of 0.028 kg was entered in the Excel datasheet along with the descriptive comment. Uncommon items (such as earbuds) or items with highly variable weights (such as pieces of tin foil) were assigned a value of 0.005 kg. This was half the scales' advertised detection limit of 0.01 kg. It should be noted, however, that this value is likely an underestimate since no weights less than 0.03 kg (on the 30 lb scale) and 0.04 kg (on the 50 lb scale) were actually measured.

## Correction for wet paper weights

Waste in parks litter baskets was often found to be wet from rain. While this was unlikely to significantly affect the weights of non-permeable materials such as plastic, absorbent materials such as paper weighed considerably more when wet. Therefore, where it was noted that waste was wet, a correction factor of 1/3 was applied to all paper (recyclable and non-recyclable) such that actual paper weight = wet paper weight/ 3. This method followed that employed for a recent City of Toronto public space (street) waste audit (Vibert 2006), where audited waste was often wet with snow, ice and rain.

## Analysis

Four main analyses were performed: (1) general composition of litter and recycling stream waste; (2) effects of twinning and labeling on recyclables capture; (3) effect of bin model on illegal dumping; and (4) effects of district and park type on recycling capture and illegal dumping.

For all analyses, baskets were first randomly assigned to groups of 10 or 20 and weight summed across each category (e.g., sum of all glass for 20 litter baskets, etc.). Baskets were grouped in order to increase the precision of subsequent estimates; the extreme variability of individual basket results is muted when several results are combined.

Variation between groups was measured using an 80% confidence interval generated for each material category. Thus, for the general composition analysis, results for each

material category are reported as ranges that can be considered accurate eight times out of ten.

For the analysis of particular effects, means were compared with a Student's t-test to determine whether or not a particular treatment had a significant effect on composition. For example, for the analysis of the effect of twinning, baskets were first sorted into 'twinned' or 'not twinned' categories, and a mean generated for percent recyclables in each category using the grouping method described above. These means were then compared using a two-sample t-test assuming unequal variances. Results were considered significant if the absolute value of the test statistic exceeded the t-critical value for a two-tailed test with an alpha (significance) level of 0.05.

Empty baskets and baskets that were not sampled (due to suspected illegal dumping or logistical problems) were excluded from the analyses described above.

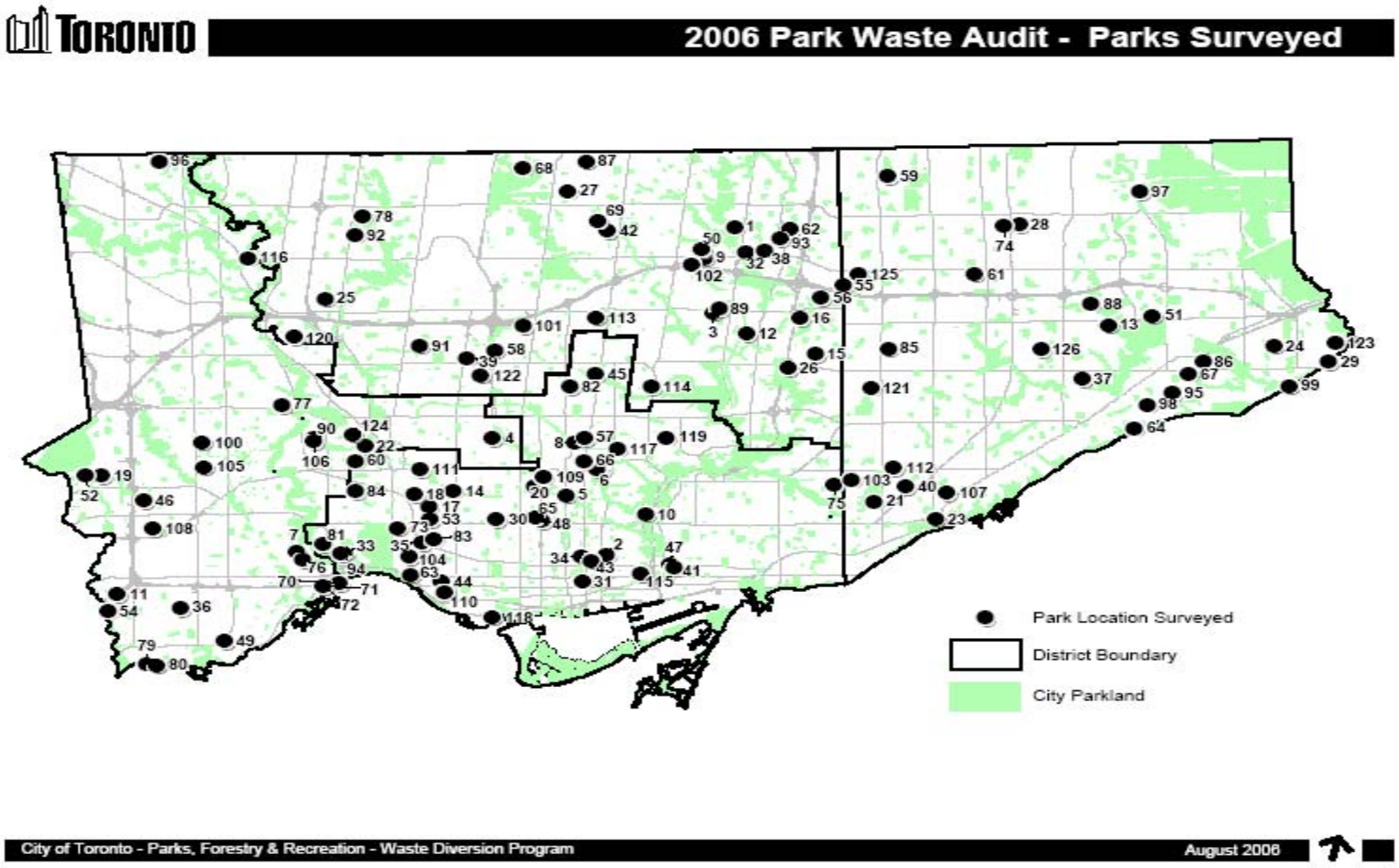
# 3. Results

Waste was sampled in 126 parks across the city (**Figure 1**). Since parks were selected randomly, all districts and classifications were represented (**Table 2**).

**Table 2 Number of Parks Sampled by District and Classification**

| | *Destination* | *Regional* | *Neighbourhood* | *Parkette* | **TOTAL** |
|---|---|---|---|---|---|
| **West** | 3 | 4 | 22 | 6 | **35** |
| **North** | 0 | 1 | 22 | 7 | **30** |
| **South** | 0 | 8 | 15 | 9 | **32** |
| **East** | 2 | 1 | 23 | 3 | **29** |
| *TOTAL* | *5* | *14* | *82* | *25* | ***126*** |

**Figure 1 Map of Parks Surveyed**




**Please see Appendix C for a numbered list of all Parks surveyed.**

Waste was sampled in 742 baskets (585 litter and 157 recycling). An additional 116 baskets were documented (for a total of 858 baskets, 688 litter and 170 recycling) but not sampled. These were not sampled because they were empty (29 baskets), because illegal dumping was suspected (32 baskets), or due to logistical problems such as a locked lid (55 baskets). **Appendix C** gives a detailed list of all parks sampled along with their district, ward, classification, and number and type of baskets.

Almost 3 tonnes of parks waste was sampled, including 2534 kg of litter stream materials and 400 kg of recycling stream materials.

The park with the largest amount of materials sampled on a single day was Christie Pits (a Regional Park in the South District), with 201 kg of litter stream materials and 63 kg of recycling stream materials.[15] The basket with the single largest amount of materials sampled was a steel drum at Humber Bay Shores (West District, Ward 6) containing 29.46 kg of waste, primarily illegally dumped household waste (13.4 kg) and dog waste (7.2 kg). Other individual park and basket audit results are not given in this report, but are available on request.[16]

General city-wide composition estimates for both litter and recycling streams are given in **Table 3** and **Table 4**, followed by more detailed results for recycling, illegal dumping, and fast food waste. Photos of typical waste are given in **Appendix E** (Photos 11 through 18).

[15] These totals represent approximately 1 day's worth of waste generated in the park, suggesting that this park alone may generate close to 2 tonnes of waste per week during the peak season.

[16] For internal PF&R users, the results are also available electronically at G:\prk\Shared\WD Staff Files\Summer 2006 WD Program\Audit\Data\Composition datasheet Basket Samples CLEANED Aug 28.xls.

## *Parks waste composition*

### Litter stream

Recyclable materials formed 24-28% of the litter stream by weight. The top two non-recyclable materials were pet waste (23-27%) and other organic waste (15-17%). Illegally dumped waste (10–15%), non-recyclable plastics (7-8%) and non-recyclable paper (4-6%) were also significant components of the parks litter stream.

**Table 3 Waste Composition Estimates for the Parks Litter Stream**

| **Recyclables** | ***Total kg*** | ***% of Total*** | ***% Range (at 80% confidence level)*** | ***Range as % of mean***[17] |
|---|---|---|---|---|
| Glass | 213.8 | 8.5% | **8 – 9 %** | <20 % |
| Paper | 301.4[18] | 11.0% | **10 – 12 %** | <20% |
| Plastic | 117.3 | 4.7% | **4 – 5 %** | <20% |
| Metal | 48.2 | 2.0% | **1.7 – 2.3 %** | <20% |
| ***Total Recyclables*** | *681.5* | *26.2%* | ***24 - 28 %*** | *<10%* |
| **Non-Recyclables** | | | | |
| Paper | 139.5[19] | 5.4% | **4 – 6 %** | <20% |
| Plastic | 182.9 | 7.4% | **7 – 8 %** | <10 % |
| Metal | 11.9 | 0.5% | **0.4 – 0.6 %** | > 20% |
| Textiles | 30.0 | 1.3% | **0.9 – 1.7 %** | > 20% |
| Pet Waste | 626.5 | 24.9% | **23 – 27 %** | <10 % |
| Other Organic Waste | 391.7 | 16.1% | **15 -17 %** | <10 % |
| Diapers | 59.2 | 2.4% | **2 - 3%** | > 20 % |
| Illegally Dumped Waste | 337.9 | 12.8% | **10 - 15 %** | = 20% |
| Hazardous Waste | 9.7 | 0.4% | **0.2 – 0.5 %** | > 20% |
| Other | 64.2 | 2.6% | **2 - 4%** | > 20% |
| ***Total Non-Recyclables*** | *1853.5* | *73.8%* | ***72 - 76 %*** | *<10%* |
| **TOTAL** | **2534.2** | | | |

[17] This is a measure of how precise the average estimate is for a given material category. For waste auditing, values <10% are considered very good and values <20% are considered reasonably good. If this value is >20% then the estimated range is not precise enough for decision-making purposes.
[18] Wet-corrected total for recyclable paper is 271.1 kg. Mean and range are based on corrected values.
[19] Wet-corrected total for non-recyclable paper is 130.3 kg. See note 14.

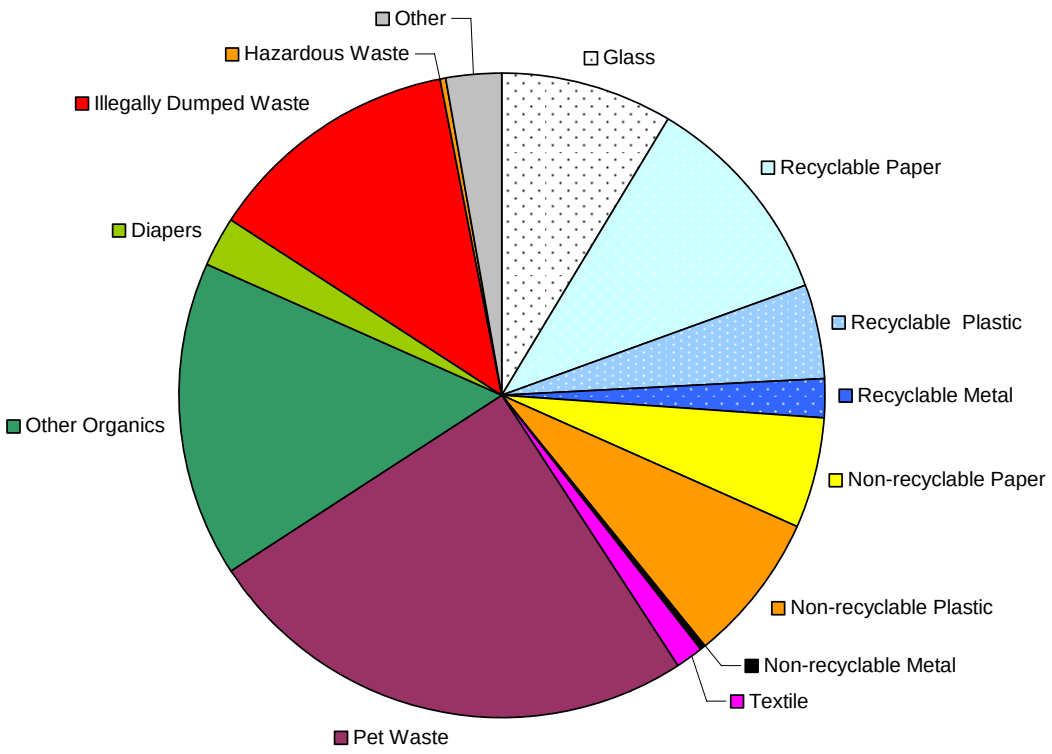



**Figure 2 Composition of the Parks Litter Stream**

## Recycling stream

Recyclables formed 59-66% of the recycling stream. The top three materials by weight were glass (21-28%), organics (17–21 %), and recyclable plastic (16–21 %). Recyclable paper was also a major component (10–15%).

**Table 4 Waste Composition Estimates for the Parks Recycling Stream**

| **Recyclables** | **Total kg** | **% of Total** | **Range (at 80% confidence level)** | **Range as % of mean** |
|---|---|---|---|---|
| Glass | 97.7 | 24.6% | **21 – 28 %** | < 20 % |
| Paper | 58.3[20] | 12.4% | **10 – 15 %** | < 20 % |
| Plastic | 71.3 | 18.5% | **16 – 21%** | < 20 % |
| Metal | 26.2 | 6.8% | **5 – 8%** | > 20 % |
| ***Total Recyclables*** | *253.6* | *62.3%* | ***59 – 66%*** | *<10 %* |
| **Non-Recyclables** | | | | |
| Paper | 15.0[21] | 3.6% | **3 – 4%** | <20 % |
| Plastic | 24.3 | 6.4% | **6 – 7%** | <20 % |
| Metal | 1.5 | 0.4% | **0.2 – 0.5%** | > 20 % |
| Textiles | 0.1 | 0.0% | **0.01 - 0.04%** | > 20 % |
| Pet Waste | 9.9 | 2.4% | **2 - 3%** | > 20 % |
| Other Organic Waste | 74.1 | 19.2% | **17 – 21%** | <10 % |
| Diapers | 7.9 | 2.1% | **1 - 3 %** | > 20 % |
| Illegally Dumped Waste | 5.6 | 1.6% | **1 – 2%** | > 20 % |
| Hazardous Waste | 1.5 | 0.4% | **0.1 – 0.7 %** | > 20 % |
| Other | 7.2 | 1.8% | **1 – 2%** | > 20 % |
| ***Total Non-Recyclables*** | *147.0* | *37.7%* | ***34 – 41%*** | *<10 %* |
| **TOTAL** | **400.4** | | | |

[20] Wet corrected total for recyclable paper is 49.4 kg. Mean and range are based on corrected values.
[21] Wet-corrected total for non-recyclable paper is 14.4 kg. Mean and range are based on corrected values.

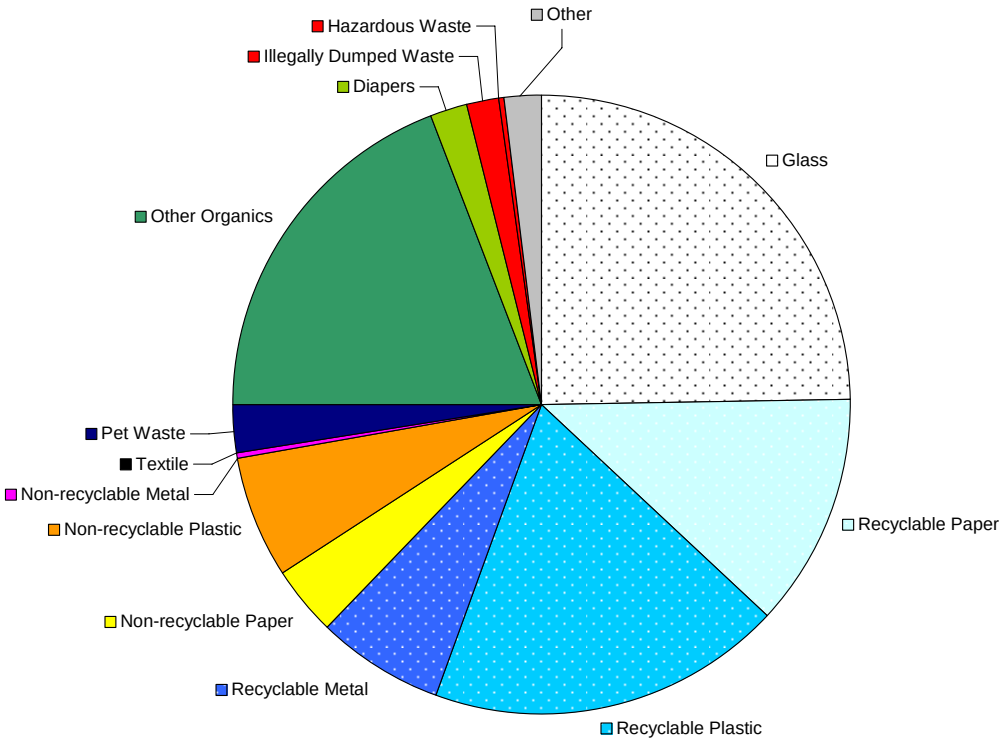



**Figure 3 Composition of the Parks Recycling Stream**

## *Recycling*

### Number and distribution of recycling baskets

**Figure 4** shows parks with recycling capacity (at least one recycling basket) in blue. At least one recycling basket was present in 44% of parks (56 parks out of 126 surveyed). However, only 20% of all baskets were recycling baskets (170 recycling baskets out of 858 surveyed).

### Recyclables in the Litter Stream

Recyclable materials formed about one-quarter (24-28%) of the parks litter stream by weight. The major recyclables in the litter stream were paper (10–12%) and glass (8-9%). Lighter but larger recyclable beverage containers, such as plastic water bottles and metal pop cans, were also found in the parks litter stream in significant amounts.

### Contamination of the Recycling Stream

Non-recyclables formed more than one-third (33 – 41%) of the parks recycling stream by weight. The major non-recyclable in the parks recycling stream were organics (17 – 21%), a category which included liquid waste (water, pop, juice) from beverage bottles as well as food waste. Light-weight, large volume non-recyclable plastics such as Styrofoam plates, cups, and plastic bags contributed 6 – 7% to the recycling stream.

### Twinning

Approximately 60% of recycling bins are twinned with litter bins. Twinning litter and recycling baskets significantly reduces contamination the recycling stream. Twinned recycling baskets have on average 15% more recyclables than those that are not twinned (critical value of 2.2, t-statistic of 3.1). **Table 5** summarizes these results.

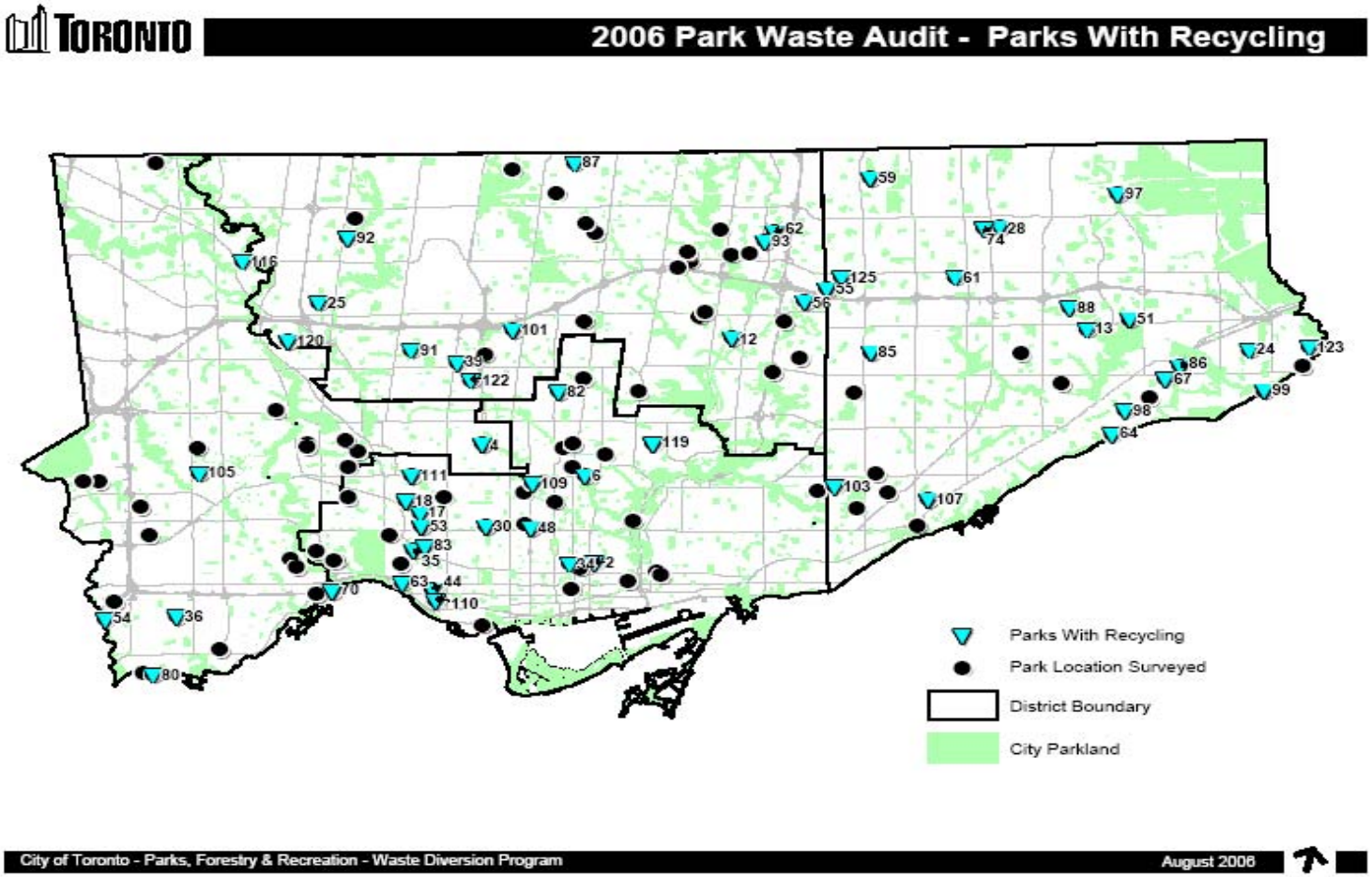



**Figure 4 Map of Parks with Recycling**

**Table 5 Effect of twinning on % recyclables in litter and recycling streams**

| | | % Recyclables | | |
|---|---|---|---|---|
| | **No. of baskets** | **% of Total** | **Range (at 80% confidence level)** | ***Range as % of mean*** |
| **RECYCLING STREAM** | | | | |
| Twinned | 95 | 69.0% | **64 – 74%** | <10% |
| Not twinned | 62 | 55.0% | **48 – 62%** | <20% |
| *All recycling* | *157* | *62.3%* | ***59 – 66%*** | *< 10 %* |
| **LITTER STREAM** | | | | |
| Twinned | 91 | 23.9% | **20 – 27%** | <20% |
| Not twinned | 496 | 28.1% | **26 – 30%** | <10% |
| *All litter* | *587* | *26.2%* | ***24 - 28%*** | *<10%* |

## Labeling

Only 35% of recycling baskets had a sticker label on the basket lid indicating acceptable materials. Of those that were labeled, some had only one sticker (a blue sticker showing plastic, glass, and metal recyclables) rather than both blue and grey stickers showing all acceptable materials. Nonetheless, labeled recycling baskets had on average 15% less contamination than baskets without labels. This difference is significant (critical value of 2.1, t-statistic of 4.4). **Table 6** summarizes this result.

**Table 6 Effect of sticker labelling on % recyclables in recycling baskets**

| | | % Recyclables | | |
|---|---|---|---|---|
| | **No. of recycling baskets** | **% of Total** | **Range (at 80% confidence)** | ***Range as % of mean*** |
| Labeled | 56 | 73.2% | 69 – 77% | < 10 % |
| Not labeled | 101 | 57.7% | 52 – 63% | < 10 % |
| *All* | *157* | *62.3%* | *59 – 66%* | *< 10 %* |

## Combined effect of twinning and labeling

The best recycling stream quality was seen in recycling baskets which were both twinned and labeled, and the worst quality in the recycling baskets that were neither twinned nor labeled. Baskets which were both twinned and labeled had on average 25% less contamination than those that were neither twinned nor labeled, a mathematically

significant difference (critical value of 2.4, t-statistic of 11.9). **Table 7** summarizes this result.

**Table 7 Combined effect of twinning and labelling recycling baskets**

| | | % Recyclables | | |
|---|---|---|---|---|
| | **No. of recycling baskets** | **% of Total** | **Range (at 80% confidence)** | ***Range as % of mean*** |
| Labeled and Twinned | 40 | 77.1% | 73 – 81% | < 10 % |
| Neither labeled nor twinned | 46 | 52.2% | 49 -55% | < 10 % |

## Recycling by District

Stream quality varied by district as well as by basket treatment. Stream contamination was notably worse in the West district, where 14% more contamination was seen in the recycling stream compared to the city-wide average. More recyclables were also present in the litter stream in the West (6% higher than the city average). As summarized in **Table 8** below, the West district also had the lowest percentage of parks with recycling (29%) and the lowest percentage of recycling baskets (10%) overall.

**Table 8 Recycling Performance by District**

| | **West** | **North** | **South** | **East** | ***All*** |
|---|---|---|---|---|---|
| ***Parks*** | | | | | |
| Number of Parks Surveyed | 35 | 30 | 32 | 29 | ***126*** |
| % Parks with Recycling | 29% | 37% | 45% | 69% | ***44%*** |
| ***Baskets*** | | | | | |
| No. baskets surveyed | 258 | 156 | 225 | 219 | ***858*** |
| % Recycling baskets | 10% | 24% | 24% | 25% | ***20%*** |
| ***Composition*** | | | | | |
| % Recyclables in Litter Stream | 29 – 35% | 16 – 22% | 23 - 30% | 21 – 29% | ***24-28%*** |
| % Recyclables in Recycling Stream | 40 - 56% | 37 - 72% | 56 - 77% | 54 – 76% | ***59 -66%*** |

## *Illegal dumping*

### Illegally dumped materials

As described in the Methods section, illegally dumped materials were typically found in plastic grocery, white kitchen catcher, or (more rarely) black garbage bags. If not reported prior to sampling, these bags were opened to verify contents. These bags contained:

- kitchen scraps (vegetable peelings, meat trays, cheese packaging) and other household food packaging such as large juice or milk containers, frozen or microwave dinner boxes, canned vegetables, soups or sauces, etc.;
- bathroom waste (adult and child diapers, used tissues, sanitary products, tissue boxes, toilet paper cores, hair, shampoo bottles, toothbrushes, shaving cream, empty prescription medication bottles, etc.);
- cleaning product containers (empty bottles of Javex, Mr. Clean, Windex, detergent, etc.);
- personal mail or papers;
- clothing;
- newspapers;
- cat litter; and
- yard or plant waste (grass clippings, potted plants, flowers).

Other illegally dumped materials observed in or near parks baskets included:

- car parts;
- construction materials or debris (glass, plexiglass, concrete, gravel, roof shingles, sawdust);
- bicycles;
- household appliances (VCR);
- and large amounts of recyclable plastic scraps or plastic bags.

## Frequency of illegal dumping

**Figure 5** shows parks with either suspected or actual illegal dumping shown in red. A list of which parks and baskets had illegal dumping, is given in **Appendix D.**

Illegally dumped materials were found in 17% of all baskets sampled (124 out of 742). In addition, an additional 32 baskets were not sampled due to the presence of suspected illegal dumping. A combined total of 156 baskets in 77 parks had suspected or actual illegal dumping. Thus, illegal dumping was present in as many as 20% of all baskets[22] and in 60% of all parks surveyed.

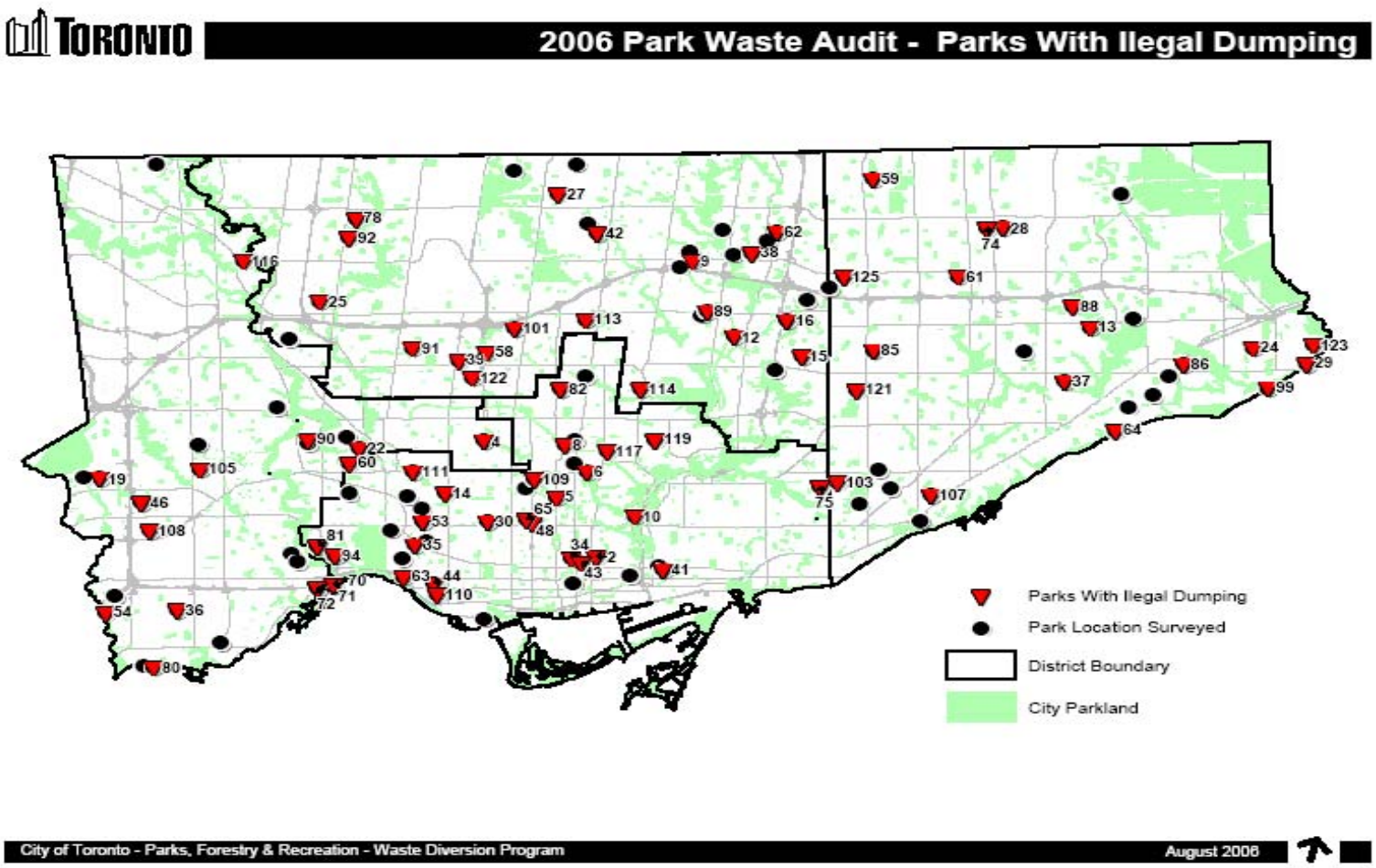
## Type of baskets where illegally dumped materials found

Illegally dumped materials were found almost exclusively in litter baskets, at a rate of 20% (118 out of 585 sampled). Only seven recycling baskets out of 157 sampled (4%) contained illegally dumped materials. Consequently, illegally dumped materials formed 10–15% of the litter stream by weight, but only 1-2 % of the recycling stream by weight.

Based on field observations, it was initially suspected that illegal dumping was more common in steel drums rather than mesh baskets. However, data analysis did not show significant differences between basket models in the percent illegally dumped materials by weight (average 12.8% in steel drums, and average 12.3% in all other types of litter baskets).

[22] This percentage is calculated as follows: 744 baskets sampled + 33 baskets suspected illegal + 28 empty = 805 baskets where it was possible to document illegal dumping. 157/ 805 x 100% = 20%.

**Figure 5 Map of Parks with Illegal Dumping**



## Park Classification and Illegal Dumping

Illegal dumping occurred in all classes of parks, however, it was more frequent in Neighbourhood parks and Parkettes than in Destination and Regional parks, both in terms of number of baskets where illegally dumped materials were found and in terms of percent weight of illegally dumped materials (**Table 9**).

**Table 9 Illegal Dumping by Park Classification**

| **Park Classification** | **No. of baskets sampled** | **No. of baskets with illegal dumping** | **% baskets with illegally dumped materials** | **% Illegal Dumping by Weight (litter stream only)** |
|---|---|---|---|---|
| *Destination* | 182 | 17 | 9% | 7 – 14% |
| *Regional* | 204 | 33 | 16% | |
| *Neighbourhood* | 218 | 63 | 29% | 12 - 20% |
| *Parkette* | 38 | 11 | 29% | |
| **TOTAL** | **742** | **124** | **17%** | **10 -15%** |

## *Fast Food waste*

Fast food waste was present in the large majority (77%) of baskets sampled. Fast food waste was present more often in litter baskets than in recycling baskets. Most of the fast food waste present in both recycling and litter baskets was not recyclable, consisting primarily waxed paper coffee cups, soiled boxboard or napkins, and polystyrene. Similar items from each contributor were found in both litter and recycling baskets.

Brand-name fast food waste contributors to parks baskets are listed in **Table 10**. The overall top contributor (as estimated visually by weight) was Tim Horton's, whose main waste product in parks baskets was coffee cups and lids.

**Table 10 Fast Food Waste Contributors to Parks Waste**

| **Top contributor** | ***Number of litter baskets where top contributor*** | ***Number of recycling baskets where top contributor*** | ***Total number of baskets where top contributor*** | ***Main items*** |
|---|---|---|---|---|
| Tim Horton's | 260 | 43 | **303** | Coffee cups , lids |
| McDonald's | 48 | 17 | **65** | Bags, food boxes |
| Coffee Time | 22 | 10 | **32** | Coffee cups |
| Wendy's | 21 | 3 | **24** | Cups |
| Starbucks | 19 | 4 | **23** | Coffee cups |
| Second Cup | 16 | 1 | **17** | Coffee cups |
| Burger King | 14 | 1 | **15** | Cups, bags |
| Kentucky Fried Chicken | 14 | 1 | **15** | Food boxes |
| Country Style | 11 | 0 | **11** | Coffee cups |
| Subway | 10 | 1 | **11** | Cups, bags, wrappers |
| Pizza Pizza | 9 | 1 | **10** | Pizza trays, box |
| Baskin Robins | 6 | 4 | **10** | Ice cream cups |
| Harvey's | 5 | 0 | **5** | Cups |
| La Notre | 4 | 0 | **4** | Coffee cups |
| Seven Eleven | 4 | 1 | **5** | Cups |
| Timothy's | 4 | 0 | **4** | Coffee cups |
| Bakers Dozen | 2 | 0 | **2** | Coffee cups |
| Dairy Queen | 2 | 0 | **2** | Cups |
| Java Joes | 2 | 0 | **2** | Coffee cups |
| Cadence Bakery | 1 | 0 | **1** | Coffee cups |
| Gourmet Coffee Bean | 1 | 0 | **1** | Coffee cups |
| Mama's Pizza | 1 | 0 | **1** | Pizza trays |
| Mr. Sub | 1 | 1 | **2** | Wrappers, Bags |
| Pizza Nova | 1 | 0 | **1** | Pizza boxes |
| Popeye's | 1 | 1 | **2** | Food boxes |
| Swiss Chalet | 1 | 0 | **1** | Plastic takeout containers |
| Allen and Wright | 0 | 1 | **1** | Coffee cups |
| Fresh to Go | 0 | 1 | **1** | Pizza trays |
| Manchu Wok | 0 | 1 | **1** | Cups |
| **TOTAL** | **480** | **92** | **572** | |

Field observations indicated that the closer a park basket was to a fast food restaurant, the more fast food waste from that restaurant was found in that basket. An outstanding example of this was seen at Farmcrest Parkette, directly across the street from a Tim Horton's. Both litter and recycling baskets in this parkette contained more than fifty Tim Horton's cups each (Photo 20).

### *Public Interactions*

Over fifty members of the public and parks staff directly addressed the audit team with questions or comments about the audit and/or waste management issues. Most people simply wanted to know what the field staff were doing. A number of people also had complaints about over-flowing parks bins, lack of recycling in parks, dog waste, and poor recycling participation by other parks users, neighbours, or Toronto residents in general.

## 4. Discussion

### *Parks Litter Stream*

Key results for the parks litter stream include the following:

- about one-quarter of the litter stream is recyclable
- about one-quarter of the litter stream is pet waste
- illegal dumping is much more common in the litter stream than in the recycling stream.

Results and recommendations are discussion in detail below according to material categories.

## Recyclables

Recyclable materials comprised about a quarter (24–28%) of the parks litter stream, or, if applied to the 2005 weigh-scale data, roughly 1200-1400 tonnes.[23] While considerably higher than the estimate of 10% recyclables in the parks litter stream generated by Clarke et al. in 2002, this study's result is very close to that given in a Toronto public space (street) waste audit, where 28% of the waste stream was found to be recyclable (Vibert 2006).

Similar to McLeod's work in eastern Ontario (McLeod 2006), this study's results indicate that there is still ample opportunity for straightforward improvements in public space waste diversion through increased recyclables capture. For example, capturing only three-quarters of the recyclables that currently end up in the parks litter stream (approximately 1000 tonnes) could push the Parks diversion rate from 39% to over 50%.

Recyclables are likely present in such large amounts in the parks litter stream due to limited opportunities to recycle in many parks, inconvenient basket placement, inadequate signage on recycling baskets, and improper recycling practices on the part of parks users. In general, there are relatively few recycling baskets in parks compared to litter baskets, with a city-wide average of one recycling basket for every four litter baskets. In addition, installation of recycling baskets in parks, an ongoing process, shows uneven progress across the city: in the West, there was only one recycling basket for every nine litter baskets. As suggested by the composition analysis by district (**Table 8**), fewer recycling baskets in parks appears to result in more contamination in the recycling stream as well as lower capture rates.

Improved stream quality and greater recyclables capture is likely to be realized through making recycling more accessible as well as more obvious to parks users. Twinning appears to make recycling baskets highly 'visible' to the public; as suggested by the high

[23] It should be noted that this is only a rough approximation, as the composition estimates were generated from parks baskets only, while the annual weigh-scale data represents all parks waste including surface litter, in-grounds, etc.

contamination rates for untwined recycling baskets, the public may see and treat these as litter baskets. McLeod (2006) also found that twinning parks recycling and litter baskets was shown to improve stream quality. The improvements in recycling stream quality – as much as 15% less contamination in twinned recycling baskets in this study - are not trivial.

These results suggest that an ideal ratio for litter:recycling baskets in parks is likely 1:1, such that parks users always have the convenient option (and immediate visual cue) to recycle. This statement does not necessarily mean putting a recycling basket next to every litter basket currently in parks, effectively doubling the number of baskets and therefore doubling purchasing costs and labour requirements. [24] The goal is not to provide twice as much space for parks waste, but rather to provide tools so that the waste can be properly sorted. A more effective option than adding baskets may be to replace litter with recycling baskets, while still aiming at a 1:1 ratio.

Further improvements in recycling stream quality through signage are discussed further below under recycling stream results, but can be briefly summarized by referring to the finding that twinned and labeled bins had on average 25% less contamination than those that were neither twinned nor labeled.

Notably, improvements in recycling basket management, while important to the overall success of waste diversion programs, do not guarantee that the public will recycle properly in parks. Increased educational outreach about recycling programs in parks is crucial, particularly since public space recycling (unlike residential recycling) is a relatively new initiative in the City of Toronto. In addition to the biannual litter pick-up in parks with schools initiated in 2005, other public outreach activities could include:

- staffing interactive displays and recycling activities at parks recycling and litter bins areas throughout summer weekends and/or at special events;
- developing and conducting parks waste management walking tours that include visits to parks baskets and yards;

[24] Thanks to front-line staff for discussion which led to this clarification.

- conducting parks waste audit activities on weekends or evenings, with the expectation that staff will spend a significant part of their time conducting one-on-one outreach to the general public;
- posting parks waste diversion information in parks washrooms, maps, picnic shelters, pools, sportsfields, community centres, bulletin boards and other in-park display locations;
- advertising in the SWMS collection calendar, in addition to existing promotional text in the PF&R Fun Guide and Waste Watch newsletter;
- seasonally targeted advertising campaign in the TTC (streetcars, subways, buses) to promote recycling in parks during the peak season;
- providing materials and training to the Toronto Environmental Volunteers to promote parks recycling at Environment Days;
- visiting door-to-door in neighbourhoods adjacent to parks where recycling participation is notably poor and/or illegal dumping high (i.e., a 'Recycling Roadshow' approach (Read 2001)).

A survey on knowledge and attitudes towards recycling (or other waste issues) in parks could also be considered in conjunction with other educational and/or audit activities in order to better target public outreach.[25]

As a last resort, enforcement of City recycling bylaws in parks could be considered. Residential recycling is mandatory, and enforcement of this bylaw by Solid Waste Management staff is anticipated to commence in the next calendar year. If this bylaw applies to public space waste, Parks bylaw enforcement may be empowered to ticket non-recyclers in parks.

## Pet Waste

This audit found that pet waste formed approximately one-quarter (23-27%) of the parks litter stream by weight, thus forming the largest single material contribution to the parks

[25] McLeod's surveys of parks users as well as staff and project managers may provide some useful ideas (McLeod 2006, Appendices O, P and Q).

litter stream. This estimate is congruent with that generated by Clarke et al. in 2002, who visually estimated pet waste at 25% of the parks waste stream. Applied to the 2005 PF&R weigh scale data, this amounts to approximately 1200-1400 tonnes of pet waste annually.

Diverting three-quarters of parks pet waste (estimated at 1000 tonnes), in addition to diverting three-quarters of recyclables from the litter stream, could push the overall Parks waste diversion rate to over 60%, the 2007 diversion goal. Nonetheless, compared to diverting recyclable (blue-box) materials, getting pet waste out of the parks litter stream represents a more difficult managerial, technical and social challenge.

As outlined in the introductory section of this report, pet waste in the parks litter stream is currently transported from parks baskets to City transfer stations, then shipped to Michigan for landfill disposal. However, this practice contravenes existing City by-laws. "Animal excrement" is listed as Item H on the "Consolidated List of Prohibited Materials that shall not be delivered to Transfer Stations for disposal purposes", which appends Toronto Transfer Station by-law No. 4745-2004. This by-law was created to meet Michigan equivalency requirements in that state, which, like many jurisdictions, bans disposal of any excrement (human or otherwise) in landfill.

Pet waste, even encased in plastic, is currently an acceptable 'green bin' material. Like kitchen waste in plastic bags, dog waste can be safely processed in the City's anaerobic digester facility where organic material is mechanically separated from plastic prior to a multi-stage composting process.[26] However, Solid Waste Management Services is not implementing any new green bin programs in the ABC&Ds for a minimum of two years, or until more processing capacity can be secured. This means that Parks cannot divert its pet waste through installing a SWMS- run green bin program in all parks for the immediate future.

[26] Plastic bags are raked out of pulped organics, then landfilled. If pet waste was tightly adhered to the plastic bag, it might also end up landfilled.

This leaves Parks with several possible courses of action for the immediate future. The first would be to install a green bin-type system, but to have the waste processed and managed privately rather than through Solid Waste Management System. This system could include pet waste as well as other organics, although as seen in this audit, pet waste would likely be the major component by weight.

A second option that also involves source-separation would be to install a collection system in parks specifically for dog waste (excluding organics). Preliminary research indicates that other cities are actively examining new strategies for separately managing pet waste in parks. Vancouver commissioned research on composting dog waste in parks (LEEs 2004), and, accordingly to recent media reports, San Francisco is currently running a pilot project where parks dog waste is separately collected for eventual processing in a power-generating methane digester (Jones 2006, Usery 2006). More locally, the City of Pickering has installed special dog-waste stations in six of its parks which provide biodegradable plastic bags and a waste receptacle specifically for dog waste. These containers are emptied by a contractor, who after ensuring no regular plastic bags are present, is able to process the waste through the Toronto sewage system.[27]

A third option is, rather than install a separate pet waste system in parks, is to advise pet owners to carry their pet waste out of the park. This could entail treating pet waste in parks waste as a prohibited material, akin to other household wastes. In the current context, where pet waste in the parks litter stream is illegally delivered to landfill via parks litter collection, and where it can be legally diverted through the residential green bin program, the comparison to illegally dumped household waste may be apt. Parks users would therefore be required to dispose of their pet waste in their green bins at home.

This may not be a reasonable approach, however, until all Toronto citizens have access to the green bin program, which is currently not the case. (Only residents living in single-

[27] Personal communication, Chantal Whittaker, Environmental Co-ordinator for the City of Pickering, October 2006. Unlike regular plastic, biodegradable plastic breaks down relatively rapidly in the presence of bacteria, water, and oxygen.

family homes have green bin access, which excludes about half of Toronto's population). In addition, it would be a major challenge to change public habits from disposing of dog waste in parks litter bins to packing it home. This social change would require extensive public education and likely enforcement in order to ensure that parks users do not leave pet waste on parks greens, an undesirable practice that motivated current 'Stoop and Scoop' bylaws. If this change could be accomplished, though, (as it is currently being accomplished with other illegally dumped household wastes), then this strategy could represent a long-term solution to the problem of pet waste in the parks litter stream.

## Other organics

'Other organics' for this audit included primarily food waste and liquids. With a range of 15-17%, applied to the 2005 weigh scale data, this category comprises approximately 770-875 tonnes of waste annually. Again, diverting even three-quarters of this material from the parks litter stream would represent a significant gain (+7%) in Parks waste diversion rates.

Similar to pet waste, the means to diverting this waste presents some technical and social challenges, particularly in the (short-term) absence of a green bin program. Again, various options for source separation in parks should be systematically considered, such as in-park composting, collection by a private contractor who processes organics waste, and/or eventual collection through the City's green bin program.

In considering any of these alternatives, however, the quality of the parks organics stream must be better ascertained. 'Other organics' in this audit included not just solid food waste but also liquid waste, such as leftover water or pop in beverage containers. Although no quantitative data was collected on the ratio of solid to liquid waste within this category, it seems probable that this ratio is lower than that seen in residential

organic waste.[28] Whether this would significantly affect the composting process of product quality requires discussion with technical experts in this area.

## Illegally dumped waste

Illegally dumped materials were observed in approximately 20% of all baskets in more than half the parks surveyed. This is a much higher frequency than that suggested by MGM Management in their 2004 surface litter audit, where illegal dumping was only observed in 8% of parks litter baskets based on a visual inspection. However, as became evident during this audit, much illegal dumping in parks baskets was not visible on first inspection, but rather became evident only during the in-container audit. This experience indicates that the best way of quantifying the actual frequency of illegal dumping inside parks baskets is by removing and measuring contents.

By this method, illegally dumped materials were found to comprise approximately 10-15% of the parks litter stream by weight. It should be noted that the 10-15% range may be an underestimate of illegally dumped materials both in baskets and in the total litter stream, due to two methodological problems. First, although based on 585 litter basket samples (including 118 baskets containing illegally dumped materials), this estimate excludes 32 additional baskets where illegal dumping was so evident on first inspection that the baskets were not sampled at all. Had results for these baskets been included, it is likely the overall estimate of illegally dumped materials in the litter stream would have been higher.

Secondly, our estimate is based only on in-basket results, and does not include illegally dumped materials outside of baskets (e.g., construction materials dumped in ravines). While MGM auditors observed evidence of this type of dumping at only 5% of the 204 sites they surveyed (MGM 2004, p.49), operational staff indicate that in some parks there are considerable amounts of these materials. As they are picked up by parks staff and delivered to transfer stations, they add to the total tonnage of waste reported for parks.

[28] This could be verified quantitatively in future audits, by separately measuring solid and liquid organic waste.

Therefore, it is likely inaccurate to apply the 10-15% estimate to the annual weigh scale results. Specific recommendations as to how to address these two methodological problems in future audits are made in the final section of this report (see Design Issues).

While the 10-15% range must be used with caution for the reasons given above, it is still interesting to note how much lower this estimate is compared to the 40% estimate generated in 2002 by Clarke et al., who also looked only at in-basket materials. Some of the difference may be partly explained by the enforcement of Parks anti-dumping bylaws since March of 2005. Some Parks supervisors have observed a decrease in illegal dumping since enforcement began (personal communication, Roger Macklin, fall 2006).[29] If this is the case, the best way to divert illegally dumped waste from the parks litter stream may be to continue enforcing anti-dumping bylaws in parks. Presumably this encourages parks users to dispose of their waste in the appropriate residential (and/or commercial) waste management systems.

Several other findings in this audit may help target ongoing enforcement and education efforts. The very little amount of illegal dumping in recycling baskets (2% by weight) implies that redesigning parks litter baskets to be less accessible to grocery or kitchencatcher bags and/or using clear collection bags may be may be an easy means of further reducing illegal dumping. As cited by McLeod (2006, p.14), the Parks and Recreation Manager for Prince Edward County (eastern Ontario) came to the identical conclusion.

Illegal dumping was found to be more common in the smaller parks in residential areas (Neighbourhood Parks and Parkettes) rather than in the larger parks more oriented to tourists and/or special events (Regional and Destination Parks). This difference is likely attributable to the proximity of housing to Neighbourhood Parks and Parkettes. Field observations also suggested that, in the larger parks, illegally dumped materials were more commonly found in baskets immediately adjacent to parking lots. These observations suggest that baskets that are most conveniently approached from housing

(either on foot or by car) are most vulnerable to illegal dumping. As already successfully implemented by some area supervisors, reducing or removing baskets in locations closest to housing and/or parking lots is likely an effective way to discourage dumping. Increased policing, and signage, may also be most effectively targeted at Neighbourhood Parks and Parkettes, and the parking lots of larger parks.

The question remains as to why people dump household waste in parks baskets. Most of the illegally dumped waste found in the course of this audit was relatively innocuous, containing little or no waste that was particularly hazardous, disgusting, or incriminating. Rather, it was banal residential waste that is readily accepted in normal curbside collection programs. Some possible reasons for disposing of this type of waste in parks might include homelessness, ignorance of normal household waste collection programs, and lack of waste storage space in some households. The latter, in conjunction with the switch to biweekly residual waste collection by the City at the time of the green bin program implementation, is sometimes given by offenders as a rationale for illegal dumping (Moe Cabral, personal communication, September 2006). Parks operational staff also observed a large increase in illegal dumping in parks following the change to biweekly residential waste collection (Environmental Stewards, fall 2006). Eliciting proposed solutions from offenders to waste storage problems might help further refine enforcement and education efforts.

## Non-recyclable plastics and paper

Non-recyclable plastics (7-8%, polystyrene, plastic film, plastic lids, and other plastic packaging) and non-recyclable paper (5-6%, mainly coffee cups and napkins) were the only other two categories that formed a significant portion of the parks litter stream.

Although these categories each formed less than 10% of the litter stream by weight, neither should be dismissed in terms of their importance to parks waste management. Like recyclable plastics and (dry) paper, non-recyclable plastics and paper tend to be large-volume, light-weight materials that fill up collection receptacles and become

surface litter. The number and volume of non-recyclable plastic items that make up 360 tonnes of waste annually (or 7% of annual litter stream) is truly staggering.

While many of these non-recyclable items are likely best diverted through increased producer responsibility programs and/or changes in consumer habits, items such as polystyrene and plastic film are anticipated to become part of the City's recycling program by the end of 2007. In addition, coffee cups, paper napkins, and soiled boxboard or paper plates that form the majority of parks non-recyclable paper waste are relatively compostable materials that may be accepted through some source-separated organics programs and/or the green bin. Again, should a source-separated organics program be implemented in parks, consideration of how the inclusion of such 'brown' items would affect compost process and quality requires more detailed technical assessment.

Other categories such as diapers, non-recyclable metals, textiles, hazardous waste and 'other' contributed less than 10% combined to the litter stream. Diapers (2-3% by weight) were found in only 16% of the litter baskets (96 out of 585), often those located next to playgrounds, wading pools or splash pads. These deserve special mention, because, unlike the other remaining categories, they are (theoretically) divertible through the green bin program.

The only category requiring further comment here is hazardous waste. Excluding pet waste, very little hazardous waste was found in the course of this audit (0.2–0.6 % by weight). Likely the most dangerous items encountered were hypodermic needles, which were found in litter baskets in only three parks (Allan Gardens, Gaffney Park, and Humber Bay East). These were placed in biohazard containers and disposed of at hazardous waste depots. Empty camping-size propane tanks and small (AA and AAA) batteries were the main hazardous materials encountered. Propane tanks were typically found at larger parks where campfires were either permitted or occurred regardless (e.g., Humber Bay). Signage in targeted areas of such parks indicating that propane tanks are in fact hazardous waste may help divert this type of waste out of the parks litter stream.

## *Parks Recycling Stream*

The key results for the parks recycling stream are as follows:

- about two-thirds of the recycling stream is recyclable
- twinned and labeled baskets are 25% less contaminated
- very little illegal dumping was seen in recycling baskets.

Results and recommendations are discussed in detail below.

### Recyclables

Recyclables formed two-thirds of the recycling stream by weight (59–66 %). Beverage bottles (whether glass (21- 28%), plastic (16–21%)), or metal (5–8%)) formed the major recyclable items. This recycling stream characterization stands is sharp contrast to that of public space (street) recycling, where the recycling stream in Eucan and EcoMupi boxes contained 95% recyclables, a very high stream quality (Vibert 2006).

The higher level of stream contamination seen in City of Toronto parks waste relative to street waste is likely due primarily to the fact that, similar to the most successful bin in McLeod's study, the street receptacles in Vibert's study were all effectively twinned and labeled. Labeling made a clear difference to parks recycling stream quality as shown in the results of this audit, with an average 15% increase in percent recyclables in labeled recycling baskets, and, as mentioned above, a 25% increase in percent recyclables between parks recycling bins that were neither labeled nor twinned and those that were both labeled and twinned. In fact, recycling baskets that were neither twinned nor labeled had about as much recyclable as non-recyclable material. The management implications for improving parks recycling stream quality are obvious.

McLeod's results on recycling pilots in eastern Ontario parks are similar to those found here. Recycling receptacles contained 57-90% recyclables, depending on bin design. A

'2-in-1 Signage' bin with litter and recycling receptacles in one labeled unit had the least contamination.[30]

## Organics

Organics formed a surprisingly large component of the recycling stream by weight (17-21%). However, as discussed for the litter stream results, much of the organic portion in the recycling stream likely consisted of water, pop, and juice (i.e., liquids) rather than food waste. In the case of the recycling stream, the liquid proportion is likely even higher than in the litter stream, since much of the recycling stream was made up of beverage bottles which were often not emptied. Indeed, in some cases, full water bottles and pop cans were discarded.

There are several implications for this finding with respect to waste diversion initiatives. The liquids contained in recyclable beverage bottles are likely dispelled during handling and processing in the MRFs, and do not render recyclable materials such as glass and plastic non-recyclable. Nonetheless, they should still be considered a contamination problem insofar as these liquids add weight (and therefore cost in terms of time and fuel) to recyclables loads. Moreover, once released, they may negatively affect processing machinery as well as render some materials, such as paper, non-recyclable. In addition, considerable liquid in the recycling stream artificially elevates waste diversion rates expressed as a quotient of the total tonnage of recyclables over the total tonnage of waste. (That is, weigh-scale data for recyclables loads will include liquid waste, although the liquids themselves are not recyclable).

For all these reasons, as well as the general wastefulness of the practice, parks users should be encouraged to empty their beverage bottles prior to recycling them.[31] One way of communicating this to the general public may be through signage that clearly indicates that beverage bottles must be empty prior to placement in recycling bins.

[30] Notably, steel drums (one of the models for recycling bins in McLeod's study) were found to have the most contamination (p.24).
[31] If a source-separated organics program were implemented in parks, this would help improve the quality of the organics stream as well.

## Non-recyclable plastics and paper

Non-recyclable plastics and non-recyclable paper formed similar proportions of the parks recycling stream as in the litter stream (6.4% and 3.6% respectively, compared to 7.4% and 5.4% in the litter stream). It seems likely that these materials, in particular non-recyclable paper coffee cups, are present in the recycling stream due to public confusion over the acceptability of these materials in the recycling stream. For example, Farmcrest Parkette, the outstanding example for Tim Horton's fast food waste, had about the same number of non-recyclable coffee cups in its litter basket as in its recycling basket (which were twinned, not labeled).

Improved signage and increased education of parks users are likely the main ways to address this type of recycling stream contamination. As well, as discussed under the litter stream, some of these non-recyclable materials will in fact shortly be recyclable.

## Other categories

Non-recyclable metals, textiles, diapers, illegally dumped materials, hazardous waste, and 'other' materials collectively formed less than 10% of the recycling stream by weight. This is a positive indication that parks users seem to clearly understand that pet waste does not belong in recycling bins (and that they are not confusing recycling bin materials with green bin materials).

Illegal dumping was also very rare in recycling bins, seen in only 4% of bins and comprising less than 2% of the recycling stream by weight. This is likely explained by the fact that the recycling basket lid does not permit the passage of full grocery bags, in which illegally dumped materials are typically found. The visibility of the recycling basket contents (contained in a clear bag) may also discourage illegal dumping. These design factors might be considered with respect to physically discouraging illegal dumping in parks litter baskets.

## *Fast Food Waste*

The main fast food waste contributor to parks baskets was Tim Horton's. Consisting primarily of waxed paper coffee cups with polystyrene lids, most of the Tim Horton's brand waste is not recyclable. However, as pointed out above, non-recyclable paper coffee cups can be processed through the green bin. More ideally, coffee consumers would chose to not use disposable coffee cups, and producers could share responsibility for preventing and/or managing the waste generated by their disposable products. This may be an area for future public education, and/or partnership between the City and fast food waste producers.

## *Design Issues*

This is the first year that in-container City of Toronto parks waste has been audited on this scale, and no similar precedents were found in the wider literature. Thus, several methodological and logistical issues require comment such that the audit design and resulting data quality may be improved upon in future years.

### General Approach

The approach taken in this year's audit was to audit waste in each basket individually. This approach permitted analysis of the effects of basket-level variables like twinning and labeling, and had other advantages such as being highly visible to the public, low-tech, and requiring little space or support from operational staff. For these reasons, and other staffing considerations, this was the method of choice for this year's audit.

However, in terms of sampling rate, the basket-by-basket approach in parks is not the most efficient means of obtaining general composition estimates. Using this method, a team of two samplers audited approximately 3-4 baskets per hour, if sampling in good weather conditions in a single park. Average litter basket weight was 4.3 kg while average recycling basket weight was 2.5 kg, which (assuming a 4:1 litter:recycling ratio and a 7 hour workday) gives an average sampling rate of about 100 kg per day per team.

However, this rate varied widely depending on amount of waste in each basket, travel time between baskets and parks, and weather. Sampling rate decreased significantly when sampling in parks with widely spread out baskets (e.g., beltline parks), and parks requiring considerable between-site travel. Poor weather conditions such as extreme heat also decreased sampling rates, and field work was cancelled entirely on three days (in a seven-week period) due to rain. The actual sampling rate was 98 kg per day (2934 kg sampled over 30 audit days), a rate which represents the combined efforts of three full-time and three part-time auditors.

One alternative method would be to sample waste in bulk, either from parks collection trucks or through a separate bulk collection. The main logistical advantages of this method are greatly increased efficiency in terms of amount of waste sampled per unit time, and more controlled sampling conditions. One waste audit consultant (Scott Freiburger, AET Consultants, Inc., personal communication September 2006) gives an estimated rate of 150 kg/ day/ auditor for bulk waste audits, about six times the rate achieved in this audit.

In addition, collection truck samples are likely more representative of the total parks waste stream insofar as they would include several types of parks waste that were excluded from this study. These include surface litter (including illegally dumped materials), special events waste, in-ground container waste, etc..

While the bulk sampling alternative was considered and rejected this year for the reasons given above, it should be reconsidered for future parks waste audits that aim exclusively at obtaining general composition estimates, or that target particular waste streams that are better accessed after collection. Notably, it requires substantively different logistical preparation, including much closer co-operation with Parks and Solid Waste Management Services operational staff such as truck drivers and heavy equipment

operators. Some logistical support for implementing this type of audit may be available through Solid Waste Management Services.[32]

## Site selection

Parks were selected randomly in this study as a means of obtaining a representative city-wide sample set. Although efforts were made to sample parks within the same general area, for parks with few baskets or widely spread-out baskets, this selection method resulted in considerable travel time for relatively little data. Unless parkette or beltline waste composition is of particular interest to managers, it may be desirable from an efficiency point of view to omit these types of parks for auditing. Alternatively, future audits could focus on a single district and sample randomly within that district, rather than city-wide, thus reducing travel time to some degree.

It should be noted that accurate, detailed information on waste management practices in the selected parks would also significantly improve the efficiency of this design. Required information includes an accurate count of recycling and litter baskets in a park (including those with no baskets at all), as well as the day(s) and (approximate) time of collection for both recycling and litter baskets. While some of this information was provided this year by parks supervisors, the quality of the information was uneven. If this information cannot be readily obtained from parks supervisors through a general call, considerable time should be set aside prior to and during the field season for detailed verification for selected parks.

Notably, if information obtained includes designated schedules for recycling collection, parks may have to be visited twice: once to sample litter at its point of maximum accumulation and once to sample recycling at the same point. This would generate more data for the recycling stream, and, in some cases, permit park-by-park generation and recyclables capture rates. (In this year's audit, less recycling stream materials were audited mostly because there were fewer recycling baskets but also because sampling was

[32] Irene Ford, Research Analyst, is currently responsible for SWMS audit co-ordination and provided helpful contacts and information this year when considering a bulk sampling alternative.

timed to the litter collection schedule, such that recycling bins were not visited at their point of maximum accumulation. In addition, recyclables capture rates were not calculated for each park since it could not be assumed that litter and recycling bins were emptied at the same frequency).

## Basket selection

As noted above, accurate information about the number, type, and collection schedule for all baskets in a park would greatly improve the ability of the field team to efficiently sample all the baskets in a given park. Also noted above are modifications that would permit the sampling of locked or otherwise inaccessible collection receptacles that were excluded from this year's audit. This audit also excluded waste collected separately for special events in parks. Since this waste likely forms a significant portion of the overall parks waste stream, a separate audit may be desirable for this waste.

In addition, excluding baskets where illegally dumped materials were immediately visible compromised the quality of the estimates for those materials. For future audits, these baskets should be included, even if it means that a small number of illegal dumping cases cannot be prosecuted. (Alternatively, auditors could be temporarily empowered as bylaw enforcement officers, since they are readily able to collect evidence as they are sorting waste). A study that focuses exclusively on illegal dumping, rather than composition estimates in general, may also provide useful information.

## Waste auditing

Several changes to the sorting categories used for this year may be considered for future audits. As discussed, a separate measurement of solid and liquid organic waste might be useful for future parks waste audits, in order to quantify how much compostable material is actually in parks waste.

Furthermore, in light of frequent changes in what is classified as recyclable in the City of Toronto, a finer sort categorization based on material types rather than current

recyclability may be warranted in future audits. For example, had non-recyclable plastic categories been further split into polystyrene, plastic film, and hard plastic, it would now be possible to project what portion of non-recyclable plastic in parks waste will shortly become recyclable.

Finally, with respect to fast food waste, it would likely be useful to quantify the weight of waste generated by fast food waste contributors such that their contribution can be tied to disposal costs. This was not considered feasible for this year's audit due to the time required to separately sort out and weigh fast food waste. If this issue is important to Parks managers in the future, however, this second sort (or a separate study) could be undertaken. Considering the relative efficiency of bulk sampling, it might be best done in conjunction with a bulk sampling program. Alternatively, if a basket-by-basket approach is again adopted, one possibility would be to conduct this second sort at a limited number of baskets (for example, every 10 baskets).

# 5. Summary of Results and Recommendations

The key findings of this audit are as follows:

- Parks **litter** basket contents are approximately one-quarter recyclable and one-quarter pet waste, with other major components being organics and illegally dumped materials.
- Parks **recycling** basket contents are about two-thirds recyclable, with the other major component being liquid organics (water, juice, and pop). Recycling stream contamination decreased dramatically when baskets were twinned and labeled.
- These results indicate **ample opportunity for increased waste diversion** in parks, most easily through **increased recyclables capture**. Major gains can still be made in this area through improvements to the existing recycling program, such as replacing and twinning litter baskets with labeled recycling baskets, as well as increased public education.
- **Pet waste, other organics,** diapers, and some paper products could also be diverted from both parks litter and recycling streams through a green bin-type source-separated organics program in parks. Although a full-scale SWMS green bin program is not currently available, several options still exist. These include a privately-managed source-separation system or a pack in/ pack out system, in particular for pet waste. Extensive public education and possibly enforcement would likely be required for successful implementation.
- **Illegal dumping** was seen in the majority of the parks sampled, almost exclusively in litter baskets. While the estimate for percent illegally dumped materials should be treated with caution, there is some evidence that bylaw enforcement is reducing the amount of dumping in parks baskets. Litter basket design as well as ongoing enforcement and education, particularly if targeted at residential or car-accessible park areas, may further reduce dumping.
- The top brand-name **fast food waste** contributor to parks litter and recycling baskets, based on a visual estimate, is Tim Horton's.
- **Tables 11** and **12** below summarize results and recommendations for each stream.

**Table 11 Summary or results and recommendations for parks litter stream**

| **Material Category** | **% Range** *(2006 data)* | **Recommended tactics** |
|---|---|---|
| **Recyclables** | 24-28% | • Divert through existing recycling program<br>• Install more recycling baskets and/or replace litter baskets with recycling baskets, especially in West district parks<br>• Ensure litter baskets are twinned with recycling baskets<br>• Label all recycling baskets and keep label updated to current acceptable materials<br>• Increase public education and outreach in parks |
| **Pet Waste** | 23-27% | • Treat pet waste as illegally dumped household waste OR<br>• Research and assess feasibility of various source-separation strategies in parks, then implement<br>• Extensive public education and/or enforcement |
| **Other Organics** | 15-17% | • Verify solid:liquid ratio<br>• Encourage public to not dispose of liquids in parks baskets<br>• Research and assess feasibility of various source-separation options in parks |
| **Illegally Dumped Materials** | 10-15% | • Continue bylaw enforcement<br>• Target signage and/or remove baskets in 'high-risk' areas<br>• Redesign litter baskets<br>• Verify estimates through improved study design |
| **Non-recyclable plastics** | 7-8% | • Divert polystyrene and plastic film into recycling program as of late 2007<br>• Update recycling labels accordingly<br>• Possible partnership with fast food waste contributors |
| **Non-recyclable paper** | 4-6% | • Divert soiled paper food packaging to source-separation organics program if/when available<br>• Public education<br>• Possible partnership with fast food waste contributors |
| **Diapers** | 2-3% | • In targeted areas, divert to green bin if/when available<br>• Public education |
| **Other** | 4-5% | • Install targeted signage (e.g. for propane tanks) |

**Table 12 Summary of recommendation for parks recycling stream**

| Material Category | % Range *(2006 data)* | Recommended tactics |
|---|---|---|
| **Recyclables** | 59-66% | • Continue to divert through existing recycling program<br>• Install more recycling baskets and/or replace litter baskets with recycling baskets, especially in West district parks<br>• Twin litter and recycling baskets<br>• Label all recycling baskets<br>• Public education |
| **Other Organics** | 17-21% | • Verify solid:liquid ratio<br>• Encourage/educate parks users to empty all liquids prior to disposal<br>• Divert solids to appropriate source-separated program |
| **Non-recyclable plastic** | 6-7% | • Divert polystyrene and plastic film into recycling program as of late 2007<br>• Update recycling labels accordingly<br>• Possible partnership with fast food waste contributors |
| **Non-recyclable paper** | 3-4% | • Divert soiled paper food packaging to source-separation organics program if/when available<br>• Public education<br>• Possible partnership with fast food waste contributors |
| **Other** | <10% | |

Finally, some of the following design modifications may be considered, subject to clarification from Parks managers on their priority information needs.

Improvements in waste audit efficiency can be obtained by:

- Bulk sampling (for general composition estimates only)
- More accurate and detailed information on parks waste management variables
- Limiting the geographic scale of the audit

Improvements in audit data quality (precision and representativeness) can be obtained by:

- Bulk sampling from collection trucks to include all waste that goes through transfer stations (e.g. in-ground containers, surface litter)
- Sampling all baskets in including those where illegally dumped materials visible on first inspection
- Weighing solid and liquid organic waste separately
- Finer sort categories based on material rather than recyclability

Additional studies that could be considered include:

- Parks user surveys on waste management knowledge and attitudes
- Study that focuses exclusively on illegal dumping (quantity and management strategies)
- Quantification of fast food waste contribution to park waste
- Special events waste composition
- Park-by-park generation and recyclable capture rates.

# 6. References

Clarke, Sophia. Waste Analysis in Parks. Parks Quality Assurance, City of Toronto. October 2002.

Jones, Carolyn. "Powered by Pooches: Rather than let pet dung go to waste, experts explore its energy potential". *San Francisco Chronicle* February 21, 2006.

LEES and Associates Landscape Architects. Dealing with Dog Waste in Vancouver Parks: Preliminary Research for Dog Waste Composting in Everett Crowley Park. Available on-line at: http://www.city.vancouver.bc.ca/parks/info/planning/everettcrowleymgmtplan/pdf/report_dogfeces_compost.pdf#search=%22dog%20waste%20management%20parks%22

McLeod, Chris. "Recycle Away": Public Park, Sports Field and Arena Recycling. For Quinte Waste Solutions, Waste Diversion Ontario and Stewardship Ontario (Effectiveness and Efficiency Fund Project Number 44, Final Report). February 2006.

MGM Management. The City of Toronto Parks Litter Audit 2004. Prepared for Economic Development, Culture and Tourism Division and Works and Emergency Services, Solid Waste Management Services Division. November 2004.

Read, Andrew D. "Public Education Campaigns and the Recycling Message what do the public think of recycling and do they want to do it?" Abstract for *Session 1: Recycling and Organic Waste Management* of the "Towards the future Waste in the 21st century" conference, Northampton, UK. February 2001. Available on-line at http://www.letsrecycle.com/features/feature.jsp?story=293#1-2

Stewardship Ontario. Guide for Single-Family Waste Audits, September 2005. Available on-line at http://www.stewardshipontario.ca/pdf/eefund/waste_audit_guide2005_sf.pdf#search=%22stewardship%20ontario%20audit%20guide%22

Ursery, Stephen. "Power of Poop". *Waste Age* 37 (3): 4. May 2006.

Vibert, Kevin. Memorandum: Waste audit results on Eucan recycling/litter bins. Solid Waste Management Services, City of Toronto. May 2006.

# Appendices

## *Appendix A  Field Data Sheets*

**Basket Data Sheet (1 per park)**

**Park:**

**Date:**

| Basket # | Litter or Recycling (L or R) | Twinned (Y or N) | Labeled (Y or N) | Illegal Dumping visible on first inspection (Y or N, describe) | Location<br>1. Mark basket # on Map<br>2. Use one of the following categories: parking lot, sidewalk, internal path, sportsfield, picnic area, dog area, bench, other (describe) | Model (oil drum, mesh basket, other (describe) |
|---|---|---|---|---|---|---|
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**Basket Summary:**

| | Total # | % |
|---|---|---|
| Total Baskets | | |
| Litter Baskets | | |
| Recycling Baskets | | |
| Baskets where illegal dumping visible | | |

**Other park observations: (description of area or main user activities, etc., bins not as expected, etc.)**

**Public Interactions While in Park: (# people, age, comments made or questions asked, etc.)**

**Waste Composition Data Sheet – Basket Samples**

| Park: | | Samplers: | | | |
|---|---|---|---|---|---|
| Date: | | | | | |
| Collection Days: | | | | | |
| Waste stream (R or L): | | | | | |
| Basket #: | | | | | |
| Time: | | | | | |
| Bulk weight (kg): | | | | | |
| **Recyclable items** | | | | | |
| Glass (kg) | | | | | |
| Paper (kg) | | | | | |
| Plastic(kg) | | | | | |
| Metal (kg) | | | | | |
| **Non-recyclables** | | | | | |
| Paper (kg) | | | | | |
| Plastic (kg) | | | | | |
| Metal (kg) | | | | | |
| Textiles (kg) | | | | | |
| Pet Waste (kg) | | | | | |
| Other Organics (kg) | | | | | |
| Diapers (kg) | | | | | |
| Illegally Dumped waste (describe, kg) | | | | | |
| Hazardous Waste (describe, kg) | | | | | |
| Other (describe, kg) | | | | | |
| | | | | | |
| | | | | | |
| Total weight (add, kg) | | | | | |
| **Fast food waste** | | | | | |
| Top Contributor (name) | | | | | |
| Major Items (describe) | | | | | |
| Majority Recyclable (Y or N) | | | | | |
| Special Notes (wet waste, sorting problems, Parks supervisor notified, etc.) | | | | | |

## *Appendix B List of Materials Below Scale Detection Limits*

| **Item** | **Mass (kg)** |
|---|---|
| 1 glass bottle, Nestea, no lid | 0.272 |
| Metal lid to above mottle | 0.004 |
| 1 500 mL plastic water bottle, no lid | 0.017 |
| Plastic lid to above bottle | 0.002 |
| 1 metal pop can | 0.014 |
| 1 AA battery | 0.018 |
| 1 Tim's large coffee cup, no lid | 0.013 |
| 1 lighter, half-full | 0.015 |
| Other items not weighed/ below detection limit of scale | 0.005 (50% of advertised detection limit) |

## *Appendix C List of All Parks Sampled*

| Map # | Park | District | Ward | Parks Classification[33] | Number of Litter Baskets | Number of Recycling Baskets |
|---|---|---|---|---|---|---|
| **1** | Alamosa Park | N | 33 | N | 1 | 0 |
| **2** | Allan Gardens Greenhouse | S | 27 | R | 27 | 5 |
| **3** | Ames Park | N | 25 | N | 1 | 0 |
| **4** | Arlington Park | S | 27 | N | 1 | 1 |
| **5** | Avenue Road Playground | S | 22 | N | 1 | 0 |
| **6** | Balfour Park, David A. | S | 27 | R | 15 | 2 |
| **7** | Bell Manor Park (WP &SP) | W | 5 | N | 3 | 0 |
| **8** | Beltline Linear Park, Kay Gardner | S | 21 | R | 7 | 0 |
| **9** | Bessarion Parkette | N | 24 | P | 1 | 0 |
| **10** | Bike Path Don Mills to Riverdale Bridge | S | 31 | R | 11 | 0 |
| **11** | Bisset Park | W | 5 | N | 1 | 0 |
| **12** | Bond Park | N | 25 | R | 10 | 17 |
| **13** | Botany Hill Park | E | 43 | N | 5 | 2 |
| **14** | Brandon Avenue Parkette | W | 17 | P | 1 | 0 |
| **15** | Broadlands Park | N | 34 | N | 5 | 0 |
| **16** | Brookbanks Park | N | 34 | N | 19 | 0 |
| **17** | Campbell Avenue Playground | S | 18 | N | 2 | 5 |
| **18** | Carlton Park | S | 18 | N | 2 | 3 |
| **19** | Carsbrook Park | W | 3 | N | 3 | 0 |
| **20** | Casa Loma Parkette | S | 21 | P | 1 | 0 |
| **21** | Cataraqui Park | E | 35 | N | 2 | 0 |
| **22** | Cayuga Park | W | 11 | N | 2 | 0 |
| **23** | Cenotaph | E | 36 | N | 1 | 0 |
| **24** | Centennial Park E | E | 44 | N | 3 | 3 |
| **25** | Chalkfarm Park | W | 7 | N | 9 | 1 |
| **26** | Charles Sauriol C. A. | N | 31 | R | 6 | 0 |
| **27** | Charlton Park | N | 23 | N | 2 | 0 |
| **28** | Chartwell Park | E | 41 | N | 2 | 3 |
| **29** | Chesterton Shores | E | 44 | N | 1 | 0 |
| **30** | Christie Pits Park | S | 19 | N | 31 | 24 |
| **31** | Cloud Gardens Park | S | 28 | N | 6 | 0 |
| **32** | Clovercrest Parkette | N | 33 | P | 1 | 0 |

[33] D = Destination, R = Regional, N = Neighbourhood, and P= Parkette.

| Map # | Park | District | Ward | Parks Classification | Number of Litter Baskets | Number of Recycling Baskets |
|---|---|---|---|---|---|---|
| **33** | Coe Hill Drive Parkette | W | 13 | P | 1 | 0 |
| **34** | College Park | S | 27 | N | 15 | 1 |
| **35** | Columbus Parkette | W | 14 | N | 1 | 1 |
| **36** | Connorvale Park | W | 6 | R | 11 | 2 |
| **37** | Cornell Park | E | 43 | N | 3 | 0 |
| **38** | Dallington Park | N | 33 | N | 3 | 0 |
| **39** | Dane Parkette | N | 15 | P | 2 | 2 |
| **40** | Danforth Gardens Park | E | 35 | N | 2 | 0 |
| **41** | De Grassi Street Parkette | S | 30 | N | 1 | 0 |
| **42** | Dempsey Park | N | 23 | N | 6 | 0 |
| **43** | Devonian Square (Ryerson Com. Park) | S | 27 | P | 7 | 0 |
| **44** | Dunn Avenue Parkette | S | 14 | P | 1 | 1 |
| **45** | Duplex Parkette | N | 16 | P | 2 | 0 |
| **46** | East Mall Park | W | 5 | N | 4 | 0 |
| **47** | Eastdale Parkette & Guard Rail | S | 31 | P | 1 | 0 |
| **48** | Ecology Park | S | 20 | N | 2 | 2 |
| **49** | Eighth St Park | W | 6 | N | 1 | 0 |
| **50** | Elkhorn Parkette | N | 24 | P | 1 | 0 |
| **51** | Ellesmere Park/Ravine | E | 43 | N | 8 | 5 |
| **52** | Elmcrest Park | W | 3 | N | 1 | 0 |
| **53** | Erwin Krickhahn Park | S | 18 | N | 1 | 1 |
| **54** | Etobicoke Valley Park | W | 6 | R | 12 | 5 |
| **55** | Farmcrest Parkette | E | 40 | P | 1 | 1 |
| **56** | Fenside Park | N | 34 | N | 6 | 1 |
| **57** | Fiona Nelson Park (Imperial) | S | 22 | P | 1 | 0 |
| **58** | Flemington West Park | N | 15 | N | 3 | 0 |
| **59** | Fundy Bay Park | E | 39 | N | 3 | 2 |
| **60** | Gaffney Park | W | 11 | N | 5 | 0 |
| **61** | Garden Ave Parkette | E | 41 | P | 1 | 1 |
| **62** | Godstone Park | N | 33 | N | 4 | 1 |
| **63** | Grafton Avenue Park | S | 14 | N | 1 | 1 |
| **64** | Guildwood Park ( Guild Inn) | E | 43 | D | 29 | 5 |
| **65** | Gwendolyn Macewen Parkette | S | 20 | N | 1 | 0 |
| **66** | Heath Street Subway | S | 21 | P | 1 | 0 |
| **67** | Heron Tennis Field House | E | 44 | R | 2 | 1 |
| **68** | Hidden Trail Park | N | 10 | N | 3 | 0 |

| Map # | Park | District | Ward | Parks Classification | Number of Litter Baskets | Number of Recycling Baskets |
|---|---|---|---|---|---|---|
| **69** | Horsham Parkette | N | 23 | P | 3 | 0 |
| **70** | Humber Bay East | W | 6 | D | 37 | 4 |
| **71** | Humber Bay Shores | W | 6 | D | 20 | 0 |
| **72** | Humber Bay West | W | 6 | D | 59 | 0 |
| **73** | Indian Mount Parkette | S | 14 | N | 1 | 0 |
| **74** | Iroquios Park | E | 41 | N | 5 | 5 |
| **75** | Joshua Cronkrite Parkette | S | 31 | N | 2 | 0 |
| **76** | Kinsdale Park | W | 5 | N | 1 | 0 |
| **77** | La Rose Park | W | 4 | N | 3 | 0 |
| **78** | Langdale Court G.B. | N | 8 | N | 2 | 0 |
| **79** | Lenford Park | W | 6 | N | 7 | 0 |
| **80** | Long Branch Park | W | 6 | R | 5 | 1 |
| **81** | Lucy Maud Montgomery Parkette | W | 13 | P | 1 | 0 |
| **82** | Lytton Park | N | 16 | N | 5 | 1 |
| **83** | MacGregor Playground | S | 18 | N | 6 | 3 |
| **84** | Maher Circle | W | 13 | P | 1 | 0 |
| **85** | Manhattan Park | E | 37 | N | 3 | 3 |
| **86** | Megan Park | E | 44 | N | 3 | 1 |
| **87** | Moore Park | N | 23 | N | 5 | 2 |
| **88** | Morningside Park | E | 43 | D | 64 | 11 |
| **89** | Mossgrove Park | N | 25 | N | 3 | 0 |
| **90** | Noble Park | W | 11 | N | 4 | 0 |
| **91** | North Park | W | 12 | N | 1 | 1 |
| **92** | Oakdale Park | N | 8 | N | 4 | 3 |
| **93** | Oriole Park | N | 33 | N | 4 | 4 |
| **94** | Ormskirk Park | W | 13 | N | 1 | 0 |
| **95** | Peter Secor Park | E | 44 | N | 2 | 0 |
| **96** | Plowshare | W | 1 | N | 2 | 0 |
| **97** | Point Rouge Trail Park | E | 42 | N | 1 | 1 |
| **98** | Poplar Park | E | 43 | N | 6 | 2 |
| **99** | Port Union RC Park | E | 44 | N | 4 | 1 |
| **100** | Princess Margaret | W | 4 | N | 1 | 0 |
| **101** | Rajah Park | N | 15 | N | 2 | 1 |
| **102** | Rean Park | N | 24 | N | 5 | 0 |
| **103** | Regents Park | E | 35 | N | 3 | 2 |
| **104** | Roncesvalles Public Library | S | 14 | P | 1 | 0 |

| Map # | Park | District | Ward | Parks Classification | Number of Litter Baskets | Number of Recycling Baskets |
|---|---|---|---|---|---|---|
| **105** | Rosethorn Park | W | 4 | N | 4 | 1 |
| **106** | Rosevalley Park | W | 11 | P | 1 | 0 |
| **107** | Sandown Parkette | E | 36 | N | 2 | 2 |
| **108** | Silverhill Park | W | 5 | N | 1 | 0 |
| **109** | Sir Winston Churchill Park | S | 22 | R | 11 | 2 |
| **110** | Spencer-Cowan Parkette | S | 14 | P | 2 | 1 |
| **111** | St. Clair Gardens | W | 17 | P | 2 | 1 |
| **112** | St. Clair Ravine | E | 35 | N | 1 | 0 |
| **113** | Stewart A. (Sandy) MacGregor Parkette | N | 16 | P | 1 | 0 |
| **114** | Stratford Park | N | 25 | N | 3 | 0 |
| **115** | Sumach-Shuter Parkette | S | 28 | N | 3 | 0 |
| **116** | Summerlea Park | W | 2 | R | 20 | 6 |
| **117** | The Mission Ground Parkette | S | 22 | P | 1 | 0 |
| **118** | Toronto Inukshuk Park | S | 19 | R | 2 | 0 |
| **119** | Trace Manes Park | N | 26 | N | 8 | 4 |
| **120** | Wallace C. Swanek (Gary Park) | W | 11 | N | 4 | 3 |
| **121** | Wayne Ave | E | 37 | P | 1 | 0 |
| **122** | Wenderley Park | N | 15 | N | 3 | 2 |
| **123** | West Rouge Park | E | 44 | N | 3 | 1 |
| **124** | Westlake Park | W | 11 | N | 4 | 0 |
| **125** | Wishing Well Woods | E | 40 | N | 2 | 2 |
| **126** | Woodsworth Park | E | 38 | N | 2 | 0 |
| | | | | **TOTAL** | **688** | **170** |

## *Appendix D List of Parks with Suspected or Actual Illegal Dumping*

| Park | District | Ward | Parks Classification | Suspected Illegal (No. of baskets) | Actual Illegal (No. of baskets) |
|---|---|---|---|---|---|
| Allan Gardens Greenhouse | S | 27 | R | | 7 |
| Arlington Park | S | 27 | N | 1 | |
| Avenue Road Playground | S | 22 | N | | 1 |
| Balfour Park, David A. | S | 27 | R | 1 | |
| Beltline Linear Park, Kay Gardner | S | 21 | R | | 3 |
| Bessarion Parkette | N | 24 | P | | 1 |
| Bike Path Don Mills to Riverdale Bridge | S | 31 | R | | 2 |
| Bond Park | N | 25 | R | 1 | 1 |
| Botany Hill Park | E | 43 | N | | 4 |
| Brandon Avenue Parkette | W | 17 | P | | 1 |
| Broadlands Park | N | 34 | N | | 1 |
| Brookbanks Park | N | 34 | N | 1 | 10 |
| Carsbrook Park | W | 3 | N | | 1 |
| Cayuga Park | W | 11 | N | | 1 |
| Cenotaph | E | 36 | N | | 1 |
| Centennial Park E | E | 44 | N | | 2 |
| Chalkfarm Park | W | 7 | N | 2 | 1 |
| Charlton Park | N | 23 | N | | 1 |
| Chartwell Park | E | 41 | N | | 1 |
| Christie Pits Park | S | 19 | R | | 10 |
| College Park | S | 27 | N | | 1 |
| Columbus Parkette | W | 14 | N | | 1 |
| Connorvale Park | W | 6 | R | 1 | |
| Cornell Park | E | 43 | N | 1 | 1 |
| Dallington Park | N | 33 | N | | 1 |
| Dane Parkette | N | 15 | P | | 1 |
| Dempsey Park | N | 23 | N | | 2 |
| Devonian Square (Ryerson Com. Park) | S | 27 | P | 1 | |
| Dunn Avenue Parkette | S | 14 | P | | 1 |
| East Mall Park | W | 5 | N | 1 | 1 |
| Ecology Park | S | 20 | N | | 2 |
| Erwin Krickhahn Park | S | 18 | N | | 1 |

| Park | District | Ward | Parks Classification | Suspected Illegal (No. of baskets) | Actual Illegal (No. of baskets) |
|---|---|---|---|---|---|
| Etobicoke Valley Park | W | 6 | R | | 2 |
| Flemington West Park | N | 15 | N | 1 | 2 |
| Fundy Bay Park | E | 39 | N | 3 | |
| Gaffney Park | W | 11 | N | | 2 |
| Garden Ave Parkette | E | 41 | P | | 1 |
| Godstone Park | N | 33 | N | | 2 |
| Grafton Avenue Park | S | 14 | N | | 1 |
| Guildwood Park ( Guild Inn) | E | 43 | D | | 2 |
| Gwendolyn Macewen Parkette | S | 20 | N | | 1 |
| Humber Bay East | W | 6 | D | | 3 |
| Humber Bay Shores | W | 6 | D | 1 | 4 |
| Humber Bay West | W | 6 | D | | 2 |
| Iroquios Park | E | 41 | N | 1 | 3 |
| Joshua Cronkrite Parkette | S | 31 | N | | 1 |
| Langdale Court G.B. | N | 8 | N | 1 | |
| Long Branch Park | W | 6 | R | | 2 |
| Lucy Maud Montgomery Parkette | W | 13 | P | | 1 |
| Lytton Park | N | 16 | N | | 1 |
| Megan Park | E | 44 | N | | 1 |
| Morningside Park | E | 43 | D | 4 | 3 |
| Mossgrove Park | N | 25 | N | | 1 |
| Noble Park | W | 11 | N | | 2 |
| North Park | W | 12 | N | 1 | |
| Oakdale Park | N | 8 | N | | 1 |
| Ormskirk Park | W | 13 | N | | 1 |
| Port Union RC Park | E | 44 | N | | 1 |
| Rajah Park | N | 15 | N | | 2 |
| Regents Park | E | 35 | N | | 2 |
| Rosethorn Park | W | 4 | N | 1 | |
| Sandown Parkette | E | 36 | N | 1 | |
| Silverhill Park | W | 5 | N | 1 | |
| Sir Winston Churchill Park | S | 22 | R | | 1 |
| Spencer-Cowan Parkette | S | 14 | P | | 2 |
| St. Clair Gardens | W | 17 | P | | 2 |
| Stewart A. MacGregor Parkette | N | 16 | P | 1 | |
| Stratford Park | N | 25 | N | | 2 |

| Park | District | Ward | Parks Classification | Suspected Illegal (No. of baskets) | Actual Illegal (No. of baskets) |
|---|---|---|---|---|---|
| Summerlea Park | W | 2 | R | 1 | 5 |
| The Mission Ground Parkette | S | 22 | P | 1 | |
| Trace Manes Park | N | 26 | N | 3 | 2 |
| Wayne Ave | E | 37 | P | | 1 |
| Wenderley Park | N | 15 | N | | 1 |
| West Rouge Park | E | 44 | N | 1 | 1 |
| Wishing Well Woods | E | 40 | N | | 2 |
| **TOTALS** | | | | **32** | **124** |

## *Appendix E – Photos*



**<u>Photos 1, 2, and 3</u>: Parks litter baskets.** Steel mesh litter basket with black plastic bag (left), steel mesh litter basket without bag (centre), steel drum (right).


**<u>Photos 4, 5, and 6:</u> Parks recycling containers.** Blue steel mesh basket with clear bag (left), in-ground container (centre), large blue toter (right).


**Photo 7: Parks recycling containers.** Recycling basket with stickers showing acceptable materials on lid.


**Photo 8: Waste audit methods.** Weighing in bulk using a digital fishing scale.

**Photo 9: Waste audit methods.** Sorting waste into categories on a tarp using tongs.

**Photo 10: Waste Audit Methods.** Weighing sorted waste and recording data.


**<u>Photos 11, 12, and 13:</u> Typical recyclable parks waste.** Recyclable paper (left), plastic (centre), and metal (right).

**<u>Photos 14 and 15:</u> Typical non-recyclable parks waste.** Pet waste (left), non-recyclable paper and plastic fast food waste (right).

**<u>Photos 16, 17 and 18:</u>  Other non-recyclable parks waste.** Non-recyclable metal (left), hazardous waste (centre), and diapers (right).