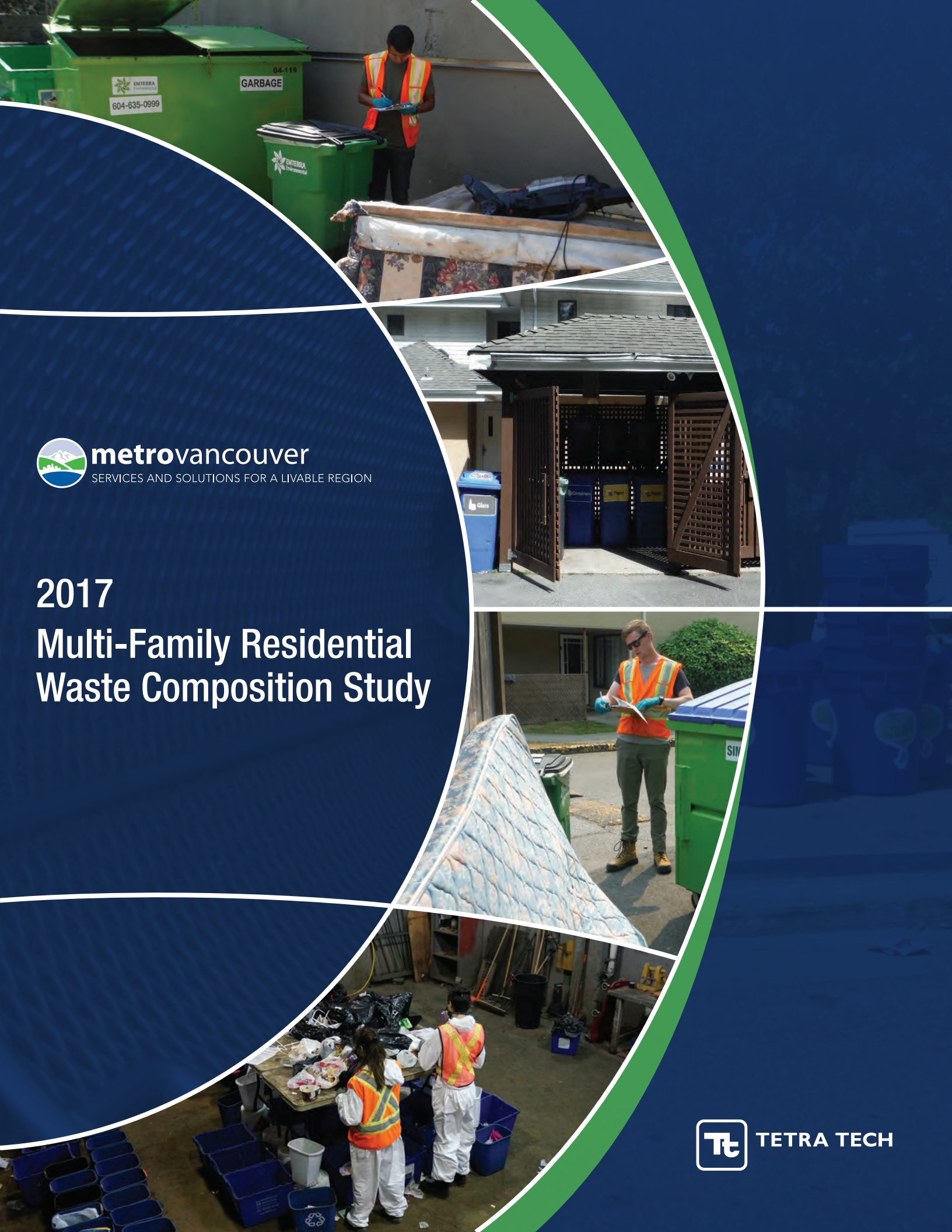




metrovancover

SERVICES AND SOLUTIONS FOR A LIVABLE REGION

2017 Multi-Family Residential Waste Composition Study



TETRA TECH

Acknowledgements

The project team would like to thank all the staff from Vancouver South Transfer Station and Metro Vancouver Regional District for their participation in the Waste Composition Study and their cooperation to make the sorting and field work safe and successful. The project team would like to thank the following individuals who were part of the field team who completed the waste sorting including:

- Ainie Gan;
- Anthony Steele;
- Brian Hendry.
- Isabella Johnson;
- Kylie Kerik;
- Laura McPhedran;
- Nathan Mazur;
- Noa Sison; and
- Sofia Leith.

Additionally, the project team would like to thank all building managers and representatives that agreed to have their garbage, recycling, and organics analyzed as a part of this study.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by Metro Vancouver to complete the 2017 Multi-Family Residential Waste Composition Study. The purpose of this study was to characterize the garbage, recycling, and organics streams from multi-family (MF) buildings and provide disposal or recycling rate estimates for each stream.

One hundred samples were analyzed from multi-family buildings across Metro Vancouver. Buildings were selected for this study to represent the distribution of buildings in the region. Parameters for representation included building type (high rise, low rise, townhouse), unit ownership type (condominiums, rental units, mixed), and characteristics of disposal and recycling areas.

Garbage Results

The largest component of garbage was compostable organics (38%), followed by paper (16%), plastic (15%), and household hygiene (15%).

The calculated disposal rate was 212 kg per capita overall. This tended to be highest in high rise buildings and buildings composed of rental units. The disposal rate tended to be lowest in townhouses and buildings composed of condominiums.

Building performance was assessed based on the proportion of the garbage that could have been diverted. In townhouses, the disposed waste stream contained the lowest proportions of organics and recyclables and the highest proportion of garbage. In contrast, the disposed waste stream in high rise buildings contained the highest proportion of recyclables and depot drop-off materials and the lowest proportion of garbage.

Recycling Results

The largest component of multi-family recycling was paper (53%), followed by cardboard (24%) and recyclable glass (7%). Overall, 5% of materials in the recycling stream were considered contamination; thus, 95% of the recycled material could be recycled within existing recycling systems.

Seventy-three samples were from buildings with multi-stream recycling systems and 27 samples were from buildings with single-stream recycling systems. The overall rate of contamination in buildings with single-stream systems was more than triple that of buildings with multi-stream systems (11% compared to 3%). However, the multi-stream recycling rate was lower (77 kg per capita) than the single-stream recycling rate (99 kg per capita). Overall, the recycling rate was 82 kg per capita.

Organics Results

Ninety-four of the 100 buildings analyzed had organics collection. The organics mostly consisted of food waste (89%). A small amount of compostable paper (6%) and yard waste (4%) was found. Contamination in the organics stream was 2% by weight. Overall, the organics recycling rate was 35 kg per capita.

Accessibility Criteria

The following accessibility criteria generally correlated with decreased contamination in recycling and organics:

- Improved cleanliness and lighting of the garbage, recycling, and organics areas;
- Improved security from vectors (rain and wind, birds, rodents, etc.);
- Improved security from unlawful entry; and
- Improved signage.

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	1
1.1 Background.....	1
1.2 Scope of Work.....	2
2.0 METHODOLOGY AND WORK PLAN	4
2.1 Recruitment and Phone Survey	4
2.2 Site Assessment.....	5
2.2.1 Building Assessment Methodology	5
3.0 GARBAGE RESULTS.....	7
3.1 Overall Waste Composition Results	7
3.1.1 Waste Composition	7
3.2 Waste Composition Results Analysis	7
3.2.1 Building Type	8
3.2.2 Unit Ownership.....	8
3.3 Special Interest Categories	9
3.3.1 Textiles.....	9
3.3.2 Expanded Polystyrene	10
3.4 Disposal Rate.....	11
3.5 Historical Composition Comparison	12
4.0 RECYCLING AND ORGANICS RESULTS.....	14
4.1 Recycling Results	14
4.1.1 Material Composition	14
4.1.2 Recycling Contamination Rates	18
4.1.3 Recycling Rates	19
4.2 Organics Results	20
4.2.1 Organics Material Composition	20
4.2.2 Organics Recycling Rate.....	21
5.0 MATERIAL DIVERSION PERFORMANCE	22
5.1 Garbage Composition Performance	22
5.2 Recycling and Organics Contamination Performance.....	24
6.0 CLOSURE.....	26

LIST OF TABLES IN TEXT

Table 1-1: Sample Distribution	3
Table 3-1: Waste Composition by Building Type ¹	8
Table 3-2: Waste Composition by Unit Ownership Type ¹	9
Table 3-3: Textile Composition of the Waste Stream	10

Table 3-4: Expanded Polystyrene Products Composition of the Waste Stream	11
Table 4-1: Number of Samples by Recycling Type and Stream	14
Table 4-2: Composition in Multi-Stream Buildings by Stream ¹²	16
Table 4-3: Composition in Single-Stream Buildings by Stream ¹²	17
Table 4-4: Non-Recyclable Materials and Improperly Recycled Materials in Recycling ¹	18
Table 4-5: Recycling Rate by Stream ¹	19
Table 5-1: Divertable Category Descriptions	23
Table 5-2: Accessibility Criteria Correlations to Recycling and Organics Contamination	25

LIST OF FIGURES IN TEXT

Figure 1: Geographical Sub-Region Map	2
Figure 2: Overall Waste Composition (N=100)	7
Figure 3: Disposal Rate by Unit Ownership Types (left); Disposal Rate by Building Type (right)	12
Figure 4: Historical Comparison ¹	13
Figure 5: Overall Recycling Composition (N=100)	15
Figure 6: Overall Recycling Composition for Multi-Stream Recycling (N=73)	16
Figure 7: Recycling Composition for Single-Stream Recycling (N=27)	17
Figure 8: Food Waste and Mixed Organics Composition (N=94)	21

APPENDIX SECTIONS

TABLES

Table A	Waste Categories
Table B	Overall Recycling Results by Recycling System and Stream
Table C	Organics Results

APPENDICES

Appendix A	Tetra Tech's Limitations on the use of this Document
Appendix B	Initial Form Email
Appendix C	Phone Survey Questions
Appendix D	Accessibility Criteria
Appendix E	Site Assessments and Sorting Photos
Appendix F	Density Reference
Appendix G	Recycling and Organics Categories
Appendix H	Sample Photos
Appendix I	Category Photos
Appendix J	Garbage Categories
Appendix K	Accessibility Factors' Influence on Recycling Contamination
Appendix L	Historical Data Comparison
Appendix M	Site Assessment Form
Appendix N	Data Analysis Methodology
Appendix O	Results with Confidence Levels

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
EPR	Extended Producer Responsibility
EPS	Expanded Polystyrene
MF	Multi-Family
PPP	Packaging and Printed Paper
U.S. EPA	United States Environmental Protection Agency

DEFINITIONS

Term	Definition
Condominium	A building (or complex of buildings) containing individually owned apartments or townhouses.
Contamination	Refers to non-recyclable materials which were placed into recycling bins or non-organic materials that were placed into organics bins. Does not include materials that were improperly recycled (i.e. placed in the wrong recycling bin).
Depot Drop-Off	Refers to all materials which could have been recycled via depot drop-off, except PPP materials which are accepted in Recycle BC's collection program. This includes all EPR materials and metal.
Disposal Rate	Refers to the rate at which materials were disposed in the landfill stream.
Extended Producer Responsibility	Refers to programs that govern material management in which it is the producer's responsibility for reducing environmental impact and managing the product throughout its entire life cycle.
High Rise	A building with five or more storeys. This is in accordance with Statistics Canada's definition of an apartment with five or more storeys.
Low Rise	A building with less than five storeys. This is in accordance with Statistics Canada's definition of an apartment with less than five storeys.
Multi-Family	Multi-family residential housing refers to a situation in which multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex. For the purpose of this report, townhouses are included in multi-family residential housing only if they receive shared garbage collection.
Multi-Stream	Refers to a recycling system in which the mixed containers are collected separately from the mixed paper are combined. This type of recycling system may have a bin for glass and/or cardboard.
Organics	Refers to materials in the organics recycling streams labelled either 'food waste' or 'mixed organics'.
Organics Recycling Rate	Refers to the rate at which organics were recycled in the organics recycling stream.
Packaging and Printed Paper	Refers to materials that are collected by Recycle BC's collection program.
Recyclables	Refers to materials that could have been recycled in a cardboard or packaging and printed paper recycling stream. Does not include materials that could have been recycled at a depot.
Recycling Rate	Refers to the rate at which materials were recycled in the packaging and printed paper and cardboard recycling streams.
Rental Units	A building (or complex of buildings) which contain units that are purposely built to be rented out to tenants. This does not include condominium units that may be rented out.
Single-Stream	Refers to a recycling system in which the mixed containers and mixed paper are combined. This type of recycling system may have a bin for glass and/or cardboard.
Stream	Refers to the types of garbage, recycling, and organics available, such as 'landfill', 'mixed containers', or 'glass'.
Yard Waste	Refers to organic materials that are typically disposed during landscaping or yard care, such as grass, leaves, branches, etc.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Metro Vancouver and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Metro Vancouver, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech Canada Inc.'s Services Agreement. Tetra Tech's General Conditions are provided in Appendix A of this report.

NOTE TO THE READER

The samples collected and audited for this study are "snapshots" in time, meaning the reported quantities are estimates and only represent the conditions for the period of time in which they were collected. Seasonal and annual variability, weather, and other factors can affect the amount and composition of waste and recyclables generated by the various sectors at any given time. Even with combined educational, regulatory and financial initiatives the reader should not assume that it is necessarily easy, practical, or economical to recover a substantial portion of a disposed material from a mixed waste stream or at its source.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by Metro Vancouver to complete the 2017 Multi-Family Residential Waste Composition Study. The purpose of this study was to characterize the garbage, recycling, and organics streams from multi-family (MF) buildings and provide a disposal rate estimate and recycling rate estimate for packaging and printed paper (PPP) and organic materials. Buildings were selected for this study to represent the distribution of buildings in the region. Parameters for representation included building type (high rise, low rise, townhouse), unit ownership type (condominiums, rental units, mixed), and building characteristics.

Recycle BC contributed funding to this project. Recycle BC is the non-profit organization responsible for residential packaging and printed paper recycling throughout British Columbia. Recycle BC was primarily involved in assessing the amount of recycling generated by buildings and quantifying potentially recyclable materials in the garbage.

The key objectives for this project included:

- Composition of garbage, recycling, and organics;
- Disposal and recycling rate estimates;
- Geographical representation; and
- Building level information (diversion programs, layout of recycling room, type of building).

1.1 Background

Metro Vancouver provides essential services, including managing a network of solid waste disposal facilities for over two million residents in British Columbia's Lower Mainland. This includes a waste-to-energy facility and five transfer stations. Combined with the City of Vancouver's transfer station and local landfill, this public-sector system provides transfer and disposal services to residents, agencies and businesses in the region.

Metro Vancouver is also responsible for long-term waste reduction planning, as outlined in the *Integrated Solid Waste and Resource Management Plan*. Metro Vancouver has set an aspirational waste reduction and recycling goal for the region to achieve 80% diversion of its waste from disposal by 2020.

Waste composition monitoring is required to track the progress in achieving the desired diversion targets and to identify areas where more progress is needed to achieve the region's diversion goals. The intent of this study was to produce information that could be used by local governments, businesses, and Recycle BC to enhance their waste management and recycling programs.

In 2006, Metro Vancouver completed a Multi-Family Building Waste Audit. This study identified composition and disposal rates for multi-family (MF) building landfill streams based on geographical location and building sub-type. It also gathered building information through phone interviews with building managers to enable the Greater Vancouver Regional District (now Metro Vancouver) to analyze the influence of building characteristics on disposal rates and composition. The 2017 study was intended to be an update of the 2006 study. The 2017 study aims to provide an updated characterization of the 2006 MF residential waste study to provide an update on waste reduction and diversion programs.

1.2 Scope of Work

Tetra Tech prepared a sampling framework and protocol customized for this study to optimize for data quality, scheduling, and safety considerations. In total, 100 multi-family buildings were visited. The building visits and waste composition sorting was conducted from June to September 2017. Figure 1-1 presents the number of samples in each geographical sub-region.

Table 1-1 presents the overall distribution of the 100 buildings analyzed based on geographical area, building type, and unit ownership type. Buildings were selected to match the distribution of buildings in Metro Vancouver.

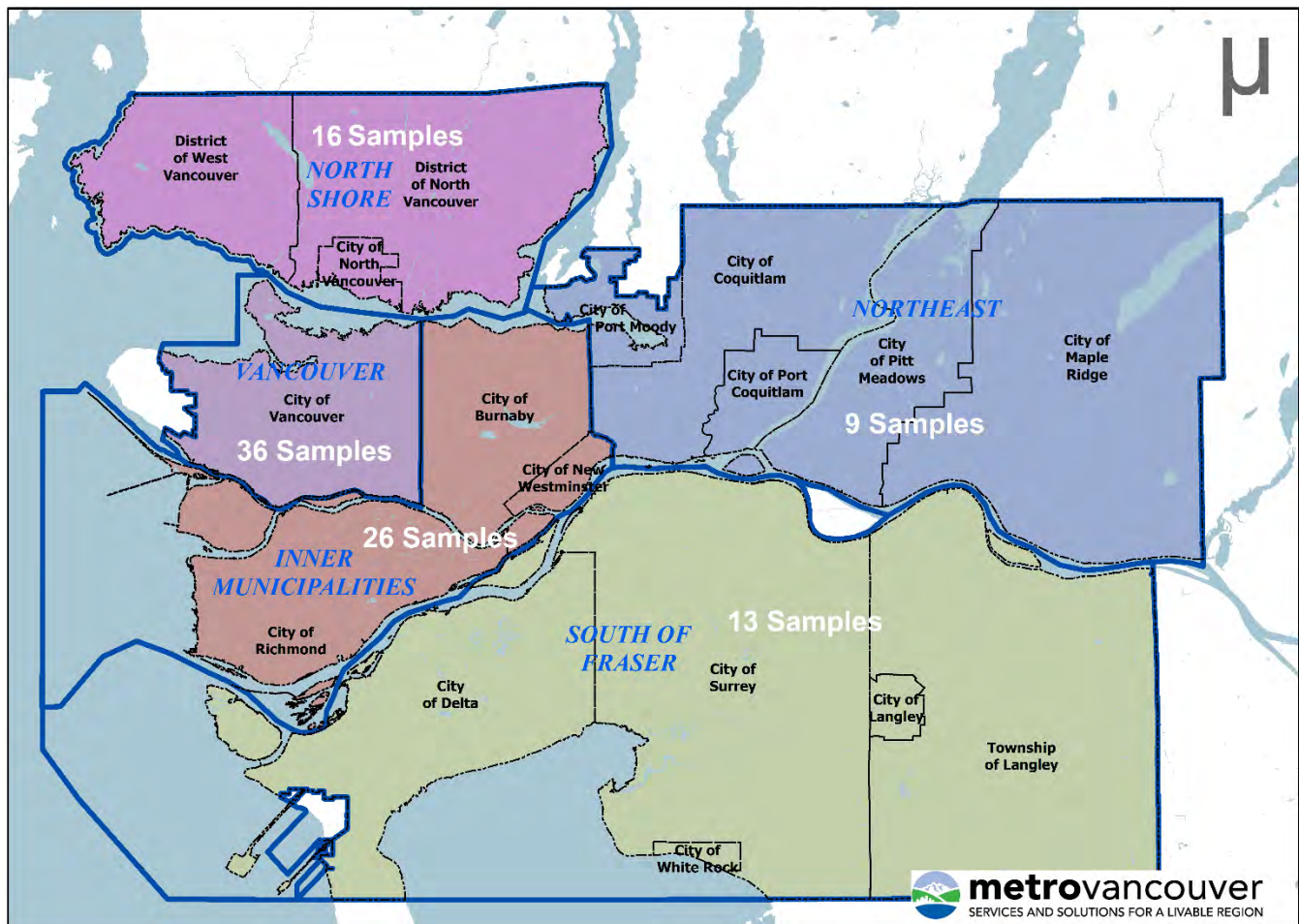


Figure 1-1: Geographical Sub-Region Map

Table 1-1: Sample Distribution

Geographic Sub-Region				
Geographic Region	Description	Regional Representation ¹	Proportion of Samples for this Study	Total Number of Samples
Vancouver	Vancouver	44%	36%	36
Inner Municipalities	Burnaby, Richmond, New Westminster	24%	26%	26
Northeast	Coquitlam, Port-Coquitlam, Port Moody, Maple Ridge	9%	9%	9
North Shore	City of North Vancouver, District of North Vancouver, District of West Vancouver	7%	16%	16
South of Fraser	Surrey, Langley, Delta	16%	13%	13
Building Type				
Building Type	Description	Regional Representation ¹	Proportion of Samples for this Study	Total Number of Samples
High Rise ⁴	One or more buildings with five or more storeys	32%	36%	36
Low Rise ⁵	One or more buildings with less than five storeys	49%	51%	51
Townhouse ⁶	A series of attached row homes	19%	13% ³	13
Unit Ownership				
Unit Ownership Type	Description	Regional Representation ¹	Proportion of Samples for this Study	Total Number of Samples
Condominium	All units in the building are condominiums. ²	50%	46%	46
Rental Units	All units in the building rental units.	50%	51%	51
Mixed	The building has a combination of condominiums and rentals units.	-	3%	3
Total Number of Samples				100

¹The regional representation is the proportion of Metro Vancouver residents living in multi-family dwellings living in the specified dwelling type.

²Most condominium buildings had some units that were rented to tenants by their owner. This information is not presented in this table.

³It was assumed that half of the townhouses in Metro Vancouver have shared garbage, recycling, and organics collection, thus, the proportion of samples is lower than the regional average.

⁴A 'high rise' in this report refers to a building with five or more storeys. This is based on the Statistics Canada census category "Apartment, building that has five or more storeys."

⁵A 'low rise' in this report refers to a building with less than five storeys. This is based on the Statistics Canada census category "Apartment, building that has less than five storeys."

⁶A 'townhouse' in this report refers to a series of attached row homes. This is based on the Statistics Canada census category "Row house."

2.0 METHODOLOGY AND WORK PLAN

Multi-family sector waste is challenging to characterize when sampling loads from transfer stations due to a large number of buildings in the region being service by commercial haulers that collect from both Industrial, Commercial, and Institutional (ICI) clients and multi-family buildings. There is also a large variation in the types of multi-family buildings and levels of service for garbage, recycling and organics. To meet the objectives of this study, the following processes were developed to execute the scope of work:

- Recruitment and surveying;
- Site assessments by team of technicians, including:
 - Waste composition and disposal rate analysis;
 - Recycling composition and recycling rate analysis;
 - Organics composition and organics recycling rate analysis; and
- Data analysis and statistical evaluation of the compiled dataset.

The following sections outline the methodology used for each step in the process. Appendix N — Data Analysis Methodology presents a methodology of the data analysis and statistical evaluation completed during this project.

2.1 Recruitment and Phone Survey

The following methods were used to identify buildings for inclusion in the study:

1. Metro Vancouver and Tetra Tech collaborated with interested municipalities through the waste coordinators meeting;
2. Metro Vancouver contacted two housing associations to provide buildings for the study:
 - Metro Vancouver Housing Corporation
 - BC Housing
3. Tetra Tech contacted several property management companies; and
4. Tetra Tech technicians visited high-density multi-family areas and called building managers based on posted contact information.

In general, there was a high level of interest in the study and a combination of all aforementioned methods were successful recruitment methods to obtain the required number of buildings. The initial form email used to recruit buildings is included in Appendix B — Initial Form Email.

Once a building had expressed information in the study, a Tetra Tech technician confirmed participation and conducted a survey over the telephone. The survey questions are included in Appendix C — Phone Survey Questions. This phone call was intended to acquire the following:

- Information required for scheduling of site assessment, such as collection days for garbage, recycling, and organics; and
- Building-specific information required for data analysis, such as the number of units and the presence of certain waste infrastructure, such as garbage chutes.

If the contact was unable to provide some or all required information, a follow-up call was scheduled. Once a building site assessment was scheduled, a confirmation email was sent to the contact. Site assessments were scheduled for the day before garbage collection wherever possible.

2.2 Site Assessment

The goals for the site assessment were to:

- Determine the quantity of on-site garbage, recycling, and organics;
- Determine the capacity (number and sizes of bins) for garbage, recycling (all streams), and organics;
- Determine the composition of on-site recycling and organics;
- Remove a 100 kg garbage sample for detailed hand sorting off-site; and
- Evaluate the building waste room and services based on the accessibility criteria included in Appendix D — Accessibility Criteria.

A copy of the building accessibility criteria form is included in Appendix D — Accessibility Criteria. The site assessment field form is included in Appendix M — Site Assessment Form. Selected building site assessment photos are included in Appendix E — Site Assessments and Sorting Photos.

2.2.1 Building Assessment Methodology

2.2.1.1 Garbage Analysis and Collection

The garbage analysis included estimation of garbage on-site, documenting the types and sizes of garbage bins present, and removal of a garbage sample for sorting.

Material quantity was estimated based on volume. The overall density of sampled garbage was calculated at the end of the study. This density was applied during data analysis to estimate a disposal rate. Reference densities are included in Appendix F — Density Reference.

A target sample size of 100 kg of garbage was collected from each building. If less than 50 kg was present, a secondary visit was scheduled to collect another sample. Nineteen buildings required secondary visits.

For buildings or multi-building complexes with multiple garbage areas where it was unclear which garbage area residents would use, a representative sample was collected from each area for a total of 100 kg. For multi-building complexes with separate garbage areas serving separate residents (for example, a complex with two buildings and one garbage area for each building), two 100 kg samples were collected.

Sites containing garbage compactors were sampled from on a case-by-case basis using additional safety precautions. If compactors could be disengaged and opened, a sample could be removed using hand tools. For buildings where compactors could not be disengaged, and with the permission of the building manager, large, clean garbage bins were placed near the compactor with signs that instructed residents to dispose of their garbage in these bins until they were full. The Tetra Tech team returned within 48 hours to collect the bins and a waste sample. Estimates for the amount of garbage generated could not be made in buildings with compactors.

Garbage Composition Analysis

Samples were tagged and transported to Vancouver South Transfer Station for analysis by the waste sorting team. Sample sorting was completed by waste sorters who were trained on safety and material sorting procedures prior to fieldwork with oversight from a site supervisor. Personal protective equipment was used by staff according to the specifications of Tetra Tech's Health and Safety Plan, which factored in special requirements for working at this site.

Safety meetings were conducted daily to emphasize key concerns including how to handle material hazards such as sharp or hazardous materials, safe lifting of garbage bags, and working around vehicles. Select sample photographs for samples are presented in Appendix H — Sample Photos. Photos of sorted garbage separated into categories are presented in Appendix I — Category Photos.

Each sample was weighed and photographed before sorting and cross-referenced with the initial sample weight for accuracy. Samples were then separated into 147 categories, which are presented in Appendix J — Garbage Categories and each was weighed to determine detailed composition of the garbage stream.

2.2.1.2 Recycling Analysis

The recycling analysis included the estimation or weighing of the total amount of recycling on-site, the types and sizes of recycling bins present, and a recycling composition analysis. At most buildings, some combination of mixed containers, mixed paper, glass, mixed containers and paper, and cardboard was found. Other types of recycling such as deposit beverage containers or batteries were noted if found.

Material quantity was estimated based on volume and material densities from the United States Environmental Protection Agency (U.S. EPA) Volume-to-Weight Conversion Factors. Reference densities are included in Appendix F. Recycling bins were weighed (except in the case of dumpsters), however, recycling bin tare weights varied and volume estimates were considered to be more reliable. Recycling composition was visually audited into ten categories based on volume (Appendix G — Recycling and Organics Categories). The results were then converted to weights for analysis according to the densities in Appendix F — Density Reference. Detailed sorting of recycling and density reference checks were completed at two buildings to inform and validate the visual audit methods used.

2.2.1.3 Organics Analysis

The organics analysis consisted of the estimation or weighing of the total amount of organics on-site, the types and sizes of organics bins present, and an organics composition analysis. It was also noted whether organics bins had bin liners or any other attempts to keep bins clean or control odour were present.

Material quantity was estimated based on volume and material densities (U.S. EPA Volume-to-Weight Conversion Factors). Reference densities are included in Appendix F — Density Reference. Organics bins were also weighed, however, it was found that organics bin tare weights varied greatly between brands and models. Therefore, visual estimates were considered to be more reliable.

Organics composition was visually audited into five categories (Appendix G — Recycling and Organics Categories) based on volume. Densities (Appendix F — Density Reference) were used for conversion to weight-based composition.

2.2.1.4 Accessibility Criteria Ranking

All buildings were ranked from one to five based on accessibility criteria. These criteria were designed to evaluate the convenience, physical accessibility, safety, and cleanliness of the garbage, recycling, and organics areas. Additionally, the clarity and presence of signage was evaluated. Accessibility criteria are included in Appendix D — Accessibility Criteria.

3.0 GARBAGE RESULTS

3.1 Overall Waste Composition Results

The waste composition results are reported as weighted average percentages by primary material category in the following sections. All percentages in this section refer to the percentage of material in comparison to the total amount of material. Weighted average percentages were calculated by combining all sample data.

3.1.1 Waste Composition

Figure 3-1 presents the weighted average primary material composition for multi-family residential garbage. The largest component of the garbage was compostable organics (38%), followed by paper (16%), plastic (15%), and household hygiene (15%). Compostable organics mainly comprised food waste (34%), of which 20% of food was avoidable and 14% was unavoidable. The largest portion of paper was other compostable paper (8%). The largest component of plastic was consumables packaging bags and non-recyclable film (3%) and durable plastic products (2%). Household hygiene mainly comprised diapers (7%) and pet waste (6%).

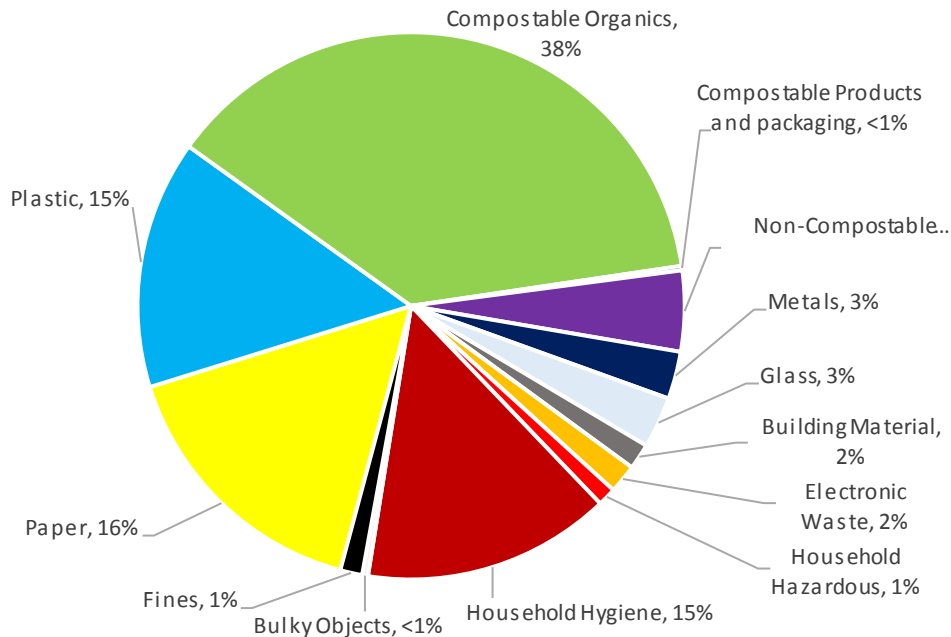


Figure 3-1: Overall Waste Composition (N=100)

A summary of the results for all 147 material categories is included in Table A. Appendix O — Results with Confidence Levels presents the overall waste composition results with their 90% confidence levels. Selected photographs from the field auditing are included in Appendix H — Sample Photos and Appendix I — Category Photos.

3.2 Waste Composition Results Analysis

This section reviews the waste composition of buildings analyzed according to:

- Building Type; and
- Unit Ownership.

3.2.1 Building Type

Table 3-1 presents the waste composition results according to building type. Building types identified in the study included:

- High Rises (more than or equal to five storeys);
- Low Rises (less than five storeys); and
- Townhouses.

These building types were chosen to be consistent with Statistics Canada census data, which makes a distinction for apartments with five or more storeys and apartments with less than five storeys.

In all building types, the largest proportion of waste was compostable organics. Paper, plastic, and household hygiene were the next largest portions of the waste stream. The waste composition variations between building types was typically small. The following trends were observed:

- Townhouses contained a larger proportion of household hygiene and high rises had a lower proportion of household hygiene.

Table 3-1: Waste Composition by Building Type¹

Primary Categories	High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Overall (N=100)
Paper	18%	15%	14%	16%
Plastic	15%	15%	14%	15%
Compostable Organics	38%	38%	36%	38%
Compostable Products and packaging	<1%	<1%	<1%	<1%
Non-Compostable Organics	5%	4%	5%	5%
Metals	3%	3%	3%	3%
Glass	4%	3%	2%	3%
Building Material	1%	1%	4%	2%
Electronic Waste	2%	2%	2%	2%
Household Hazardous	1%	1%	1%	1%
Household Hygiene	11%	16%	18%	15%
Bulky Objects	1%	<1%	<1%	<1%
Fines	1%	1%	1%	1%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

3.2.2 Unit Ownership

Table 3-2 presents the waste composition results according to unit ownership type. Unit ownership types identified in the study including:

- Condominiums (buildings where all units are condominiums);
- Rental Units (buildings where all units were purpose-built rental units); and

- Mixed (buildings where a mix of condominiums and purpose-built rental units were present). Only three buildings of this type were analyzed, thus data for mixed buildings is not presented separately in the discussion below, however, these samples are included in the totals.

In all unit ownership types, the largest proportion of waste was compostable organics. Paper, plastic, and household hygiene were the next largest portions of the waste stream. The waste composition variations between unit ownership types was typically small. The following trends were observed:

- Buildings with rental units had a noticeably higher proportion of organics in the garbage.
- Buildings with rental units tended to have less plastic in the waste stream and more household hygiene.

Table 3-2: Waste Composition by Unit Ownership Type¹

Primary Categories	Condominium (N=46)	Rental Units (N=51)	Overall (N=100)
Paper	16%	16%	16%
Plastic	16%	14%	15%
Compostable Organics	35%	40%	38%
Compostable Products and packaging	<1%	<1%	<1%
Non-Compostable Organics	5%	4%	5%
Metals	3%	2%	3%
Glass	4%	3%	3%
Building Material	2%	1%	2%
Electronic Waste	2%	2%	2%
Household Hazardous	1%	1%	1%
Household Hygiene	13%	16%	15%
Bulky Objects	<1%	1%	<1%
Fines	1%	1%	1%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

3.3 Special Interest Categories

Metro Vancouver requested additional sorting and categories for textiles and expanded polystyrene due to landfill bans being considered on these materials. The data collected on those two categories is presented in the following two subsections.

3.3.1 Textiles

Textiles in Metro Vancouver waste composition studies are categorized as synthetic or natural fibres. Past methodologies did not include checking tags to determine the textile type, rather was based on visual inspection of the garment (e.g. observing the fabric texture or weave). In 2017, Metro Vancouver changed the methodology to:

- Checking of tags for all clothing items to determine whether each item was synthetic, natural fibre, or a blend;
- Categorizing clothing items as suspected synthetic, natural fibre, or a blend if a tag could not be located; and
- Counting of clothing items.

Table 3-3 presents the textile results. The waste stream was found to contain 5.1% textiles. An average of 15.1 clothing items per 100 kg was found.

Table 3-3: Textile Composition of the Waste Stream

Primary Category	Tertiary Category	Composition of Total Waste Stream (%)	Average Number of Items per 100 kg ¹
Plastics	Synthetic Clothing and Accessories	0.3%	1.6
	Blends and Multi-Layer Clothing and Accessories	0.5%	1.3
	Suspected Synthetic Clothing and Accessories	0.4%	5.1
	Household	1.3%	-
	Other	0.4%	-
	Total Textiles in Plastics	2.9%	7.9
Non-Compostable Organics	Natural Fibre Clothing	0.6%	3.2
	Semi-synthetic Clothing	0.1%	0.5
	Suspected Natural Clothing	0.3%	3.6
	Household	1.0%	-
	Other	0.2%	-
	Total Textiles in Non-Compostable Organics	2.2%	7.2
Total Textiles		5.1%	15.1

¹Household and other textiles were not counted.

Photos 1 and 2 present examples of textiles found during this study.



Photo 1: Natural-Fibre Clothing Items (Left);



Photo 2: Suspected Natural-Fibre Clothing Items (Right)

3.3.2 Expanded Polystyrene

Expanded polystyrene (EPS) (commonly referred to as Styrofoam™) was also of interest in this waste composition study as Metro Vancouver is exploring options to reduce the quantity of this material entering the landfill. The intent of this study was to estimate the proportion of EPS in the multi-family sector that would be targeted by a potential disposal ban. EPS was sorted into white packaging EPS (more recyclable and higher potential for a material disposal ban) and “other EPS” (e.g. single-use food containers). Table 3-4 presents the composition of this material in the waste stream.

The waste stream was found to contain 1.1% EPS. Most EPS found was other EPS (0.8%). While EPS represents a small proportion of the waste stream by weight, due to the low density of EPS, it represents a much larger proportion of the volume of the waste stream.

Table 3-4: Expanded Polystyrene Products Composition of the Waste Stream

Tertiary Category	Description	Composition of Total Waste Stream (%)
White Packaging EPS	Large blocks of packaging expanded polystyrene frequently used for packaging televisions and appliances.	0.3%
Other EPS	All other EPS. Typically, single-use food containers commonly used for sushi and other fast food and any coloured EPS products.	0.8%
Total		1.1%

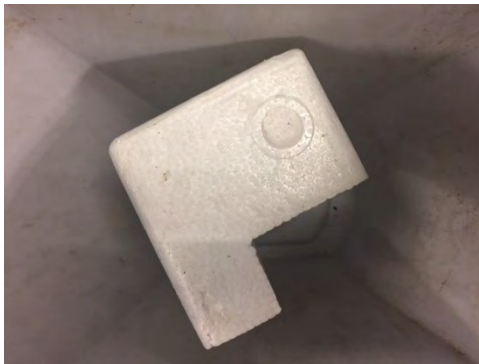


Photo 3: White Packaging EPS



Photo 4: Other EPS

3.4 Disposal Rate

The per capita disposal rates were calculated for each building as described in Section 2.2.1.1. There were 10 buildings with compactors where a reliable volume estimate could not be made and therefore excluded from the disposal rate calculations.

Figure 3-2 presents the disposal rate by unit ownership and building type. Overall, the average disposal rate was 212 per capita.

Disposal rates were highest in the following sample types:

- High rise buildings; and
- Buildings with rental units.

Disposal rates were lowest in the following sample types:

- Townhouses; and
- Buildings with condominiums.

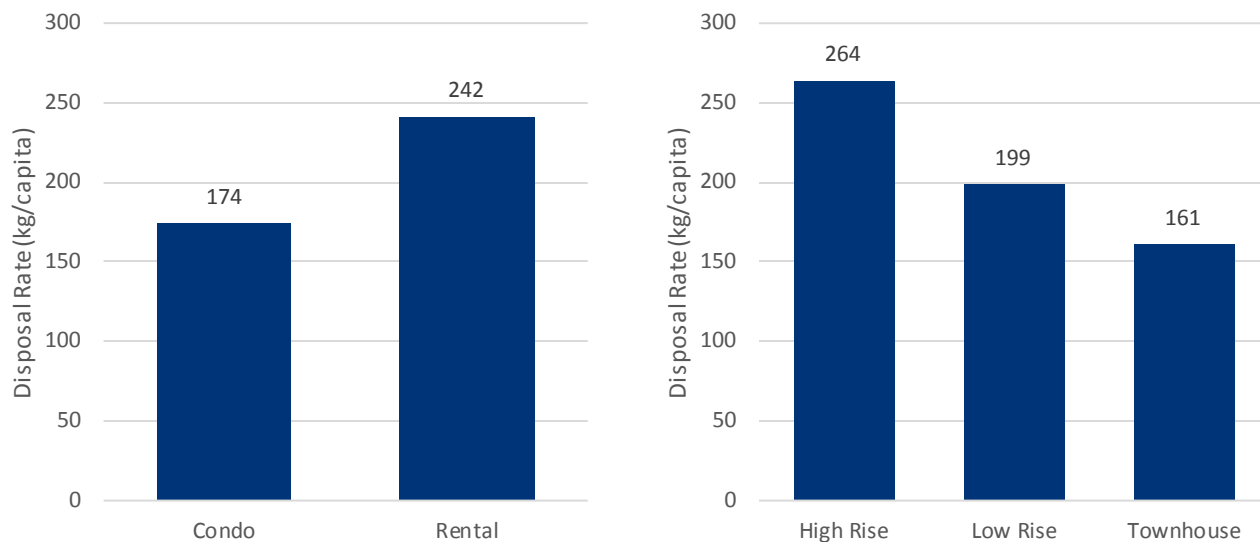


Figure 3-2: Disposal Rate by Unit Ownership Types (left); Disposal Rate by Building Type (right)

3.5 Historical Composition Comparison

An extensive multi-family focused waste composition study was conducted in 2006. Additionally, in other years, data was collected on multi-family waste composition during the waste composition monitoring. Figure 3-3 presents the 2006, 2013, and 2017 data for comparison, weighted by disposal rates in each corresponding year.

The multi-family disposal rate calculated in 2006 was 245 per capita and the disposal rate calculated in 2013 was 234 kg per capita. The 2013 disposal rate was based on overall collected tonnages from multi-family garbage hauling routes. The 2017 study used an alternative methodology based on the amount of garbage found at each building, as described in Section 2.2.1.1.

The calculated disposal rate was an average of 212 kg per capita in 2017. The decrease in the disposal rate generally correlates with the introduction of organics collection to multi-family buildings in the last four years and region-wide organics disposal ban. The amount of organics in the waste stream was 80 kg per capita in 2017 compared to 100 kg per capita in 2013 and 105 kg per capita in 2006. More household hygiene was found in 2017 than in 2013.

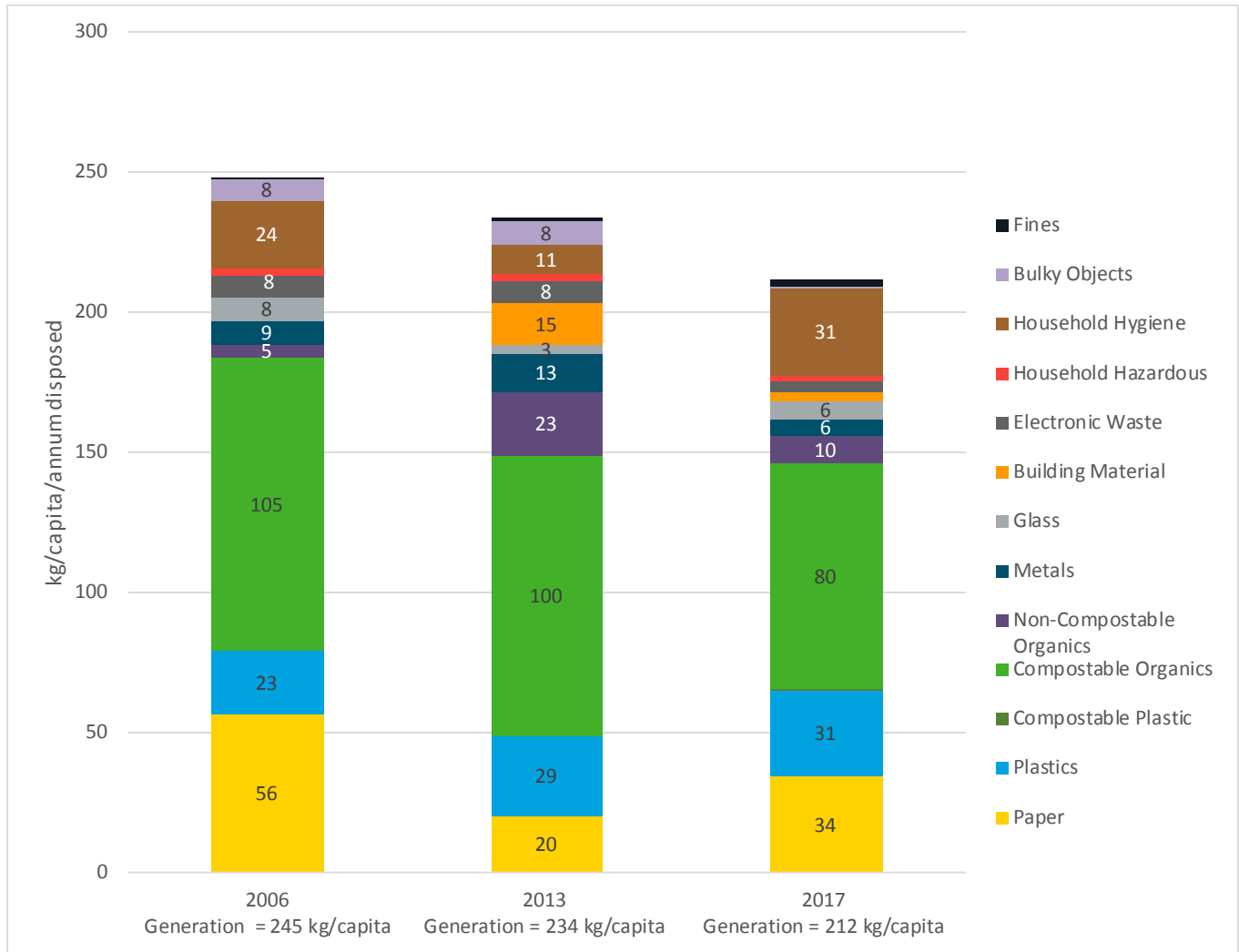


Figure 3-3: Historical Comparison¹

- Notes:**
1. For readability, only material disposal rates greater than 5 kg per capita are shown. Full results are presented in Appendix L — Historical Data Comparison.
 2. In 2013, a proportion of the compostable paper materials were classified as organics, leading to a lower than expected proportion of paper in the waste stream.

Metro Vancouver conducted other waste composition studies between 2006 and 2017 that included multi-family samples. A comparison of all historical multi-family waste composition data is presented in Appendix L — Historical Data Comparison.

4.0 RECYCLING AND ORGANICS RESULTS

4.1 Recycling Results

Recycling composition was estimated visually on-site. In total, 100 recycling samples were analyzed. Seventy three samples were from buildings with multi-stream recycling and 27 samples were from buildings with single-stream recycling systems. Single-stream recycling systems refers to buildings that had mixed containers and mixed paper combined in one bin; these buildings sometimes also had cardboard or glass collection. Results tended to vary between these recycling systems, so results are presented separately in this section.

Table 4-1 presents the types of streams found in each recycling type.

Table 4-1: Number of Samples by Recycling Type and Stream

Recycling System	Total Samples	Mixed Containers Samples	Mixed Paper Samples	Mixed Container and Paper Samples	Glass Samples	Cardboard Samples	Other Recycling Sample
Multi-Stream	73	73	73	-	58	33	19
Single-Stream	27	-	-	27	16	8	1
Total	100	73	73	27	74	41	20

In addition to the standard streams outline in Table 4-1, 20 buildings had separate bins dedicated to materials outside of the current norms for multi- and single-stream systems. More than half of these were for deposit beverage containers. There were a few buildings with dedicated collection streams for one or a combination of the following materials:

- Batteries;
- Small electronics;
- Soft plastic;
- Lightbulbs; and
- Metal.

4.1.1 Material Composition

The recycling composition results are reported by weight-based percentages for each category. All percentages in this section refer to the percentage of material in comparison to the total amount collected. Weighted average percentages were calculated by combining all sample data. Recycling was visually audited into ten categories, listed in Appendix G — Recycling and Organics Categories.

One challenge in determining the amount of cardboard recycling was the uncertainty and irregularity of cardboard collection days. The cardboard results in this section (presented in the combined results in Figure 4-1, Figure 4-2, and Figure 4-3) are high-level estimates.

4.1.1.1 Overall Recycling Composition

Figure 4-1 presents the overall composition results for buildings with recycling collection. The largest component of the recycling was paper (53%), followed by cardboard (24%) and recyclable glass (7%).

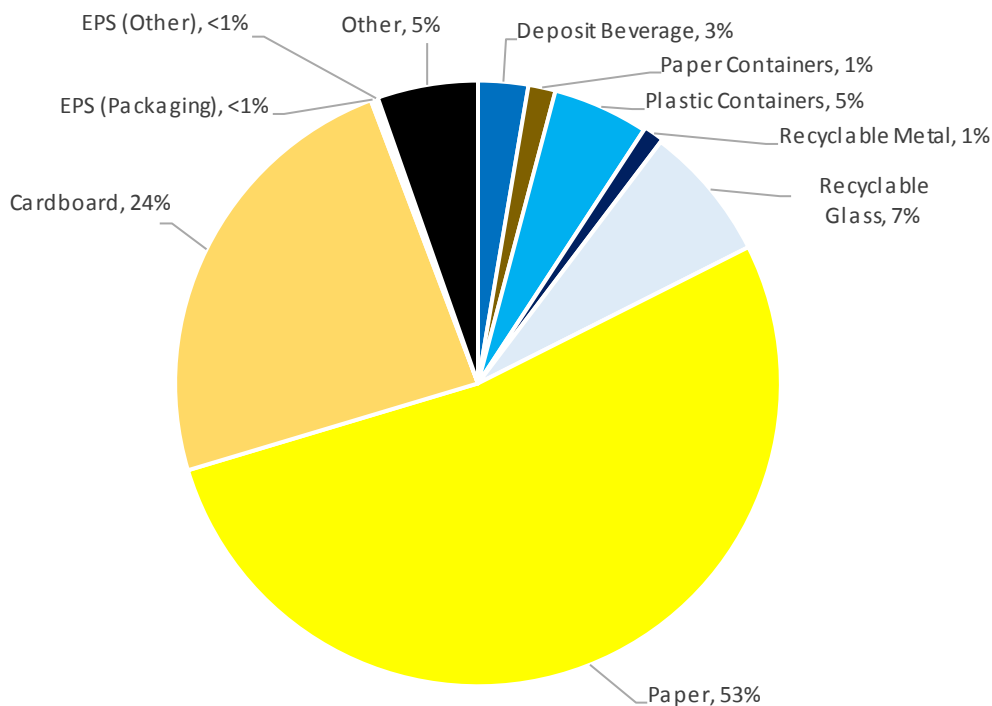


Figure 4-1: Overall Recycling Composition (N=100)

- Notes:**
1. For readability, only material disposal rates greater than 5 kg per capita are shown. Full results are presented in Appendix L- Historical Data Comparison).
 2. In 2013, a proportion of the compostable paper materials were classified as organics, leading to a lower than expected proportion of paper in the waste stream.

Sections 4.1.1.2 and 4.1.1.3 break down recycling results into buildings with multi-stream and single-stream systems.

4.1.1.2 Multi-Stream Recycling

Figure 4-2 presents the overall composition results for buildings with multi-stream recycling. The largest component of the recycling is paper (56%), followed by cardboard (24%) and recyclable glass (6%). 73 samples were analyzed from buildings with multi-stream recycling.

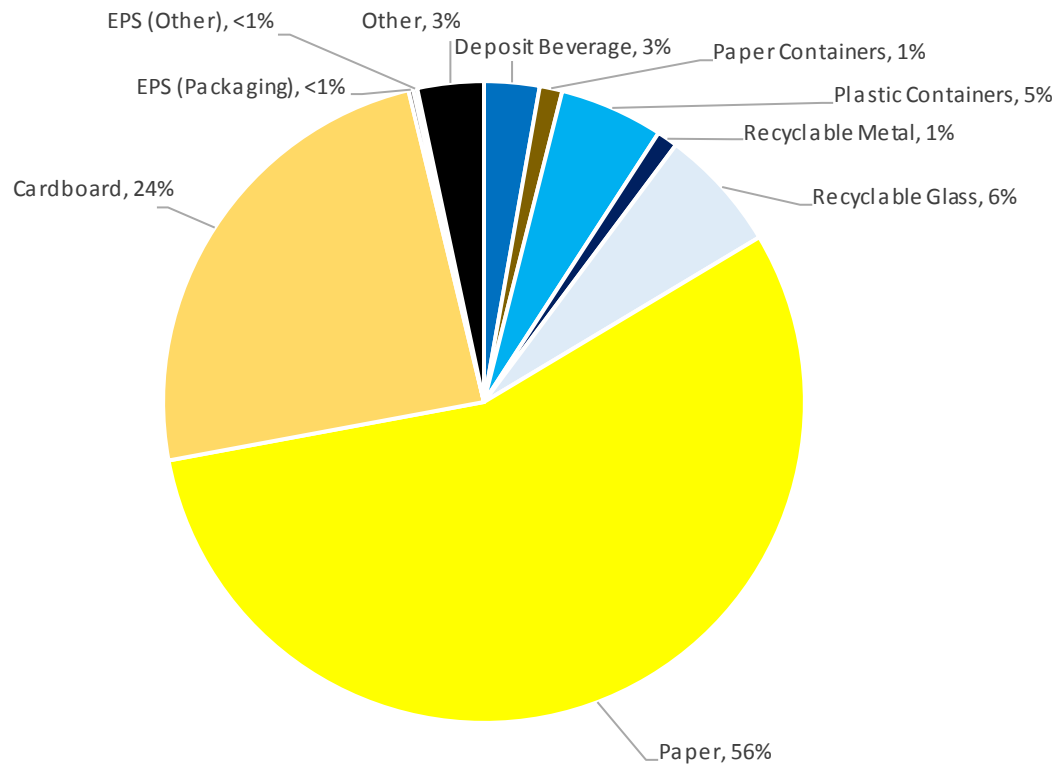


Figure 4-2: Overall Recycling Composition for Multi-Stream Recycling (N=73)

Notes: Due to uncertainty and irregularity regarding cardboard collection days, the percentage of cardboard is a high-level estimate with an expected range from 17 to 31%."

Table 4-2 presents the composition by stream for buildings with multi-stream recycling.

Table 4-2: Composition in Multi-Stream Buildings by Stream¹²

Recycling Category	Mixed Containers	Mixed Paper	Glass	Cardboard	Other
Deposit Beverage	10%	<1%	5%	<1%	31%
Paper Containers	5%	1%	1%	1%	<1%
Plastic Containers	39%	<1%	2%	<1%	1%
Recyclable Metal	7%	<1%	3%	<1%	<1%
Recyclable Glass	16%	<1%	84%	<1%	<1%
Paper	10%	89%	1%	14%	42%
Cardboard	<1%	9%	<1%	84%	1%
EPS (Packaging)	1%	<1%	<1%	<1%	<1%
EPS (Other)	1%	<1%	<1%	<1%	<1%
Other	12%	1%	4%	<1%	25%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%

²Green values indicate materials which were properly recycled.

4.1.1.3 Single-Stream Recycling Systems

Figure 4-3 presents the overall composition results for buildings with multi-stream recycling. The largest component of the recycling is paper (44%), followed by cardboard (23%) and other (contamination) (11%). 27 samples were analyzed from samples with single-stream recycling.

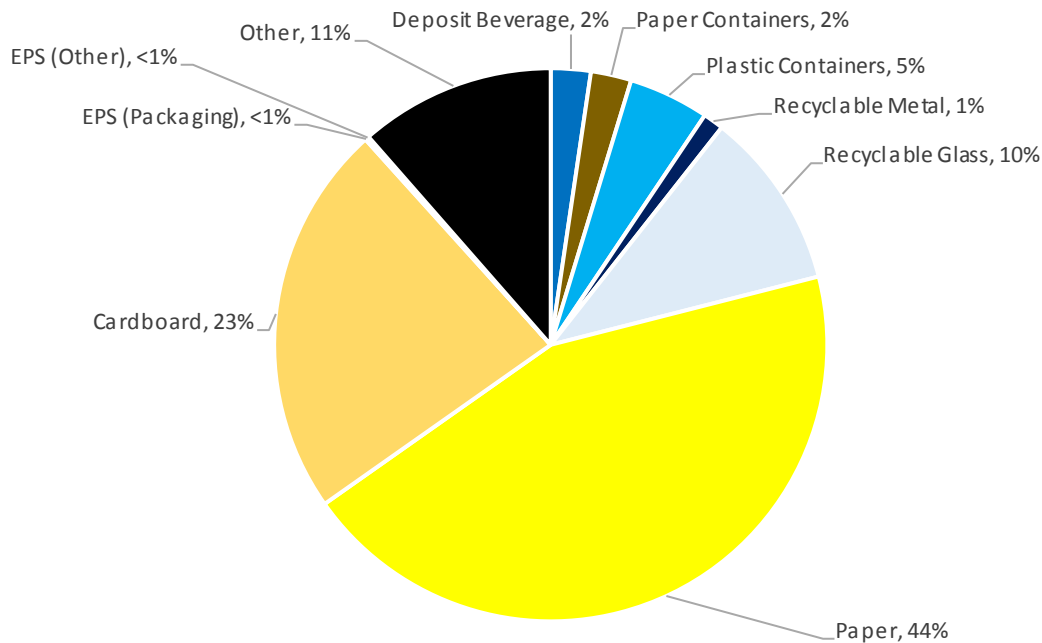


Figure 4-3: Recycling Composition for Single-Stream Recycling (N=27)

Notes: Due to uncertainty and irregularity regarding cardboard collection days, the percentage of cardboard is a high-level estimate with an expected range from 17 to 31%.

Table 4-3 presents the composition by stream for buildings with single-stream recycling.

Table 4-3: Composition in Single-Stream Buildings by Stream¹²

Recycling Category	Mixed Containers and Paper	Glass	Cardboard	Other
Deposit Beverage	2%	1%	1%	97%
Paper Containers	3%	<1%	1%	<1%
Plastic Containers	7%	1%	<1%	<1%
Recyclable Metal	1%	2%	<1%	3%
Recyclable Glass	1%	78%	<1%	<1%
Paper	56%	7%	30%	<1%
Cardboard	14%	1%	64%	<1%
EPS (Packaging)	<1%	<1%	<1%	<1%
EPS (Other)	<1%	<1%	<1%	<1%
Other	14%	9%	4%	<1%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

²Green values indicate materials which were properly recycled.

4.1.2 Recycling Contamination Rates

A difference was observed in contamination rates in samples from buildings with multi- and single-stream systems. Contamination was classified into one of the following types:

1. **Improperly recycled materials.** This includes materials that could have been recycled in one of the other streams but had been put into the wrong container.
2. **Materials that are not recyclable.** This includes hazardous materials and non-recyclable municipal solid waste.

Table 4-4 presents the contamination rates in buildings with multi- and single-stream systems.

Materials that are recyclable via depot drop-off may be considered contamination, since this material is managed by separate extended producer responsibility programs. The majority of this material comprised deposit beverage containers. Since these beverage containers do not typically compromise the quality of the recycling stream, they were not considered contamination. However, the quantity of this type of material found in each stream is noted in Table 4-4.

Table 4-4: Non-Recyclable Materials and Improperly Recycled Materials in Recycling¹

Category	Multi-Stream Recycling					Single-Stream Recycling			
	Mixed Containers	Mixed Paper	Glass	Cardboard	Total	Mixed Containers and Paper	Glass	Cardboard	Total
Properly Recycled Materials	66%	98%	84%	98%	93%	83%	78%	94%	86%
Improperly Recycled Materials	10%	1%	7%	1%	N/A	N/A	11%	1%	N/A
Non-Recyclable Materials	12%	1%	4%	<1%	3%	14%	9%	4%	11%
Total Improperly Recycled and Non-Recyclable Materials	22%	2%	11%	1%	7%	14%	20%	5%	14%
Depot Drop-Off Materials ²	12%	<1%	5%	<1%	3%	3%	1%	1%	2%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

²Depot Drop-Off Materials includes materials that are *only* recyclable via drop-off at a depot. This category does not include PPP materials which Recycle BC collects from multi-family buildings. However, this includes PPP materials accepted by Recycle BC which can only be recycled at a depot (i.e. recyclable plastic film). Furthermore, this category includes all materials recyclable at a depot which are managed by EPR programs other than Recycle BC.

The following trends were observed:

- The glass bins at buildings with single-stream systems had more contamination than the glass bins at buildings with multi-stream systems (20% compared to 11%).
- The cardboard bins at buildings with single-stream systems had five times the contamination of cardboard bins at buildings with multi-stream systems (5% compared to 1%).

- The overall rate of contamination in buildings with single-stream recycling, including contamination due to improperly recycled materials, was double that of buildings with multi-stream recycling.

In addition to the visual audits conducted during the site assessments, several hand sorts were completed on individual recyclable streams to provide further context on the composition of the stream and any contamination. The results of these analyses found:

- In the Mixed Containers stream, the most commonly improperly recycled materials were plastic film, paper packaging and durable plastic products.
- Mixed Paper contained minimal contamination. The few non-recyclable materials were generally plastic film or compostable food-ware.
- Contamination in the glass stream was most commonly non-recyclable glass and other ceramics. Additionally, many lids were left on glass containers and there was a presence of improperly recycled rigid plastic beverage and non-beverage containers.

4.1.3 Recycling Rates

As discussed in section 2.2.1.1, the recycling rate was determined by estimating the volume of on-site recycling and applying a U.S. EPA Volume-to-Weight Conversion Factor. All densities used are included in Appendix F — Density Reference.

Table 4-5 presents the multi-stream, single-stream, and overall recycling rate broken down by stream. The multi-stream recycling rate was found to be lower (77 kg per capita) than the single-stream recycling rate (99 kg per capita). Overall, the recycling rate is 82 kg per capita.

The recycling rates below include all materials that were placed in recycling bins, including non-recyclable materials and improperly recycled materials. Thus, the figures below may not be consistent with the figures in Section 4.1.1. For example, the 'mixed paper' recycling rate also include materials that were *not* mixed paper but were placed in the mixed paper recycling bin.

Table 4-5: Recycling Rate by Stream¹

	Overall	Mixed Containers	Mixed Paper	Glass	Mixed Containers and Paper	Cardboard ²	Other
Multi-Stream Recycling (kg/capita)	77	13	24	15	N/A	21	4
Single-Stream Recycling (kg/capita)	99	N/A	N/A	40	44	14	1
Overall	82	9	17	22	12	19	3

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

²Due to uncertainty and irregularity regarding cardboard collection days, the expected range of recycling rates are 15 to 27 kg per capita for multi-stream, 10 to 18 kg per capita for single-stream, and 13 to 25 kg per capita overall.

The following trends were observed:

- Buildings with single-stream recycling had higher recycling rates than buildings with multi-stream recycling.
- The largest component of the recycling generated in buildings with multi-stream recycling was from the mixed paper stream (31%) and cardboard stream (28%).
- The largest component of the recycling generated in buildings with single-stream recycling was from the mixed containers and paper stream (45%) and the glass stream (41%).
- Cardboard and 'other' recycling streams (e.g. Batteries or deposit beverage containers), which were often collected by the same hauling company as garbage, accounted for 27% of the recycling streams. Adjusted recycling rates without cardboard are:
 - 52 kg per capita for multi-stream recycling;
 - 84 kg per capita for single-stream recycling; and
 - 60 kg per capita overall.

4.2 Organics Results

The organics composition results are reported by weight-based percentages for each category. All percentages in this section refer to the percentage of material in comparison to the total amount collected. Weighted average percentages were calculated by combining all sample data. Organics was visually audited into five categories, listed in Appendix G — Recycling and Organics Categories.

Organics collection was documented at 94 buildings; six buildings did not have organics collection. Organics results were quantified visually on-site. While several buildings had bins that specified 'food waste only' or 'food waste and yard waste', bins were typically poorly labelled. Therefore, the results for mixed organics and food waste were combined. Additionally, four buildings had yard waste collection. Yard waste collection was generally separate from the mixed organics stream and therefore was not considered part of the multi-family organics sector composition. Yard waste results are discussed briefly below.

4.2.1 Organics Material Composition

Figure 4-4, below, presents the organics composition results. The organics mostly comprised food waste (89%). A small amount of compostable paper (6%) and yard waste (4%) was found.

All non-organic materials were considered to be contamination. Contamination was 2% by weight.

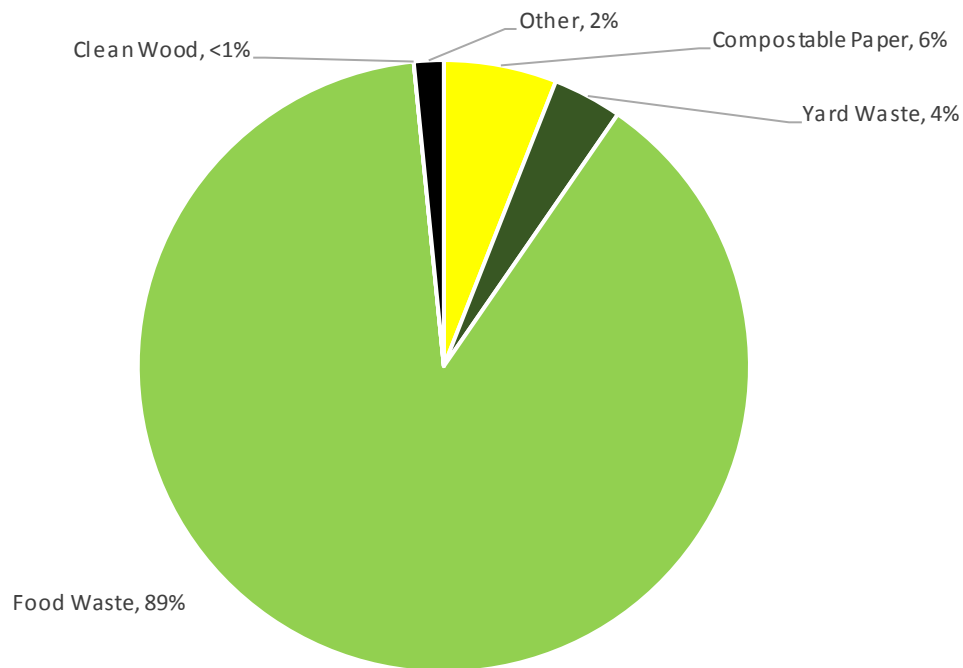


Figure 4-4: Food Waste and Mixed Organics Composition (N=94)

The yard waste analyzed was primarily composed of yard waste (97%) with a small amount of food waste (2%) and compostable paper (1%).

4.2.2 Organics Recycling Rate

As discussed in Section 2.2.1.3, the organics recycling rate was determined by estimating the volume of on-site organics and applying a U.S. EPA Volume-to-Weight conversion factor to it. All densities used are included in Appendix F — Density Reference.

The organics recycling rate at buildings with multi-stream systems (38 kg per capita) was found to be higher than the organics recycling rate at buildings with single-stream systems (27 kg per capita). The overall organics recycling rate was 35 kg per capita.

Notably, this is a per capita average of all buildings, including the six buildings that did not have organics collection. Buildings that did not have organics collection bring the average organics recycling rate down, since they contribute a 'zero' to this average.

5.0 MATERIAL DIVERSION PERFORMANCE

This section discusses the performance of multi-family buildings.

As described in Section 2.2.1.4 and Appendix D — Accessibility Criteria, site assessments included evaluating various accessibility criteria that may have an effect on garbage, recycling, and organics composition. Buildings demonstrated varying performance in these accessibility criteria. The following criteria were selected for further analysis to determine if there was any correlation to material diversion performance:

- Distance to reach the garbage, recycling, and organics from the unit;
- Clarity of garbage, recycling, and organics streams;
- Overall cleanliness and lighting;
- Security from vectors;
- Security from unlawful entrance; and
- Clear signage (not including signage on bins).

This section discusses the impact that these factors had on building performance, including waste composition and recycling and organics contamination. Furthermore, overall diversion rates are discussed.

5.1 Garbage Composition Performance

Building performance was based on the amount of non-divertable materials in the waste stream (i.e., “garbage”) versus the amount of divertable (i.e., recyclable and organics) and/or hazardous materials in the garbage.

Material composition (presented in Section 3.0) was useful for comparison with past waste composition studies and other jurisdictions, however, each primary category may contain recyclable and non-recyclable secondary and tertiary categories. Therefore, waste composition by material categories may not be a good indicator of performance.

To assess performance, waste composition material categories were grouped into five different divertability categories, presented in Table 5-1. Category classifications are based on divertability of materials at the time of this report’s publishing and are subject to change in the event of changing markets for recycled materials or the acceptability of materials in evolving EPR programs. Furthermore, the classification of materials as compostable is subject to acceptance by local processors of organic materials.

Appendix J — Garbage Categories, which lists all 147 garbage categories, describes how each material category fits within the broader divertable categories.

Table 5-1: Divertable Category Descriptions

Divertable Category	Description
Garbage	Includes all materials not currently able to be diverted through collection or depot drop-off infrastructure
Recycling	- Includes materials that are accepted in Recycle BC's collection programs (printed paper and packaging) - Does not include materials which are only collected by Recycle BC's depot drop-off programs (e.g., grocery bags, EPS) - Includes all cardboard, including that which is not considered 'packaging.'
Organics	- Includes all materials that are accepted in organics collection programs - Includes yard and food waste, other compostable organics, and food soiled and compostable paper
Depot Drop-Off	- Includes materials collected at transfer stations and other drop-off depots where material is self-hauled for collection and diversion - Does not include materials which are accepted in Recycle BC's curbside program - Does not include hazardous materials that may be accepted in depot drop-off programs - Examples include EPS, deposit beverage containers, some metals, and electronics
Hazardous	- Includes all materials that pose significant hazards when disposed in the garbage stream. - Materials are sometimes accepted at transfer stations or specific depots - Examples include batteries, oils, paint, and medications/sharps

The overall proportion of materials in the garbage by divertability is presented in Figure 5-1. More than half of the garbage could have been diverted through recycling and composting systems currently available. Eleven percent could have been diverted through recycling systems and 46% could have been diverted through composting systems.

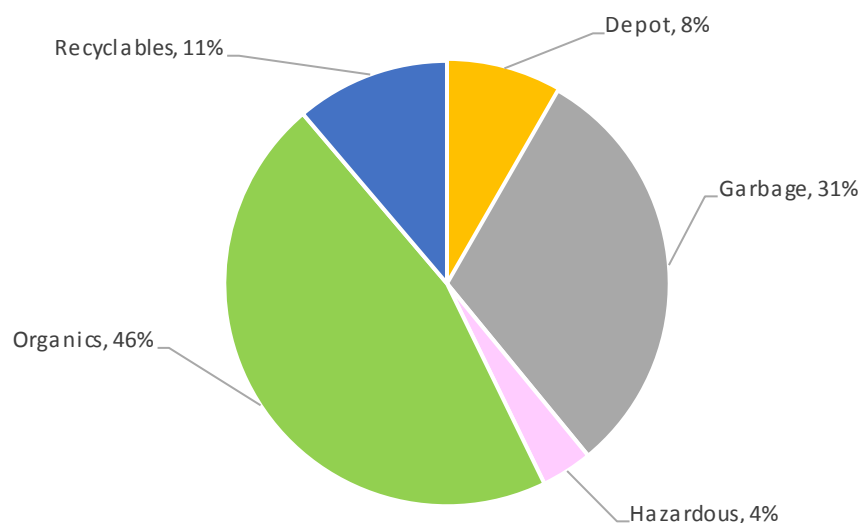


Figure 5-1: Overall Divertability of Garbage

Buildings with higher scores in the following accessibility criteria generally had a slightly lower proportion of organics in the garbage:

- Distance to reach recycling, garbage, and organics;
- Overall cleanliness and lighting;
- Security from vectors;
- Security from unlawful entrance; and
- Clear signage (not including signage on bins).

No correlations were found between accessibility criteria and the proportion of recycling in the garbage.

5.2 Recycling and Organics Contamination Performance

This section discusses the relative performance of multi-family buildings with particular attention to the contamination rates of recycling and organics.

In order to assess this performance, the 'other' category was used as a proxy for performance to simplify comparison between buildings with different streams. This 'other' category included:

- In recycling streams, all non-recyclable materials (category 10R); and
- In organics streams, all non-organic materials (category 5R).

A variety of accessibility criteria were considered. Correlations with contaminants were found for the following accessibility criteria:

- Distance to reach recycling, garbage, and organics;
- Clarity of garbage, recycling, and organics streams;
- Overall cleanliness and lighting;
- Security from vectors;
- Security from unlawful entrance; and
- Clear signage (not including signage on bins).

Table 5-2 outlines the trends observed. The contamination rates of buildings ranking one to five in each of these criteria are included in Appendix K — Accessibility Factors' Influence on Recycling Contamination.

Table 5-2: Accessibility Criteria Correlations to Recycling and Organics Contamination

Accessibility Criteria	Correlation
Distance to reach recycling, garbage, and organics	Where residents had to walk less far to the garbage, recycling, and organics areas, slightly higher rates of organics contamination were found.
Clarity of garbage, recycling, and organics streams	Buildings with better clarity of streams had half or lower the proportion of recycling contamination and significantly less organics contamination.
Overall cleanliness and lighting	Buildings with better overall cleanliness and lighting of the garbage, recycling, and organics areas had a quarter to a third less recycling contamination and slightly less organics contamination.
Security from vectors	Buildings with better security from vectors had half the recycling and organics contamination of the least secure buildings.
Security from unlawful entrance	Buildings where garbage, recycling, and organics was secure from unlawful entry one-third the organics contamination and slightly less recycling contamination than the least secure buildings.
Clear signage	Buildings with better signage had one-seventh the recycling contamination and half the organics contamination of buildings with poor signage.

6.0 CLOSURE

This proposed scope of work will be undertaken subject to the attached Limitations for the use of this Document, which will be incorporated into the report. With respect to contractual terms, this assignment will be undertaken subject to the attached sample Services Agreement unless other Contractual Terms are executed by both parties.

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



Prepared by:
Melissa Nielsen, E.I.T.
Project Engineer-in-Training
Solid Waste Management Practice
Direct Line: 604.317.8276
Melissa.Nielsen@tetrattech.com



Prepared by:
Jeremy Reid, E.I.T.
Project Engineer-in-Training
Solid Waste Management Practice
Direct Line: 778.945.5766
Jeremy.Reid@tetrattech.com



Reviewed by:
Avery Gottfried, ME, P.Eng.
Solid Waste Planning Engineer

Reviewed by:
Tamara Shulman, BA, M.Sc.
Team Lead – Planning and Consultation Specialist
Solid Waste Management Practice
Direct Line: 604.608.8636
Tamara.Shulman@tetrattech.com

/sy

TABLES

Table A	Waste Categories
Table B	Overall Recycling Results by Recycling System and Stream
Table C	Organics Results

Table A: All Category Results

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
Paper	Fine, Office, Envelopes	001 Junk Mail, Flyers, Unaddressed Mail	0.9%	0.5%	0.3%	0.7%	0.5%	0.6%
		002 Other Fine Office Paper or Envelopes	1.0%	1.0%	1.3%	1.2%	0.9%	1.0%
	Total Fine, Office, Envelopes		1.9%	1.4%	1.7%	1.9%	1.4%	1.6%
	Newsprint	003 Newsprint	1.4%	1.4%	0.6%	1.5%	1.2%	1.3%
		Total Newsprint	1.4%	1.4%	0.6%	1.5%	1.2%	1.3%
	OCC	004 Clean Recyclable OCC	0.9%	0.5%	0.4%	0.4%	0.7%	0.6%
		005 Waxed OCC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		006 Other soiled OCC	0.2%	0.3%	0.2%	0.2%	0.3%	0.3%
	Total OCC		1.1%	0.8%	0.6%	0.6%	1.1%	0.9%
	Boxboard	007 Cereal Boxes and Other Box Packaging	2.2%	1.9%	1.7%	1.7%	2.3%	2.0%
		Total Boxboard	2.2%	1.9%	1.7%	1.7%	2.3%	2.0%
	Bound Paper Products	008 Telephone Books	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
		009 Magazines	0.3%	0.4%	0.1%	0.4%	0.3%	0.3%
		010 Books	0.7%	0.2%	0.3%	0.2%	0.6%	0.4%
	Total Bound Paper Products		1.0%	0.7%	0.4%	0.6%	0.9%	0.8%
	Beverage Containers - Drink Box/Aseptic	011 Dairy or Dairy Substitute	0.3%	0.3%	0.2%	0.2%	0.3%	0.3%
		012 Non-Dairy/Deposit	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	Total Beverage Containers - Drink Box/Aseptic		0.4%	0.4%	0.3%	0.3%	0.4%	0.4%
	Other Paper	013 Single Serving Cups and Lids	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
		014 Other Compostable Paper	8.7%	8.3%	7.9%	8.5%	8.1%	8.4%
		015 Non-Compostable, Non-Recyclable Paper	0.3%	0.3%	0.4%	0.4%	0.3%	0.3%
	Total Other Paper		9.5%	8.9%	8.6%	9.2%	8.8%	9.1%
	Total Paper		17.6%	15.5%	13.8%	15.9%	16.0%	16.0%
Plastic	Film	016 Re-used Retail & Grocery bags	0.7%	0.7%	0.5%	0.7%	0.7%	0.7%
		017 Empty Retail & Grocery Bags	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
		018 Consumables Packaging Bags and Film-Recyclable	1.2%	1.2%	1.0%	1.3%	1.0%	1.2%
		019 Consumables Packaging Bags and Film-Non-Recyclable	2.8%	2.8%	2.9%	3.2%	2.5%	2.8%
		020 Garbage Bags	0.5%	0.4%	0.4%	0.4%	0.5%	0.4%
		021 Freezer/Sandwich Bags	0.2%	0.2%	0.2%	0.3%	0.2%	0.2%
		022 Deposit Beverage Pouches	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		023 Other Plastic Film	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%
	Total Film		6.1%	6.0%	5.6%	6.6%	5.5%	6.0%
	Textiles	024 Synthetic Clothing and Accessories	0.3%	0.3%	0.1%	0.1%	0.4%	0.3%
		025 Blends and Multi-Layer Clothing and Accessories	0.4%	0.5%	0.3%	0.5%	0.4%	0.4%
		026 Suspected Synthetic Clothing and Accessories	0.4%	0.4%	0.4%	0.4%	0.4%	0.4%
		027 Household	1.4%	1.1%	1.7%	1.8%	0.8%	1.3%

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
		028 Other	0.4%	0.4%	0.3%	0.4%	0.2%	0.4%
		Total Textiles	2.9%	2.6%	2.8%	3.3%	2.3%	2.7%
	Rigid Beverage Containers	029 Dairy or Dairy Substitute	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%
		030 Deposit Containers - Water	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
		031 Deposit Containers - Other	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%
		032 Single Serving Cups	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
		033 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Total Rigid Beverage Containers	0.7%	0.7%	0.4%	0.6%	0.7%	0.6%
	Rigid (non-beverage)	034 # 1 PETE - Bottles and Jars	0.3%	0.4%	0.2%	0.2%	0.4%	0.3%
		035 #1 PETE - Other Packaging	0.4%	0.3%	0.2%	0.3%	0.4%	0.3%
		036 #2 HDPE - Bottles and Jugs	0.4%	0.3%	0.4%	0.3%	0.4%	0.4%
		037 #2 HDPE - Tubs and Lids	0.0%	0.1%	0.1%	0.0%	0.1%	0.1%
		038 #3 PVC	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		039 #4 LDPE	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		040 #5 PP	0.4%	0.5%	0.4%	0.4%	0.5%	0.4%
		041 #6 PS - Non-Foam	0.2%	0.2%	0.1%	0.1%	0.2%	0.2%
		042 #6 PS - Packing Foam	0.3%	0.3%	0.2%	0.3%	0.2%	0.3%
		043 #6 PS - Other Foam	0.8%	0.8%	0.7%	0.8%	0.7%	0.8%
		044 #7 Mixed Resin Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		045 Uncoded packaging/containers	0.6%	0.5%	0.5%	0.5%	0.6%	0.5%
		Total Rigid (non-beverage)	3.5%	3.3%	2.9%	3.1%	3.5%	3.3%
	Other	046 Durable Plastic Products	1.3%	1.6%	2.0%	2.0%	1.2%	1.5%
		047 Coffee Pods	0.4%	0.3%	0.1%	0.4%	0.3%	0.3%
		048 Other/mixed plastics	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
		Total Other	1.8%	2.1%	2.2%	2.5%	1.6%	2.0%
		Total Plastic	15.0%	14.7%	13.9%	15.9%	13.5%	14.7%
Compostable Packaging and Products	Foodware	049 Cutlery, cups, lids, boxes, trays	0.3%	0.2%	0.3%	0.3%	0.2%	0.2%
		Total Foodware	0.3%	0.2%	0.3%	0.3%	0.2%	0.2%
	Film	050 Bags and liners	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Total Film	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other Compostable Products & Packaging	051 Sunchip bags, bottles	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Total Other Compostable Products & Packaging	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		Total Compostable Packaging and Products	0.3%	0.2%	0.3%	0.3%	0.2%	0.3%
Compostable Organics	Yard Waste	052 Small yard waste	2.5%	2.4%	7.0%	3.4%	2.7%	3.1%
		053 Large yard waste	0.0%	0.2%	0.0%	0.0%	0.2%	0.1%
		Total Yard Waste	2.5%	2.6%	7.0%	3.4%	2.9%	3.2%
	Food Waste	054 Unavoidable food waste	16.3%	13.7%	10.2%	12.9%	15.4%	14.2%
		055 Plate scrapings, unfinished meals	10.0%	10.6%	9.6%	8.9%	11.4%	10.2%

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
		056 Whole fruits and vegetables	2.8%	3.1%	2.0%	2.8%	2.7%	2.9%
		057 Whole meats, fish	0.8%	0.9%	0.5%	0.6%	0.9%	0.8%
		058 Full/unused ready-made	0.7%	1.0%	1.5%	0.9%	1.0%	1.0%
		059 Baked goods	1.4%	1.7%	1.7%	1.5%	1.6%	1.6%
		060 Dairy	0.7%	0.7%	1.1%	0.8%	0.8%	0.7%
		061 Liquids (drinks, oil in package)	0.7%	1.0%	0.4%	0.7%	0.9%	0.8%
		062 Candy and Snacks	0.6%	0.6%	1.0%	0.7%	0.6%	0.6%
		063 Condiments and Sauces	0.9%	1.1%	0.7%	0.9%	1.0%	1.0%
		064 Pet Food	0.0%	0.6%	0.4%	0.7%	0.1%	0.4%
	Total Food Waste		34.9%	35.0%	29.2%	31.6%	36.5%	34.1%
	Clean Wood	065 Wood pallets	0.3%	0.0%	0.0%	0.0%	0.2%	0.1%
		066 Unfinished wood furniture	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		067 Other wood	0.3%	0.4%	0.1%	0.3%	0.4%	0.3%
	Total Clean Wood		0.6%	0.4%	0.1%	0.3%	0.6%	0.4%
	Other Compostable Organics	068 Manure, slaughterhouse, animals	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Other Compostable Organics		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Compostable Organics		38.0%	38.0%	36.4%	35.3%	40.0%	37.8%
Non-Compostable Organics	Treated and Painted Wood	069 Pressure Treated Wood	0.0%	0.4%	0.3%	0.4%	0.0%	0.2%
		070 Finished Wood	0.4%	0.3%	0.2%	0.4%	0.3%	0.3%
		071 Finished Wood furniture	1.1%	0.2%	0.2%	0.6%	0.4%	0.5%
	Total Treated and Painted Wood		1.5%	0.8%	0.7%	1.5%	0.7%	1.1%
	Textiles	072 Natural Fiber Clothing	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%
		073 Semi-synthetic Clothing	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
		074 Suspected Natural Clothing	0.4%	0.2%	0.4%	0.3%	0.3%	0.3%
		075 Household	0.8%	1.1%	1.0%	0.9%	1.0%	1.0%
		076 Other	0.2%	0.2%	0.1%	0.1%	0.1%	0.2%
	Total Textiles		2.1%	2.2%	2.4%	2.1%	2.2%	2.2%
	Rubber	077 Tires	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
		078 Other Rubber	0.4%	0.5%	0.5%	0.4%	0.5%	0.4%
	Total Rubber		0.4%	0.5%	0.5%	0.4%	0.5%	0.5%
	Leather/Multiple/Composite Organic Materials Other	079 Leather	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%
		080 Composite Organic Materials (shoes)	0.6%	0.6%	0.5%	0.6%	0.6%	0.6%
		081 Other (wax, non-compostable)	0.4%	0.2%	0.6%	0.5%	0.2%	0.3%
	Total Leather/Multiple/Composite Organic Materials Other		1.1%	1.0%	1.1%	1.2%	0.9%	1.0%
	Total Non-Compostable Organics		5.2%	4.5%	4.8%	5.2%	4.3%	4.8%
Metals	Ferrous	082 Food Containers	0.5%	0.6%	0.4%	0.4%	0.6%	0.5%
		083 Spiral-wound Containers	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
		084 Other Ferrous	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
	Total Ferrous		0.6%	0.7%	0.5%	0.5%	0.7%	0.6%
	Bimetallic	085 Food Containers	0.1%	0.2%	0.1%	0.2%	0.1%	0.1%
	Total Bimetallic		0.1%	0.2%	0.1%	0.2%	0.1%	0.1%
	Non-Ferrous (copper, aluminum, brass)	086 Alcoholic	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
		087 Non-Alcoholic	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
		088 Food containers	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
		089 Foil trays, wrap	0.5%	0.4%	0.3%	0.5%	0.4%	0.4%
	090 Other Non-Ferrous		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Non-Ferrous (copper, aluminum, brass)		0.7%	0.6%	0.7%	0.7%	0.6%	0.7%
	Non-Consumable Mixed Metals	091 Household	1.4%	0.9%	1.2%	1.7%	0.7%	1.1%
		092 Machine Parts	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
		093 Construction/Industrial	0.2%	0.1%	0.6%	0.4%	0.0%	0.2%
	Total Non-Consumable Mixed Metals		1.5%	1.1%	1.9%	2.1%	0.8%	1.4%
	Total Metals		3.0%	2.5%	3.2%	3.4%	2.2%	2.8%
Glass	Beverage Containers	094 Beer	0.3%	0.1%	0.1%	0.3%	0.1%	0.2%
		095 Other Alcohol	0.6%	0.4%	0.2%	0.5%	0.5%	0.5%
		096 Non-Alcoholic & Non-Dairy	0.2%	0.1%	0.1%	0.2%	0.1%	0.2%
		097 Dairy or Dairy Substitute	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Beverage Containers		1.2%	0.7%	0.4%	1.0%	0.7%	0.8%
	Food Containers	098 Food Containers	0.7%	0.8%	0.6%	0.6%	1.0%	0.7%
	Total Food Containers		0.7%	0.8%	0.6%	0.6%	1.0%	0.7%
	Other Glass and Ceramics	099 Other Glass and Ceramics	1.9%	1.2%	1.1%	2.1%	0.9%	1.4%
	Total Other Glass and Ceramics		1.9%	1.2%	1.1%	2.1%	0.9%	1.4%
	Total Glass		3.8%	2.7%	2.1%	3.6%	2.6%	3.0%
Building Material	Gypsym/Drywall	100 Gypsym/Drywall	0.3%	0.7%	3.5%	1.8%	0.2%	0.9%
	Total Gypsym/Drywall		0.3%	0.7%	3.5%	1.8%	0.2%	0.9%
	Masonry	101 Masonry	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%
	Total Masonry		0.1%	0.0%	0.0%	0.0%	0.1%	0.0%
	Rock, Sand, Dirt	102 Rock, Sand, Dirt	0.0%	0.2%	0.4%	0.1%	0.3%	0.2%
	Total Rock, Sand, Dirt		0.0%	0.2%	0.4%	0.1%	0.3%	0.2%
	Rigid Asphalt	103 Rigid Asphalt	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Rigid Asphalt		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Carpet Waste	104 Carpet Waste	0.3%	0.0%	0.0%	0.2%	0.0%	0.1%
	Total Carpet Waste		0.3%	0.0%	0.0%	0.2%	0.0%	0.1%
	Other Inorganics	105 Other Inorganics	0.0%	0.4%	0.1%	0.2%	0.3%	0.2%
	Total Other Inorganics		0.0%	0.4%	0.1%	0.2%	0.3%	0.2%
	Total Building Material		0.8%	1.4%	4.1%	2.4%	0.9%	1.5%

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
Electronic Waste	Computer and Peripherals	106 Desktop Computers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		107 Notebook Computers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		108 Computer Peripherals	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%
		109 Computer Monitors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		110 Printers, Scanners	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Computer and Peripherals		0.1%	0.1%	0.0%	0.1%	0.1%	0.1%
	Televisions & AV Equipment	111 Televisions	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		112 Other audio/video	0.2%	0.1%	0.0%	0.1%	0.2%	0.1%
	Total Televisions & AV Equipment		0.2%	0.1%	0.0%	0.1%	0.2%	0.1%
	Telephones & Telecommunications Equipment	113 Mobile Phones & Accessories	0.1%	0.0%	0.3%	0.2%	0.1%	0.1%
		114 Other	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%
	Total Telephones & Telecommunications Equipment		0.1%	0.1%	0.3%	0.3%	0.1%	0.2%
	Small Appliances & Floor Care Appliances	115 Small Appliances	0.9%	1.0%	1.1%	1.1%	0.9%	1.0%
	Total Small Appliances & Floor Care Appliances		0.9%	1.0%	1.1%	1.1%	0.9%	1.0%
	Electronic Toys	116 Electronic Toys	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	Total Electronic Toys		0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
	Smoke Detectors	117 Smoke Detectors	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Smoke Detectors		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Other Electronics	118 Other Electronics	0.3%	0.4%	0.1%	0.2%	0.4%	0.3%
	Total Other Electronics		0.3%	0.4%	0.1%	0.2%	0.4%	0.3%
	Total Electronic Waste		1.5%	1.8%	1.6%	1.8%	1.7%	1.7%
Household Hazardous	Batteries	119 Lead acid	0.5%	0.0%	0.0%	0.4%	0.0%	0.2%
		120 All other batteries	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	Total Batteries		0.6%	0.1%	0.1%	0.6%	0.1%	0.3%
	Medical/Biological	121 Sharps	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		122 Animal Carcass (Pets)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		123 Other	0.0%	0.3%	0.0%	0.1%	0.3%	0.2%
	Total Medical/Biological		0.0%	0.4%	0.0%	0.1%	0.3%	0.2%
	HHW	124 Stains/preservatives	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%
		125 Latex Paint	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%
		126 Oil-based Paint	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		127 Paint Aerosols	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		128 Solvents	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		129 Cleaners, Soaps etc.	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
		130 Pesticides/Herbicides/Preservatives	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
		131 Motor Oil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		132 Oil Filters	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		133 Antifreeze	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Primary Category	Secondary Category	Tertiary Category	Building Type		Unit Ownership Type			Overall (N=100)
			High Rise (N=36)	Low Rise (N=51)	Townhouse (N=13)	Condo (N=46)	Rental (N=51)	
		134 Pharmaceuticals	0.3%	0.2%	0.1%	0.2%	0.2%	0.2%
		135 Other Petroleum Based Products	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%
		136 Other HHW or containers	0.1%	0.1%	0.1%	0.2%	0.0%	0.1%
	Total HHW		0.6%	0.7%	0.4%	0.8%	0.5%	0.6%
	Mercury Containing Items	137 Thermostants and switches	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		138 CFLs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Mercury Containing Items		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total Household Hazardous		1.3%	1.1%	0.6%	1.5%	0.8%	1.1%
Household Hygiene	Biological	139 Diapers	6.0%	7.1%	10.2%	6.7%	7.5%	7.1%
		140 Pet Waste	3.9%	7.5%	6.2%	4.8%	7.0%	6.0%
		141 Other (sanitary products, condoms)	1.0%	1.3%	1.5%	1.3%	1.1%	1.2%
	Total Biological		10.8%	15.8%	17.8%	12.8%	15.5%	14.2%
	Liquid Product	142 Personal care	0.6%	0.4%	0.3%	0.6%	0.3%	0.4%
	Total Liquid Product		0.6%	0.4%	0.3%	0.6%	0.3%	0.4%
	Total Household Hygiene		11.4%	16.2%	18.2%	13.4%	15.9%	14.7%
Bulky Objects	White Goods	143 Large Appliances	0.0%	0.1%	0.0%	0.1%	0.0%	0.1%
	Total White Goods		0.0%	0.1%	0.0%	0.1%	0.0%	0.1%
	Furniture	144 Mattresses, Box Springs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		145 Other upholstered Furniture	0.5%	0.0%	0.0%	0.0%	0.3%	0.2%
		146 Other furniture	0.2%	0.1%	0.0%	0.0%	0.2%	0.1%
	Total Furniture		0.7%	0.1%	0.0%	0.0%	0.5%	0.3%
	Total Bulky Objects		0.7%	0.2%	0.0%	0.1%	0.5%	0.3%
Fines	Fines	147 Fines	1.4%	1.3%	1.1%	1.2%	1.4%	1.3%
	Total Fines		1.4%	1.3%	1.1%	1.2%	1.4%	1.3%
	Total Fines		1.4%	1.3%	1.1%	1.2%	1.4%	1.3%
Grand Total			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table B: Overall Recycling Results by Recycling System and Stream

Overall Recycling Results (N=100)						
	Mixed Containers	Mixed Paper	Glass	Cardboard	Mixed Containers and Paper	Overall
Deposit Beverage	10%	0%	4%	0%	2%	3%
Paper Containers	5%	1%	0%	1%	3%	1%
Plastic Containers	39%	0%	2%	0%	7%	5%
Recyclable Metal	7%	0%	3%	0%	1%	1%
Recyclable Glass	16%	0%	82%	0%	1%	7%
Paper	10%	89%	4%	18%	56%	53%
Cardboard	0%	9%	0%	79%	14%	24%
EPS (Packaging)	1%	0%	0%	0%	0%	<1%
EPS (Other)	1%	0%	0%	0%	0%	<1%
Other	12%	1%	6%	1%	14%	5%

Recycling Results for Buildings with Multi-Stream Systems (N=73)					
	Mixed Containers	Mixed Paper	Glass	Cardboard	Overall
Deposit Beverage	10%	0%	5%	<1%	3%
Paper Containers	5%	1%	1%	1%	1%
Plastic Containers	39%	<1%	2%	<1%	5%
Recyclable Metal	7%	<1%	3%	<1%	1%
Recyclable Glass	16%	0%	84%	<1%	6%
Paper	10%	89%	1%	14%	56%
Cardboard	<1%	9%	<1%	84%	24%
EPS (Packaging)	1%	<1%	<1%	<1%	<1%
EPS (Other)	1%	<1%	<1%	<1%	<1%
Other	12%	1%	4%	0%	3%

Recycling Results for Buildings with Single-Stream Systems (N=27)				
	Mixed Containers and Paper	Glass	Cardboard	Overall
Deposit Beverage	2%	1%	1%	2%
Paper Containers	3%	<1%	1%	2%
Plastic Containers	7%	1%	<1%	5%
Recyclable Metal	1%	2%	<1%	1%
Recyclable Glass	1%	78%	<1%	10%
Paper	56%	7%	30%	44%
Cardboard	14%	1%	64%	23%
EPS (Packaging)	<1%	<1%	<1%	<1%
EPS (Other)	<1%	<1%	<1%	<1%
Other	14%	9%	4%	11%

Table C: Organics Results

	Organics Category	Sum of Category Weight (kg)
1	Compostable Paper	6%
2	Yard Waste	4%
3	Food Waste	89%
4	Clean Wood	0%
5	Other	2%
	Grand Total	100.0%

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner

consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

INITIAL FORM EMAIL

Initial Contact Letter

Dear **NAME OF BUILDING CONTACT**,

I am contacting you on behalf of Metro Vancouver. I understand that you are the primary contact for the multi-family residential property located at **ADDRESS** and that you have agreed to have your building be part of a regional study on multi-family waste composition. Tetra Tech Canada Inc. (Tetra Tech) is completing this study and conducting a survey on behalf of Metro Vancouver to determine waste composition and the current state of recycling programs in multi-family complexes. An authorization letter for Tetra Tech from Metro Vancouver is attached, including the intended outcomes of this study.

This study consists of two parts:

1. A short online or phone survey; and
2. A site visit by Tetra Tech staff to your complex to sample your garbage and view your recycling room, if applicable

It is important to stress that this is *not* an audit or a regulatory check; no fines will be issued based on the findings of this study. Rather, the goal of the study is simply to collect data to improve support and resources available to multi-family buildings.

Please complete the survey at the following link: www.survey.com.

This survey should not take more than 5-10 minutes of your time. The final question will inquire about your schedule in order to schedule an appropriate time for our staff to visit to your complex. A Tetra Tech representative will respond to you within two business days of your completion of this survey to schedule this site visit. During the site visit, all that will be required is for you to allow us access to your garbage room and bins.

If you do not feel that you are the best person to complete the survey for the complex at **ADDRESS**, we ask that forward this email to the appropriate contact.

If you no longer manage or reside in the complex at **ADDRESS**, please respond to this email to let us know.

Thank you for your time and cooperation with this study. If I do not receive a reply from you, I will follow up by phone in the next several days. Alternatively, please feel free to contact me by phone at 604.608.8638.

Thank you for your time,

APPENDIX C

PHONE SURVEY QUESTIONS

No.	Question	Possible Answers
1	What type of complex is it?	(Apartment Building, Multiple Buildings, Townhouse)
2	Do you have shared bins if townhouse?	(Y/N or N/A)
3	When is your garbage day(s)?	Days of Week
4	Recycling Days?	Days of Week
5	Organics Days?	Days of Week
6	Do you have a compactor and who is hauler, if so?	Y/N, hauler
7	Are your bins locked or in a locked area?	Y/N
10	Are your garbage, recycling, or organics bins shared with any businesses?	Y/N
11	How many storeys does your complex have?	Number
12	Number of units?	Number
13	Does your complex have condominiums, rental units, or a mix of both?	Condos, rentals, mixed
14	If condos: How many units are rented?	Number
15	How many units have in-sink disposal?	Number
16	Do your complex have a garbage chute(s)?	Y/N
17	Comment on how bulky items are disposed?	Open-ended
18	Have residents been provided with resources to assist them in their recycling efforts?	Y/N
19	What resources have your residents been provided?	Open-ended

APPENDIX D

ACCESSIBILITY CRITERIA

Complexes were ranked for the accessibility criteria below on a scale of 1-5. In the table below, G=garbage, R=recycling, O=organics.

No.	Criteria	Best (5)	Worst (1)
Convenience			
1	Distance that residents walk to reach R/G/O	Residents walk <10 m	Residents walk >50 m
2	Distance that residents walk to reach R/O, relative to the distance residents walk reach G	R, G, & O together	R/O farther than G
3	Distance from G to R/O	In the same room	>50 m apart
4	Clarity of streams that are in the same area	For every bin present, it is clear which stream the bin contains	It is not clear which stream bins contain for many of the bins present
5	Presence of designated bulky item collection area	A bulky item area has been clearly demarcated	No bulky items area is present and there is no sign prohibiting the dumping of bulky items
Accessibility			
6	Physical accessibility of R/G/O area.	Easy, area can be used by those with physical restrictions	The path to R/G/O area is obstructed, uneven, or difficult to use
7	Ease of reaching bins in R/G/O area	All bins were easily accessible	Bins were not easy to reach; bins needed to be moved to reach other bins or R/G/O area was very small
8	Ease of opening bins	Easy; no obstructions	Obstructions blocked opening of bins
Safety & Cleanliness			
9	Current bin conditions	Labels for all bins were clean and visible; no damage	All or most bins are damaged
10	Overall cleanliness, lighting and safety	Area is bright, well-kept and clean	Area is dark, has a foul odour, bins are overflowing
11	Security from vectors (i.e. animals, rain, wind)	R/G/O area is in secured space with gate and overhanging roof	R/G/O area is in open area with no lock
12	Security from unlawful entry	R/G/O area is in secured, locked space	Bins are neither in locked area nor are bins equipped with locks
Education			
13	Clarity and presence of signage (other than signage on bins)	All streams have signs. Signs are in line of sight, clear and colour-coded.	No signs except stickers on bins (make note if no signs whatsoever)

APPENDIX E

SITE ASSESSMENTS AND SORTING PHOTOS

SITE ASSESSMENT PHOTOGRAPHS



Photo 1: Field technician takes note of illegal dumping in the refuse area



Photo 2: Field technician records size and stream for each bin before inspecting the contents



Photo 3: Field technician visually audits and weighs each bin for all waste streams



Photo 4: Field technician collects a garbage sample from the dumpster for sorting off site

WASTE COMPOSITION PHOTOS



Photos 5&6: Field technicians carefully sort through garbage sample while wearing personal protective equipment

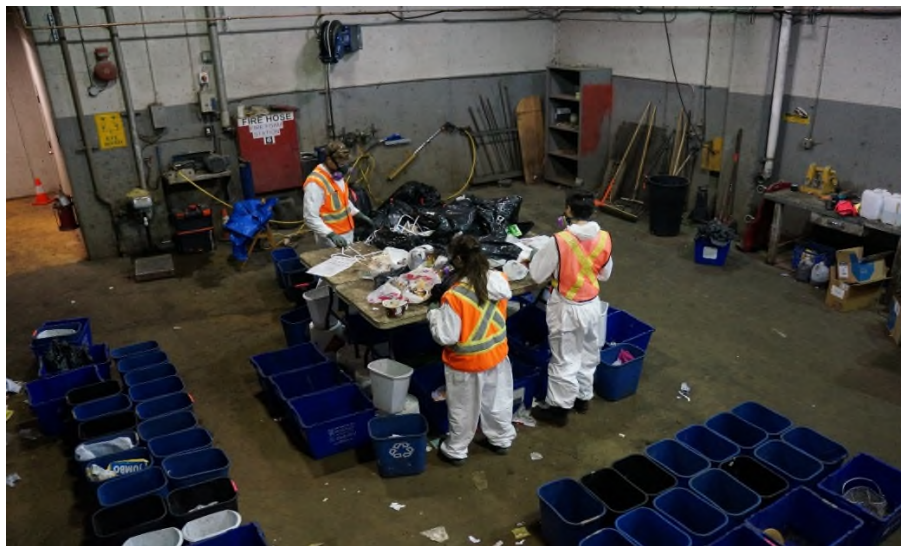


Photo 7: Waste sorting set-up includes many bins for sorting waste into 147 categories

APPENDIX F

DENSITY REFERENCE

	Category	kg/m ³	Reference
Recycling and Organics Streams – Overall Stream Densities			
MC	Mixed Containers	18	EPA Conversion Factors - Commingled Recyclable Material, Containers (Containers (plastic bottles, Aluminum cans, Steel cans, Glass bottles) – No paper, Multifamily Recyclables.
MP	Mixed Paper	18	EPA Conversion Factors - Commingled Recyclable Material, Multifamily Recyclables.
G	Glass	132	EPA Conversion Factors - Glass, Bottles, Loose.
SS	Single Stream	18	EPA Conversion Factors - Commingled Recyclable Materials, Multifamily Recyclables.
CB	Cardboard	26	EPA Conversion Factors - Paper, Old Corrugated Containers and Chip Board, Uncompacted.
MO	Mixed Organics	161	EPA Conversion Factors - Food Waste.
FW	Food Waste	161	EPA Conversion Factors - Food Waste.
YW	Yard Waste	86	EPA Conversion Factors - Yard Trimmings, Mixed Yard Waste, Uncompacted.
Recycling Categories			
1R	Deposit Beverage	24	EPA Conversion Factors - Commingled Recyclable Material, Containers (Plastic bottles, Aluminum cans, Steel cans, Glass bottles) — No paper, Campus Recyclables.
2R	Paper Containers	18	EPA Conversion Factors - Paper, Miscellaneous, Cartons (milk and juice) uncrushed.
3R	Plastic Containers	14	EPA Conversion Factors - Plastic, Mixed Bottles/Containers #1 -#7, Loose.
4R	Recyclable Metal	23	EPA Conversion Factors - Metals, Average of Aluminum Cans & Steel Cans.
5R	Recyclable Glass	132	EPA Conversion Factors - Glass, Bottles, Loose.
6R	Paper	85	EPA Conversion Factors - Paper, Average of Office Paper - Mixed – Loose.
7R	Cardboard	26	EPA Conversion Factors - Paper, Old Corrugated Containers and Chip Board, Uncompacted.
8R	EPS (packaging)	11	EPA Conversion Factors - Plastic, Miscellaneous, Expanded Polystyrene Packaging/Insulation.
9R	EPS (other)	11	EPA Conversion Factors - Expanded Polystyrene Packaging/Insulation.
10R	Other (add comments)	62	Calculated average density of MSW in this study.
Organics Categories			
1O	Compostable Paper	85	EPA Conversion Factors - Average of Office Paper - Mixed – Loose.
2O	Yard Waste	86	EPA Conversion Factors - Yard Trimmings, Mixed Yard Waste, Uncompacted.
3O	Food Waste	161	EPA Conversion Factors - Food Waste.
4O	Clean Wood	59	EPA Conversion Factors - C&D, Wood, Other Recyclable Wood.
5O	Other Materials	62	Calculated average density of MSW in this study.

APPENDIX G

RECYCLING AND ORGANICS CATEGORIES

Table G-1: Recycling Categories

No.	Recycling Categories	Examples
1R	Deposit Beverage	Single-use beverage containers which can be returned for a refund.
2R	Paper Containers	Single serving paper cups (i.e., coffee cups), cartons for milk and milk substitutes, and other paper packaging, such as ice cream containers.
3R	Plastic Containers	All plastic containers other than single-use beverage containers.
4R	Recyclable Metal	Metal packaging such as food cans, foil trays, aluminum beverage containers.
5R	Recyclable Glass	Glass for food packaging such as jam jars and pasta sauce jars.
6R	Paper	All paper materials except corrugated cardboard, such as boxboard, office paper, and envelopes.
7R	Cardboard	All corrugated cardboard.
8R	EPS (food packaging)	Single-serve food containers commonly used for sushi and other fast food.
9R	EPS (other)	Large blocks of packaging expanded polystyrene frequently used for packaging televisions and appliances.
10R	Other	All materials that do not fit into one of the above categories.

Table G-2: Organics Categories

No.	Organic Categories	Examples
1O	Compostable Paper	Food-soiled paper products such as paper towel and tissues.
2O	Yard Waste	All yard waste such as cut grass, cut flowers, or pruned branches.
3O	Food Waste	All food waste.
4O	Clean Wood	All wood products that were not treated or painted.
5O	Other Materials	All materials that do not fit into one of the above categories.

APPENDIX H

SAMPLE PHOTOS



Photo 1: Garbage, Sample 1301



Photo 2: Garbage, Sample 2201

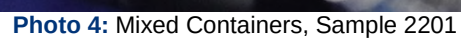
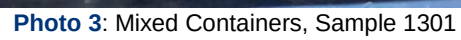




Photo 5: Mixed Paper, Sample 1301



Photo 6: Mixed Paper, Sample 2201



Photo 7: Cardboard, Sample 1301



Photo 8: Cardboard, Sample 2201



Photo 9: Single Stream Recycling, Sample 1313



Photo 10: Glass Recycling, Sample 1306



Photo 11: Garbage Sample Photo, Sample 1306



Photo 12: Garbage Sample, Sample 1315

APPENDIX I

CATEGORY PHOTOS



Image 1: Category 2 - Other Fine Office Paper or Envelopes



Image 2: Category 13 - Single Serving Cups



Image 3: Category 15 - Non-compostable, Non-recyclable Paper



Image 4: Category 21 - Freezer/Sandwich Bags



Image 5: Category 35 - #1 Polyethylene Terephthalate (Other Packaging)



Image 6: Category 43 - #6 Polystyrene (All Other Foam)



Image 7: Category 46 - Durable Plastic Products



Image 8: Category 49 - Compostable Cutlery, Cups, Lids, Boxes, Trays



Image 9: Category 72 - Natural Fiber Clothing



Image 10: Category 74 - Suspected Natural Clothing



Image 11: Category 78 - Other Rubber

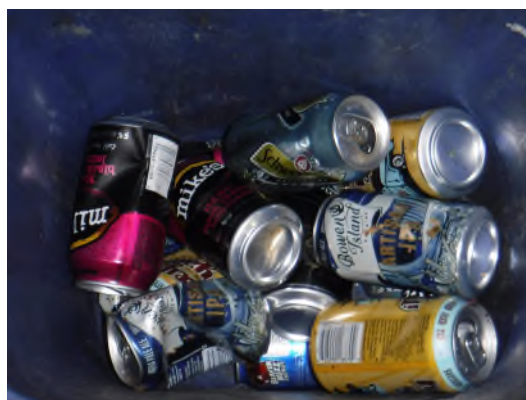


Image 12: Category 86 - Non-Ferrous Alcoholic Containers



Image 13: Category 90 - Other Non-Ferrous Containers



Image 14: Category 98 - Glass Food Containers



Image 15: Category 119 - All Other Batteries



Image 16: Category 142 - Personal Care

APPENDIX J

GARBAGE CATEGORIES

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
1	Paper	Fine, Office, Envelopes	Junk Mail, Flyers, Unaddressed Mail		Recyclables
2			Other Fine Office Paper or Envelopes		Recyclables
3		Newsprint	Newsprint		Recyclables
4		OCC	Clean Recyclable OCC		Recyclables
5			Waxed OCC	Non-recyclable, compostable	Organics
6			Other Soiled OCC	Contaminated with food/blood/grease, dirty pizza boxes	Recyclableness
7		Boxboard	Cereal Boxes and Other Box Packaging		Recyclables
8		Bound Paper Products	Telephone Books		Recyclables
9			Magazines		Recyclables
10			Books		Depot
11		Beverage Containers – Drink Box/Aseptic/Gabletop Containers	Dairy or Dairy Substitute		Recyclables
12			Non-Dairy/Deposit		Depot
13		Other Paper	Single Serving Cups	Coffee, tea, drinks, etc.	Recyclables
14			Other Compostable Paper	paper plates, tissue paper, toweling, etc.	Organics
15			Non-compostable, non-recyclable paper	Tar paper, laminated paper. Coated paper, etc.	Garbage
16	Plastic	Film	Re-Used Retail & Grocery Bags	Re-used as kitchen catchers: HDPE & LDPE retail and grocery carry out plastic bags containing waste (e.g., household or for containing recyclables or organics)	Depot
17			Empty Retail & Grocery Bags	Empty: HDPE and LDPE retail and grocery carryout bags that have not been reused	Depot
18			Consumables Packaging Bags and Film - Recyclable	Dry cleaning bags, bread bags, frozen food bags, milk bags, toilet paper and toweling over-wrap, garden product bags (seed, soil, fertilizer), furniture and electronic overwrap; etc.	Depot

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
19			Consumables Packaging Bags and Film – Non-recyclable	Multi-layer plastic films; vacuum sealed bacon, luncheon meat and cheese overwrap; cereal liners; chip bags and other snack food bags; meat, poultry and fish wrap; candy wraps; pasta bags; plastic based food pouches; bubble wrap; cling wrap etc.	Garbage
20			Garbage Bags	HDPE & LDPE garbage bags, kitchen catchers, blue or clear bags for recyclables	Depot
21			Freezer/Sandwich Bags	HDPE & LDPE sandwich, freezer bags, ziplocs and other food use bags	Depot
22			Deposit Beverage Pouches		Depot
23			Other Plastic Film	Pallet / distribution wrap and lumber wrap (nonwoven), tarps, other plastic film	Garbage
24		Textiles (Synthetic)	Synthetic Clothing and Accessories (COUNT)	Wearable or formerly wearable that are >80% Polyester, acrylic, nylon, organza, polypropylene, Satin, Spandex, Lycra and Elastane	Garbage
25			Blends and Multi-Layer Clothing and Accessories (COUNT)	20-80% synthetic or has multiple material such as wool jackets with satin liner	Garbage
26			Suspected Synthetic Clothing and Accessories (COUNT)	Unidentified, has no tag, but likely synthetic such as socks, bras and underwear	Garbage
27			Household	Linens, blankets, old clothes used as rags etc.	Garbage
28			Other	All other textiles (e.g., filter fabric, artificial turf)	Garbage
29		Rigid Beverage Containers	Dairy or Dairy Substitute		Recyclables
30			Deposit Containers – Water	Water Bottles	Depot
31			Deposit Containers – Other	All other deposit beverage bottles: juice, pop, alcohol	Depot
32			Single Serving Cups	PE, PS, coffee, tea, drinks, etc.	Recyclables
33			Other	Non-deposit juice, water or pop containers	Recyclables

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
34		Rigid (non-beverage)	# 1 PETE – Bottles and Jars	Other Bottles and Jars: #1, cooking oil, peanut butter, dish soap, mouthwash, etc. (excluding bottles that contained HHW)	Recyclables
35			#1 PETE – Other Packaging	Other Packaging: #1, bakery, clamshells, trays, ovenable trays, egg cartons	Recyclables
36			#2 HDPE – Bottles and Jugs	Other Bottles and Jugs: #2, laundry soap, shampoo, windshield washer fluid, etc. (excluding bottles that contained HHW)	Recyclables
37			#2 HDPE – Tubs and Lids	Wide mouth tubs and lids, dairy tubs, pails, lawn, garden, pool supplies, kitty litter, etc.	Recyclables
38			#3 PVC	Bottles and Jars: #3 bottles and jars, lotions, soaps, bug repellents, shampoos, etc.	Recyclables
39			#4 LDPE	Wide mouth tubs and lids, dairy tubs, etc.	Recyclables
40			#5 PP	Wide mouth tubs and lids, dairy tubs, pails, lawn, garden, pool supplies, kitty litter, etc.	Recyclables
41			#6 PS – Non-Foam	#6 PS (non-foam), trays, clamshells, lids, pill and vitamin bottles, seedling trays, etc.	Recyclables
42			#6 PS – Packing Foam	#6 PS (foam) EPS used to protect boxed products, like tv's etc.	Depot
43		Rigid (non-beverage) (Cont'd)	#6 PS – All Other Foam	#6 PS (foam), food trays, clamshells, seedling trays, packing peanuts etc.	Depot
44			#7 Mixed Resin Plastic	Food containers, mustard, ketchup and some juices	Garbage
45			Uncoded Packaging/Containers	Blister packaging, tubes for pharmaceutical & health care/cosmetic products, plant pots, unmarked/coded packaging, etc.	Garbage
46			Durable Plastic Products	Non-packaging such as VCR tapes, CDs, toys, games, plant pots,	Garbage

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
				Tupperware, furniture, siding, plumbing pipes, etc.	
47		Other	Coffee Pods		Recyclables
48			Other/Mixed Plastics		Garbage
49	Compostable Products and Packaging	Foodware	Cutlery, Cups, Lids, Boxes, Trays	Compostable cutlery (including chopsticks, wooden cutlery etc.), cups, lids, bowls, deli containers, trays, etc.	Organics
50		Film	Bags and Liners	Compostable kitchen catcher bags, toter liners, overwrap, grocery bags, etc.	Organics
51		Other Compostable Products and Packaging	Packaging , Bottles	Sunchip bags, pop bottles, water bottles, or other compostable packaging	Organics
52	Compostable Organics	Yard & Garden	Small Yard Waste	Small yard waste (leaves, branches, brush, grass clippings, wood chips, plant material, potting soil, peat, etc.)	Organics
53			Large Yard Waste	Other large yard wastes (branches, etc. over 15 cm dia. or 1 m long)	Organics
54		Food Waste	Unavoidable Food Waste	Unavoidable food waste arising from food/drink preparation (bones, egg shells, tea bags, peels, oil, fats)	Organics
55			Plate Scrapings, Unfinished Meals		Organics
56			Whole Fruits and Vegetables		Organics
57			Whole Meats, Fish		Organics
58			Full/Unused Ready-Made	Packaged items, canned foods,	Organics
59			Baked Goods		Organics
60			Dairy	Yogurt, cheese, butter	Organics
61			Liquids (drinks, oil in package)		Organics
62			Candy and snacks	Chips, candy, nuts	Organics
63			Condiments and sauces	Condiments, pasta sauce, salsa in container	Organics
64			Pet food		Organics

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
65		Clean Wood	Wood Pallets	Unpainted, untreated	Depot
66			Unfinished Wood Furniture	No composites	Depot
67			Other Wood	Mixed/dimensional lumber, rotting wood - unpainted, untreated	Depot
68		Other Compostable Organics	Manure, Slaughterhouse, Animals	Manure, animals prepared for food	Organics
69	Non-Compostable Organics	Treated or Painted Wood	Pressure Treated Wood	Treated lumber, shingles, decking etc.	Garbage
70			Finished Wood	Flooring, paneling, siding, glued particle board, plywood, OSB - painted, stained or finished	Garbage
71			Finished Wood Furniture	Not multi-material	Garbage
72		Textiles	Natural Fiber Clothing (COUNT)	Wearable or formerly wearal that are >80% Cotton, denim, wool, alpaca, angora, cashmere, bamboo, hemp, jute, linen, or silk	Garbage
73			Semi-synthetic Clothing (COUNT)	>80% of the following fibre types: Modal, Rayon, Tencel, Viscose	Garbage
74			Suspected Natural Clothing (COUNT)	Unidentified, no tag but suspected natural	Garbage
75			Household	Drapes, blankets and linens, towels, sheets, table cloths, stuffed toys	Garbage
76			Other	Drop cloths	Garbage
77		Rubber	Tires		Depot
78			Other Rubber	Gloves	Garbage
79		Leather/ Multiple/Composite Organic Materials	Leather	Jackets, purses, belts	Garbage
80			Composite Organic Materials (shoes)	Including leather footwear	Garbage
81			Other	Wax and other non-compostable materials	Garbage
82	Metals	Ferrous	Food Containers		Recyclables
83			Spiral-Wound Containers	Frozen juice containers, coffee cans, chip and nut containers	Recyclables
84			Other Ferrous		Depot Drop-Off

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
85		Bimetallic	Food Containers		Recyclables
86		Non-Ferrous (copper, aluminium, brass)	Alcoholic		Depot
87			Non-Alcoholic		Depot
88			Food Containers		Recyclables
89			Foil Trays, Wrap		Recyclables
90			Other Non-Ferrous		Depot
91		Non-Consumable Mixed Metals	Household	Kitchen & bathroom fixtures, coat hangers, other metal fixtures, closet doors, filing cabinets, furnishings, etc.	Depot Drop-Off
92			Machine Parts	Auto parts, electric motors, bicycles and parts, lawn mowers, etc.	Depot Drop-Off
93			Construction/Industrial	Nails, screws, handheld tools, drywall trim, flashing, baseboard heaters, industrial doors, panels, etc.	Depot
94	Glass	Beverage Containers	Beer		Depot
95			Other Alcohol		Depot
96			Non-Alcoholic & Non-Dairy		Depot
97			Dairy or Dairy Substitute		Recyclables
98		Food Containers	Food Containers		Recyclables
99		Other Glass and Ceramics	Other Glass and Ceramics	Dishware, mirrors, incandescent light bulbs, fibreglass insulation, plant pots, coffee cups	Garbage
100	Building Material	Gypsum / Drywall	Gypsum/Drywall		Hazardous
101		Masonry	Masonry		Depot
102		Rock, Sand, Dirt	Rock, Sand, Dirt		Depot
103		Rigid Asphalt	Rigid Asphalt		Depot
104		Carpet Waste	Carpet Waste		Depot
105		Other Inorganics	Other Inorganics	Insulation, Linoleum, Laminate, Stucco, etc.	Garbage
106		Computers and Peripherals	Desktop Computers		Hazardous
107			Notebook Computers		Hazardous

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
108	Electronic Waste		Computer Peripherals	Including key board, mouse, cables, modems, routers and external hardware other than below	Hazardous
109			Computer Monitors		Hazardous
110			Printers, Scanners		Hazardous
111		Televisions & AV Equipment	Televisions		Hazardous
112			Other Audio/Video		Hazardous
113		Telephones &	Mobile Phones & Accessories		Hazardous
114		Telecommunications Equipment	Other	Land line phones and accessories, fax machines	Hazardous
115		Small Appliances & Floor Care Appliances	Small Appliances & Floor Care Appliances	Microwaves, toasters, vacuum cleaners, coffee makers, corded and cordless, etc.	Hazardous
116		Electronic Toys	Electronic Toys		Hazardous
117		Smoke Detectors	Smoke Detectors		Hazardous
118		Other Electronics	Other Electronics		Hazardous
119	Household Hazardous	Batteries	Lead Acid	Car, truck, boat, wheel chair, golf cart batteries over 2 kg under BCBCP Stewardship Program	Hazardous
120			All Other Batteries	All types of Rechargeable and Non Rechargeable Batteries Ni-Cd, Ni-MH, Li-ion and Small Pb under 1 kg, Dry cell, alkaline, copper top, button cell and other household batteries	Hazardous
121		Medical/Biological	Sharps	Needles	Hazardous
122			Animal Carcass (Pets)		Hazardous
123			Other	Bandages, IV bags, etc.	Hazardous
124		HHW	Stains/Preservatives		Hazardous
125			Latex Paint		Hazardous
126			Oil-Based Paint		Hazardous
127			Paint Aerosols		Hazardous
128			Solvents		Hazardous
129			Cleaners, Soaps etc.		Hazardous

No.	Primary	Secondary	Tertiary/Quaternary	Additional Comments	Divertability
130			Pesticides/Herbicides/Preservatives	With PCP Reg. #	Hazardous
131			Motor Oil		Hazardous
132			Oil Filters		Hazardous
133			Antifreeze		Hazardous
134			Pharmaceuticals		Hazardous
135			Other Petroleum Based Products		Hazardous
136			Other HHW or Containers		Hazardous
137		Mercury Containing Items	Thermostats and Switches		Hazardous
138			CFLs		Hazardous
139	Household Hygiene	Biological	Diapers		Garbage
140			Pet Waste	Animal feces, bedding, cat litter	Garbage
141			Other (sanitary products, condoms)	Sanitary napkins, tampons, condoms	Garbage
142		Liquid Product	Personal Care	Full shampoo bottles, beauty products, creams, etc.	Garbage
143	Bulky Objects	White Goods	Large Appliances		Depot
144		Furniture	Mattresses, Box Springs		Depot
145			Other Upholstered Furniture		Depot
146			Other Furniture	Multi-material furniture (e.g., plastic, metal, small amount wood)	Garbage
147	Fines	Fines	Fines	Items too small to classify efficiently (e.g., bread tabs, twist ties, typically <1")	Garbage

APPENDIX K

ACCESSIBILITY FACTORS' INFLUENCE ON RECYCLING CONTAMINATION

Score	Recycling Contamination	Organics Contamination
Distance to Reach Recycling, Organics, and Garbage		
1	4.1%	0.8%
2	8.0%	1.0%
3	5.6%	1.4%
4	4.5%	1.3%
5	4.4%	2.8%
Clarity of Streams		
1	19.1%	11.0%
2	7.1%	3.9%
3	11.9%	1.0%
4	3.5%	1.3%
5	4.0%	1.0%
Overall Cleanliness and Lighting		
1	7.3%	1.7%
2	4.1%	2.6%
3	7.0%	1.4%
4	4.0%	1.1%
5	5.4%	1.5%
Security from Vectors		
1	6.2%	1.7%
2	12.2%	1.5%
3	3.9%	3.6%
4	4.0%	1.0%
5	3.6%	0.9%
Security from Unlawful Entry		
1	11.9%	3.1%
2	3.5%	1.3%
3	5.1%	1.4%
4	4.4%	0.2%
5	3.6%	1.2%

Score	Recycling Contamination	Organics Contamination
Clear Signage		
1	7.0%	2.2%
2	5.0%	1.4%
3	4.8%	1.2%
4	4.8%	1.2%
5	0.9%	0.4%

APPENDIX L

HISTORICAL DATA COMPARISON

Table L-1: Comparison of Historical MF Residential Waste Composition¹

	2006	2007	2009	2010	2011	2013 ²	2015	2016	2017
Paper	23%	18%	18%	18%	19%	8%	17%	21%	16%
Plastics	9%	15%	14%	13%	13%	12%	16%	18%	15%
Compostable Plastic	-	-	-	-	-	0%	0%	0%	0%
Compostable Organics	43%	20%	30%	35%	39%	43%	35%	37%	38%
Non-Compostable Organics	2%	13%	10%	9%	8%	10%	4%	4%	5%
Metals	4%	3%	3%	3%	3%	6%	4%	3%	3%
Glass	3%	3%	3%	3%	3%	1%	3%	2%	3%
Building Material	0%	13%	8%	6%	3%	6%	2%	1%	2%
Electronic Waste	3%	8%	5%	4%	3%	3%	2%	2%	2%
Household Hazardous	1%	1%	1%	1%	1%	1%	1%	1%	1%
Household Hygiene	10%	2%	5%	6%	8%	5%	15%	9%	15%
Bulky Objects	3%	4%	2%	2%	1%	4%	1%	0%	0%
Fines	0%	0%	0%	0%	1%	1%	1%	1%	1%

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

²The 2013 waste composition study methodology was adjusted to place a significant portion of compostable paper in the compostable organics category. As a result, the paper category appears to be less than in other years.

APPENDIX M

SITE ASSESSMENT FORM

Sample ID	
Address	
Date	
Initials	

Garbage

Please describe on-site garbage bins below.

Compactor? (circle) Y N

of compactors: _____

Specify size of each compactor: _____

Compactor Comments: _____

Garbage Hauler: _____

If no compactor, please describe on-site bins in the table below.

Container	1	2	3	4	5	6
Size (specify cubic yd, gallon, or other unit)						
% Full						

Garbage Comments: _____

Bulky Items

Please describe the bulky items (anything that won't fit in garbage bins) found in or near the garbage bins.
 Only items which appear to have been disposed *recently* should be noted below.

Large Items	1	2	3	4	5	6
Item Type (e.g. toilet)						
% by volume of garbage						

Describe bulky items area: _____

Recycling Containers & Composition					
Recycling Hauler: _____					
Recycling Comments: _____					
Recycling Composition (p. 1 of 3)					
Bin Information Circle: Cart / Box / Bag / Dumpster	Stream (e.g., MP)	1		2	
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				
Bin Information Circle: Cart / Box / Bag / Dumpster	Stream (e.g., MP)	3		4	
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				

Recycling Composition (p. 2 of 3)					
Bin Information Circle: Cart / Box / Bag / Dumpster		5		6	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				
Bin Information Circle: Cart / Box / Bag / Dumpster		7		8	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				

Recycling Composition (p. 3 of 3)					
Bin Information Circle: Cart / Box / Bag / Dumpster		9		10	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				
Bin Information Circle: Cart / Box / Bag / Dumpster		11		12	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	1R: Deposit Beverage				
	2R: Paper Containers				
	3R: Plastic Containers				
	4R: Recyclable Metal				
	5R: Recyclable Glass				
	6R: Paper				
	7R: Cardboard				
	8R: EPS (packaging)				
	9R: EPS (other)				
	10R: Other (comments):				

Organics Containers	
Organics Hauler:	
Has the property manager tried to make organics bin(s) more user-friendly or less 'gross' for users (eg. Bin liner, air fresheners, etc.)? Describe.	
Organics Comments:	

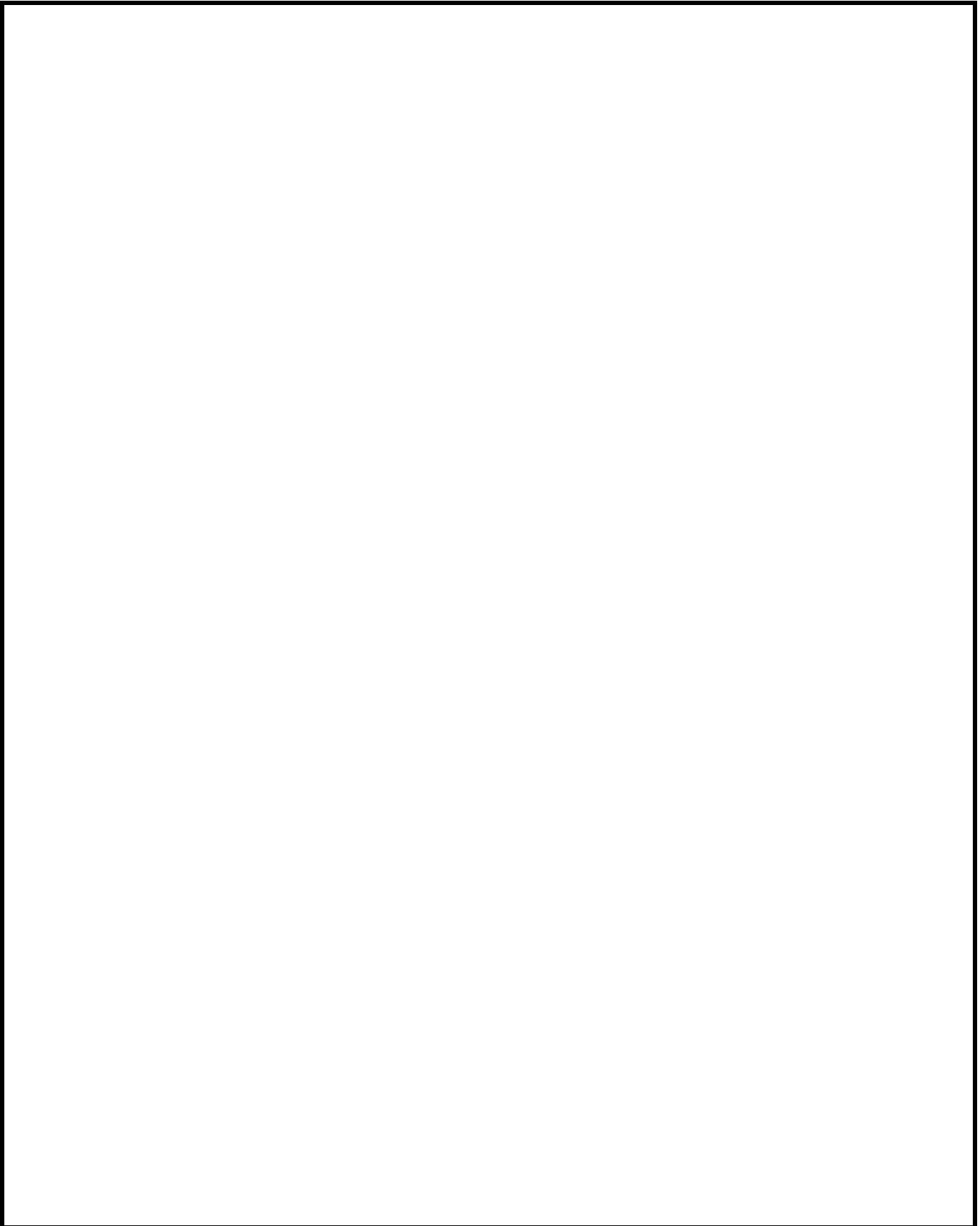
Organics Composition					
Bin Information		1		2	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	10: Compostable Paper				
	20: Yard Waste				
	30: Food Waste				
	40: Clean Wood				
	50: Other Materials				
Bin Information		3		4	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	10: Compostable Paper				
	20: Yard Waste				
	30: Food Waste				
	40: Clean Wood				
	50: Other Materials				
Bin Information		5		6	
	Stream (e.g., MP)				
	Size				
	Weight				
	% full (volume)				
Categories		% by volume	Comments	% by volume	Comments
	10: Compostable Paper				
	20: Yard Waste				
	30: Food Waste				
	40: Clean Wood				
	50: Other Materials				

Accessibility Criteria (p. 1 of 2)					
G=Garbage		R=Recycling		O=Organics	
	Criteria	Best	Worst	Score /5 (5 is best)	Comments
Convenience					
1	Distance that tenants go to reach the R/G/O.	Residents walk <10 m.	Residents walk >50 m.		
2	Distance to R/O, relative to distance to G.	R, G, & O together.	R/O farther than G.		
3	Distance from G to R/O	In the same room	Far apart		
4	Clarity of streams that are in the same area.	Very clear which stream is which.	Not clear which stream is which.		
5	Is there a designated bulky item collection area	Yes, clearly marked.	No		

Accessibility					
6	How easy to get to R/G/O area?	Easy, can be used by those with restrictions	Obstructed/ difficult path & difficult to use		
7	Easiness of getting to bins in R/G/O area.	Easy to access each bin.	Tight space; hard to access each bin.		
8	How easy to open bins?	Easy; no obstructions	Obstructions to opening bins		

Accessibility Criteria (p. 2 of 2)					
G=Garbage		R=Recycling		O=Organics	
	Criteria	Best	Worst	Score /5 (5 is best)	Comments
Safety & Cleanliness					
9	Current bin conditions	Label clean and visible; no damage.	Bin is damaged.		
10	Overall cleanliness, lighting and safety	Area is bright, well-kept and clean.	Room is dark, smelly; bins overflowing		
11	How secure are bins from vectors (animals, rain, wind)?	In secured space w/ gate and overhanging roof.	In open area with no lock.		
12	How secure are bins from unlawful entry?	In secured space; locks on gate.	Bins are neither in locked area nor have locks on them.		
Education					
13	How clear is the signage for recycling and organics?	All bins have signs; signs are in line of sight, clear and colour coded. (excluding stickers on bins)	No signs except stickers on bins (make note if no signs whatsoever)		
Of the criteria listed above, which would you recommend for feedback? (Please list 3 numbers, and add any comments)					

Draw a simple map of the complex layout and garbage, recycling, and organics locations on this page.



Garbage Sample Information						
Please describe the sample you remove from the site.						
Sample Bin	1	2	3	4	5	6
Size (S/M/L/NT)						
Weight (kg)						
What was left over in the garbage bin, if any? _____						

APPENDIX N

DATA ANALYSIS METHODOLOGY

DATA ANALYSIS METHODOLOGY

1.0 RECRUITMENT AND PHONE SURVEY

Scheduling data was recorded electronically in an online calendar system that could be shared with the site visit team. Data gathered during phone surveys was compiled electronically.

2.0 GARBAGE COMPOSITION ANALYSIS

Data was compiled electronically throughout during garbage composition analysis. Data collection logs were reviewed daily to ensure accuracy. Quality assurance and quality control methods included ensuring the difference between pre-sorting weights of each sample were compared to the calculated final sample weight after sorting to ensure they were within an acceptable margin of accuracy. The average was calculated using a weighted mean for each waste sector and material category. Standard deviations and 90% confidence intervals for primary material categories by waste sector were calculated. These parameters were determined using waste composition percentages to normalize the data set, as each sample can have a different total sample weight.

3.0 RECYCLING AND ORGANICS COMPOSITION ANALYSIS

Data was compiled manually during the on-site assessments. Data collection logs were backed up and reviewed daily to ensure accuracy. For recycling and organics composition, the average was calculated using a weighted mean. Standard deviations and 90% confidence intervals for overall recycling and organics composition were calculated. To convert the data from volume to weight, U.S. EPA Volume-to-Weight Conversion Factors were used, as detailed in Appendix F.

4.0 DISPOSAL AND RECYCLING RATES ANALYSES

Volumetric estimates of all materials present was recorded during on-site assessments. Furthermore, the number of units in the building and the collection days for garbage, recycling, and organics were known from the initial phone survey. The average density for garbage was calculated by determining the overall weight of all samples and the number of sample bins used, which had a known volume capacity. The densities used for garbage and organics streams were based on U.S. EPA Volume-to-Weight Conversion Factors, as detailed in Appendix F. The number of residents in the building was calculated based on the number of units in the building and the average number of residents per unit based on municipality, as reported by Statistics Canada.

A challenge was faced in calculating the cardboard recycling rate due to uncertainty and irregularity regarding the cardboard collection day. Thus, estimates for cardboard recycling have a precision of $\pm 30\%$.

APPENDIX O

RESULTS WITH CONFIDENCE LEVELS

STATISTICAL ANALYSIS OF RESULTS

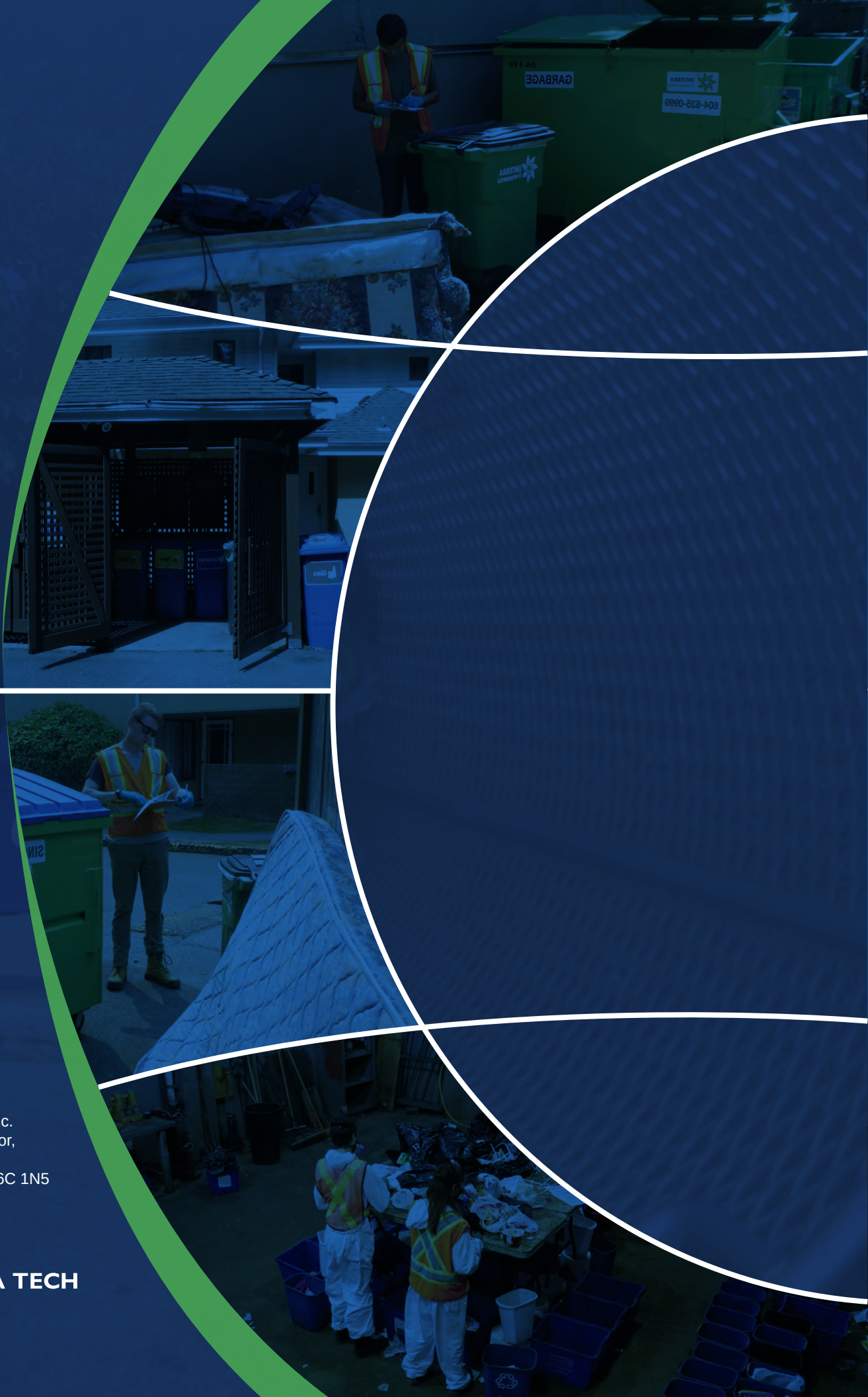
Table O presents the overall waste composition results for primary material categories with 90% confidence levels.

Table O: Overall Waste Composition Results with 90% Confidence Levels

Primary Material Category	Weighted Average (N=100)	90% Confidence Level ²
Paper	16%	±1%
Plastic	14%	±1%
Compostable Organics	37%	±2%
Compostable Products and packaging	<1%	-
Non-Compostable Organics	5%	±1%
Metals	3%	-
Glass	3%	±1%
Building Material	2%	±1%
Electronic Waste	2%	-
Household Hazardous	1%	-
Household Hygiene	15%	±1%
Bulky Objects	<1%	-
Fines	1%	-

¹Percentages are rounded to the nearest whole number and therefore may not add up to 100%.

²Only 90% confidence intervals greater than 1% are reported.



Tetra Tech Canada Inc.
Suite 1000 - 10th Floor,
885 Dunsmuir Street
VANCOUVER, BC V6C 1N5
p. 604.685.0275



TETRA TECH