TETRA TECH EBA

OQM | Organizational Quality Management Program

RESIDENTIAL FOOD WASTE COMPOSITION STUDY

PRESENTED TO

British Columbia Ministry of Environment

MAY 2015
ISSUED FOR USE
FILE: ENVSWM03477-02

CONSULTING ENGINEERS & SCIENTISTS · www.eba.ca

Tetra Tech EBA Inc.
Suite 1000 – 10th Floor, 885 Dunsmuir Street
Vancouver, BC V6C 1N5 CANADA
Tel 604.685.0275 Fax 604.684.6241

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by the British Columbia Ministry of Environment (Ministry) to complete a waste composition study to determine the quantity of avoidable and edible food waste from the residential sector. The goal of this study was to investigate the proportions of food waste that are considered "wasted food" to provide the Ministry with quantitative information to support future food waste prevention initiatives. The study focused on small and medium-sized communities and aimed to provide waste composition as well as baseline food waste generation rates.

The study was completed in the Cowichan Valley Regional District (CVRD) where there is a mixture of small- and medium-sized communities and varying curbside organics service levels. The CVRD provides recycling collection services to all nine Electoral Areas, and provides garbage collection services to homes in electoral areas D, E, F, G, and I. Member municipalities including the City of Duncan, District of North Cowichan, Town of Ladysmith, and Town of Lake Cowichan provide their own garbage, organics, and recycling collection services to their residents.

Households with Garbage, Organics, and Recycling Collection

For households with curbside organics collection, 12% of the garbage bin was avoidable food waste and over 50% organics bin was avoidable food waste. In total between the two material streams, 29% of the material set out at the curbside is avoidable food waste.

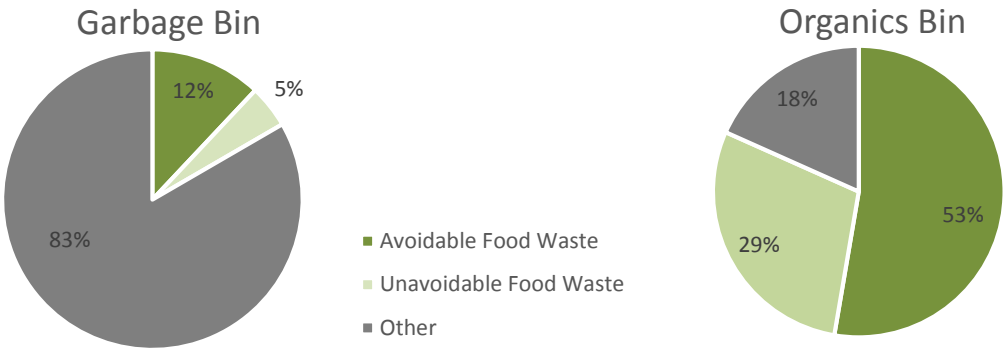

Figure A: Garbage and Organics Bin Composition for Residences with Organics Collection

Households with Garbage and Recycling Collection (No Organics Collection)

For households with no curbside organics collection, 24% of the garbage bin was avoidable food waste.

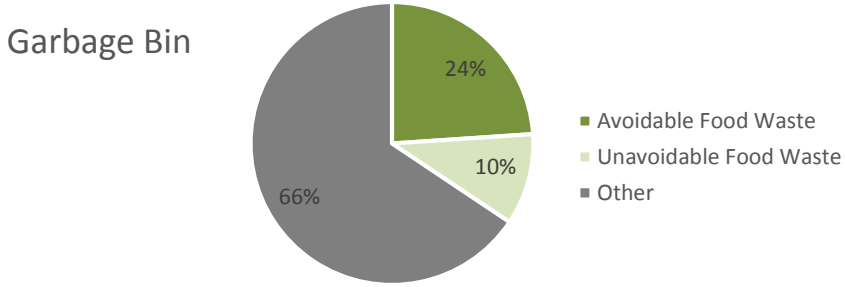

Figure B: Garbage Composition for Residences without Organics Collection

The ratio of avoidable food waste to total compostable organics in the garbage was close to 70% for both service levels. Therefore, 70% of the organic waste in the garbage bin is avoidable food waste and this ratio is about the same for both households with and without curbside organics programs.

To determine the total quantity of avoidable food waste being disposed per household, the waste composition results were multiplied by the total tonnage of material collected for each community in 2014 and is summarized in Table A. For homes with organics collection, the total amount of disposed avoidable food waste was calculated by adding the avoidable food waste found in the garbage with the organics.

Table A: Per Household Generation Summary

	Single Family with Organics Collection (kg/household/year)	Single Family without Organics Collection (kg/household/year)
Total Curbside Garbage (in 2014)	131	257
Total Curbside Organics (in 2014)	89	-
Avoidable Food Waste in the Curbside Garbage	16	62
Avoidable Food Waste in the Curbside Organics	47	-
Total Avoidable Food Waste Generated	**63**	**62**

On average, homes with no food waste collection programs generated twice the amount of garbage than those with programs in place, primarily due to the increased presence of food waste in the garbage. However, the total quantity of avoidable food waste (from garbage and organics) is the same for both service levels, calculated to be approximately 63 kg/household/year. This indicates that providing organics collection services does not impact the total amount of food waste generated per household. The act of preventing food waste is a separate learned behaviour compared to recycling and composting.

Avoidable food waste was further sorted into 10 additional categories to identify the types of food that are typically thrown away. Produce, which included fresh food such as vegetables and fruits, represented the largest proportion of avoidable food waste, between 15% and 45% of the total avoidable food waste. The next most commonly identifiable wasted food categories included cooked meals/mixed food, confectionary/snacks, and baked goods. These items are avoidable food waste, and represent a significant opportunity to reduce the total quantity of waste through a food waste reduction program.

Summary of Key Findings

- Approximately 25% of the total material set out for curbside collection is avoidable food waste;
- The ratio of avoidable food waste to total compostable organics in the garbage was close to 70%. This ratio is the same for both households with and without curbside organics programs. As a starting point, it could be assumed that this ratio applies to other municipalities in British Columbia;
- Curbside organics collection services results in overall garbage reduction;
- Providing organics collection services does not impact the total amount of avoidable food waste generated per household; and
- The act of preventing food waste is a separate learned behaviour compared to recycling and composting.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

LIST OF FIGURES IN TEXT

APPENDIX SECTIONS

ACRONYMS & ABBREVIATIONS

Acronym	Definition
BC	British Columbia
CCME	Canadian Council of Ministers of Environment
CVRD	Cowichan Valley Regional District
kg	Kilogram
MF	Multi-Family
Ministry	British Columbia Ministry of Environment
MSW	Municipal Solid Waste
N	Number of Samples
PPE	Personal Protective Equipment
SF	Single Family
Tetra Tech EBA	Tetra Tech EBA Inc.

Terminology	Definition
Avoidable Food Waste or Preventable Food Waste or Wasted Food	Food that was purchased to eat but has since spoiled, or food that was prepared but was not eaten and then thrown away. The vast majority of avoidable food is composed of material that was edible at some point prior to disposal, even though a proportion was not edible at the time of disposal due to deterioration (e.g., has become mouldy).
Possibly Avoidable Food Waste	Food and drink that some people eat and others do not (e.g., apple and potato skins). As with 'avoidable' waste, 'possibly avoidable' waste is composed of material that was edible at some point prior to disposal.
Unavoidable or Non-Edible Food Waste	Waste arising from food and drink preparation or consumption that is not, and has not been, edible under normal circumstances. This includes egg shells, banana peels, pineapple skins, apple cores, meat bones, tea bags, and coffee grounds.

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the British Columbia Ministry of Environment and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) 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 the British Columbia Ministry of Environment, 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 EBA's Services Agreement. Tetra Tech EBA's General Conditions are provided in Appendix A of this report.

1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by the British Columbia Ministry of Environment (Ministry) to complete a waste composition study to determine the quantity of avoidable and edible food waste that is discarded from the residential sector in municipal solid waste (MSW) and organics collection programs. The goal of this study was to investigate the proportions of food waste that are considered "avoidable food waste" to provide the Ministry with quantitative information to support future food waste prevention initiatives. The study focused on characterizing the amount of avoidable food waste that is disposed from households through curbside collection programs from small- and medium-sized communities in British Columbia, to provide baseline food waste composition and generation rates.

The study was conducted in the Cowichan Valley Regional District (CVRD) where there is a mixture of small and medium-sized communities and varying curbside organics service levels which met the needs of the study from data completeness, scheduling, and budgetary perspectives. The CVRD provides recycling collection services to all nine Electoral Areas, and provides garbage collection services to homes in electoral areas D, E, F, G, and I. Member municipalities including the City of Duncan, District of North Cowichan, Town of Ladysmith, and Town of Lake Cowichan provide their own garbage, organics, and recycling collection services for their residents.

The garbage and organic samples were collected and sorted from March 4 to March 13, 2015 at the Bings Creek Solid Waste Management Complex in Duncan, British Columbia. Samples were collected from Municipal Areas that have garbage, organics, and recycling curbside collection, and Electoral Areas that have garbage and recycling curbside collection, and no organics collection program.

The study data can be grouped into the following datasets, referred to herein as "sectors":

- Single Family Residential (SF) with curbside organics collection programs in place (SF+O);
- SF without curbside organics collection programs in place (SF); and
- MF residential without organics collection programs (MF).

Both garbage and organics samples (where available) were sampled and sorted at the transfer station. The study included a total of 27 garbage samples and 10 organics samples from the residential sectors.

2.0 METHODOLOGY

This section reviews the components of the study, provides an overview of how garbage and organics were collected and sampled, and outlines other key factors and considerations for the study. A detailed review of the methodology, and more information about conducting a food waste composition study can be found in Appendix D.

Tetra Tech EBA prepared a sampling framework and protocol customized for this study, from data completeness, scheduling, safety, and budgetary perspectives. Sampling and sorting was conducted in a statistically defensible manner in accordance with the methodology set out in the Recommended Waste Characterization Methodology for Direct Waste Analysis Studies in Canada (Canadian Council of Ministers of Environment [CCME] 1999).

Material categories were chosen based on the Ministry Waste Composition Spreadsheet Tool with input from the Ministry and the CVRD. There were a total of 12 primary categories (Paper, Plastic, Metal, Glass, Compostable Organics, etc.) that were further broken into a total of 70 secondary categories that the garbage and organics were sorted into. Additional material categories were developed by Tetra Tech EBA and the Ministry for the detailed analysis of the food waste portion of the garbage and organics. The additional waste characterization categories used for food waste include sorting the food scraps into additional categories that identify food as "wasted/avoidable/preventable food scraps" or unavoidable/inedible food scraps. Food waste was separated into 10 categories including unavoidable food waste and the main categories of avoidable food waste. Additional categories, definitions and sample photos of each categories contents from previously completed are included in Appendix C. Material that is decomposed and hard to identify because of its decomposition state or mixture was classified as avoidable "unidentified/other" food waste.

The transfer station method for sample collection was used. This method relies on identifying specific collection routes in an area, and collecting samples from collection vehicles associated with the selected routes at the transfer station. Consideration went into confirming that the load sources were representative of the region at large. The Tetra Tech EBA team coordinated with CVRD staff to develop a collection schedule for the two weeks of the study that determined how many samples were needed from each Municipality or Electoral Area each day to confirm that all samples were collected on the appropriate days.

The Tetra Tech EBA site supervisor worked closely with the Bings Creek facility site supervisor and/or the scale operator to coordinate identification and selection of the load samples to reduce interruption of daily operations. Scale tickets were retrieved from operations staff to verify load sources and weights. Both garbage and organics samples (where available) were sampled and sorted at the transfer station. The study involved the sorting of garbage and organics samples from SF households with organics collection programs in place, SF households without organics collection programs in place, along with garbage samples from MF households with no organics collection program as outlined in Table 1.

Table 1: Number of Samples Completed

Sector	Number of Garbage Samples	Number of Organics Samples
Single Family – Organics Collection (SF+O)[1]	**8**	**10**
Single Family – No Organics Collection (SF)[2]	**7**	**-**
Multi-Family (MF)	**2**	**-**
Total	**17**	**10**

[1] Locations with curbside organics collection included the District of North Cowichan, Town of Lake Cowichan, City of Duncan, and Town of Ladysmith.

[2] Locations with no curbside organics collection included the Electoral Areas of Cowichan Bay, Cowichan Station/Sahtlam/Glenora, Saltair, Cowichan Lake South/Skutz Falls, and Youbu/Meade Creek.

Sorting was overseen by the Tetra Tech EBA site supervisor and conducted by two to three waste sorters who were trained on safety and material sorting procedures prior to the fieldwork. Personal protective equipment (PPE) was used by staff to the specifications of Tetra Tech EBA's Health and Safety Plan, which factored in requirements for the facility. Safety meetings were conducted daily prior to the start of each sorting event to emphasize key concerns including how to handle material hazards such as sharp or hazardous materials, and working safely around vehicles. Workers were required to have up-to date-tetanus and hepatitis vaccinations.

To collect a sample for waste characterization analysis, the waste sort team would be notified when trucks identified in the sampling plan for the day passed through the scales. The waste sort team would then contact the transfer station operators, who would use a front end loader to collect approximately 200 kg to 500 kg of material from the material unloaded by the truck and deliver it to the sorting area. Loads would be visually inspected by a sort supervisor to confirm the load source and confirm there was no contamination for other waste sources in mixed source loads. One sample (typically 100 kg of garbage) would then be randomly collected in a grid pattern from the material delivered by the loader operator. This sample was then sorted into bins representing each sort category required and weighed using a bench scale.

During waste sorting, the sorting team did not manipulate the waste in a significant way, such as remove food from packaging. Food within packaging and containers was placed into the category of the material with the highest content or significance. For example a container that was still half full of sauce or a bottle that was one-quarter full of liquid would be placed into the compostable organics food waste category as a majority of the weight of the item is compostable organics. If a container was almost empty, then it would be placed in the appropriate material category such as rigid plastics or beverage containers. Photos of the sorting set-up, samples and material categories are presented in Appendix B.

Data collection logs and scale tickets were reviewed daily to confirm accuracy, and then scanned and compiled manually throughout the course of the fieldwork. The Tetra Tech EBA team used basic statistical methods to analyze the data to determine the weighted mean composition for each material category and to calculate standard deviation for each category.

3.0 COMPOSITION AUDIT RESULTS

The following tables and figures represent the garbage and organics composition, including the primary category composition for each sector, the overall percentage of avoidable and unavoidable food scraps, and the detailed composition of avoidable food waste. Section 3.3 uses the composition data and the per household garbage and organics generation rates to determine the overall quantity and unit weights of garbage and food scraps as well as the total amount of food waste generated for each sector.

3.1 Garbage Composition – Primary Categories

Table 2 summarizes the overall garbage composition in each of the three residential sectors, and the overall residential average. All percentages were calculated using a weighted mean combining all sample data for each sector.

Table 2: Garbage Composition

Primary Category	SF+O (N = 8 Samples)		SF (N = 7 Samples)		Multi-Family (N = 2 samples)		Residential Average (N = 17 samples)	
	Avg (%)	Std.Dev (+/-)	**Avg (%)**	Std.Dev (+/-)	**Avg (%)**	Std.Dev (+/-)	**Avg (%)**	Std.Dev (+/-)
Paper	**10%**	2%	**11%**	2%	**20%**	4%	12%	3%
Plastic	**20%**	5%	**19%**	6%	**12%**	2%	19%	5%
Compostable Organics	**19%**	5%	**36%**	10%	**39%**	13%	28%	10%
Non-Compostable Organics	**5%**	5%	**3%**	2%	**2%**	2%	4%	4%
Metal	**3%**	1%	**3%**	1%	**2%**	1%	3%	1%
Glass	**3%**	2%	**2%**	2%	**2%**	1%	2%	2%
Building Material	**3%**	4%	**3%**	5%	**3%**	4%	3%	4%
Electronic	**2%**	2%	**1%**	1%	**<1%**	1%	1%	2%
Household Hazardous	**1%**	1%	**1%**	1%	**3%**	2%	1%	1%
Household Hygiene	**30%**	13%	**18%**	9%	**15%**	7%	23%	12%
Bulky Objects	**1%**	2%	**<1%**	<1%	**<1%**	<1%	0%	1%
Fines	**3%**	2%	**3%**	2%	**2%**	1%	3%	2%
Total	**100%**		**100%**		**100%**		**100%**	

N = Number of samples sorted
Avg = Weighted average of the samples sorted
Std.Dev = Standard deviation of the samples sorted

The percentage of compostable organics was 19% in single family homes with organics collection compared to 36% to 39% in homes with no organics collection. Conversely, household hygiene represented 30% of the waste stream in single family homes with organics collection, and only 15% to 18% in those without. All other categories were relatively similar; however, multi-family homes had twice as much paper (20%) as single family homes (10% to 11%). The quantity of compostable organics in the single family homes with food waste collection in this study is

significantly lower that the quantity typically seen in waste audits in British Columbia, where compostable organics typically make up 35% to 45% of the residential waste stream.

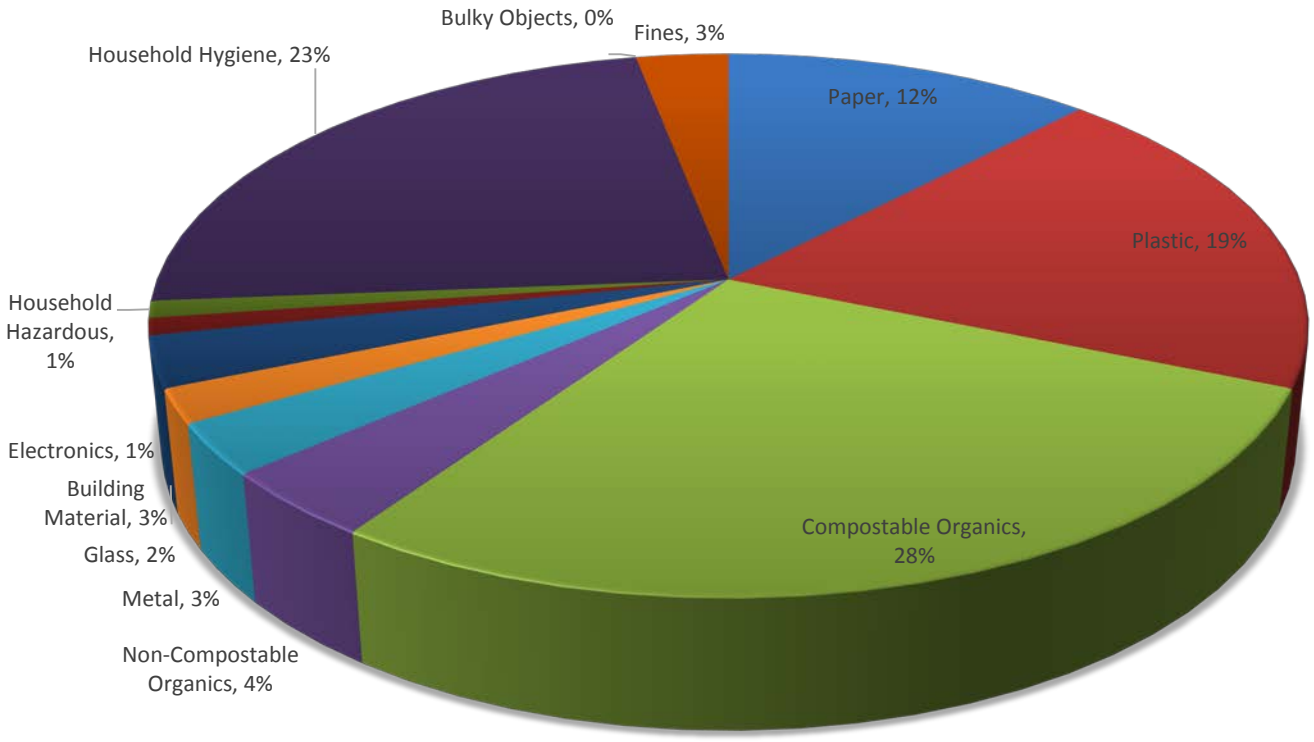

Figure 1: Residential Garbage Composition

Compostable organics, which is primarily food scraps, represented the largest proportion of residential waste at 28% as shown in Figure 1. The next largest category was household hygiene (23%), which includes items that do not have a diversion program such as diapers, pet waste and sanitary products. The next most prevalent categories were plastic (19%) and paper (12%). All other categories represented approximately 15% of the residential waste stream. Plastics included bulky items such as plastic film and film packaging, along with a smaller quantity of hard plastics and durable plastic products. Paper included compostable paper items such as napkins and paper towels, along with small quantities of boxboard and coffee cups.

3.1.1 Garbage Composition – Avoidable Food Waste

A breakdown of compostable organics was completed to identify the amount and composition of the avoidable and unavoidable food waste. Figure 2 shows the proportion of avoidable and unavoidable food waste within each sector. For single family households with curbside organics collection, 12% of the garbage was avoidable food waste, compared to 24% for single family households with no organics collection and 17% for multi-family residences. The ratio of avoidable to unavoidable compostable organics is close to 70% for all sectors. This means that 70% of the organic waste in the garbage is avoidable food waste. The largest amount of avoidable food waste was packaged food that was disposed of in containers, bags, or jars. These items would require de-packaging prior to putting it into the organics bin and the level of effort to de-package the food waste is likely a barrier to some residents,

resulting in it going into the garbage. These items are avoidable food waste, and represent a significant opportunity to reduce the total quantity of waste through a food waste reduction program.

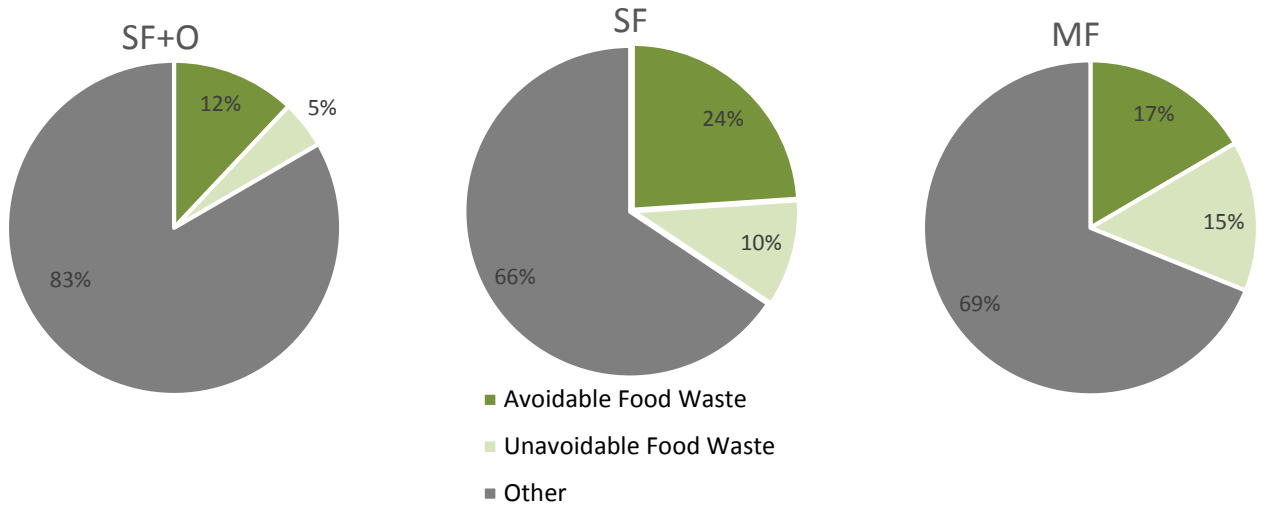

Figure 2: Avoidable and Unavoidable Food Waste Composition in the Garbage

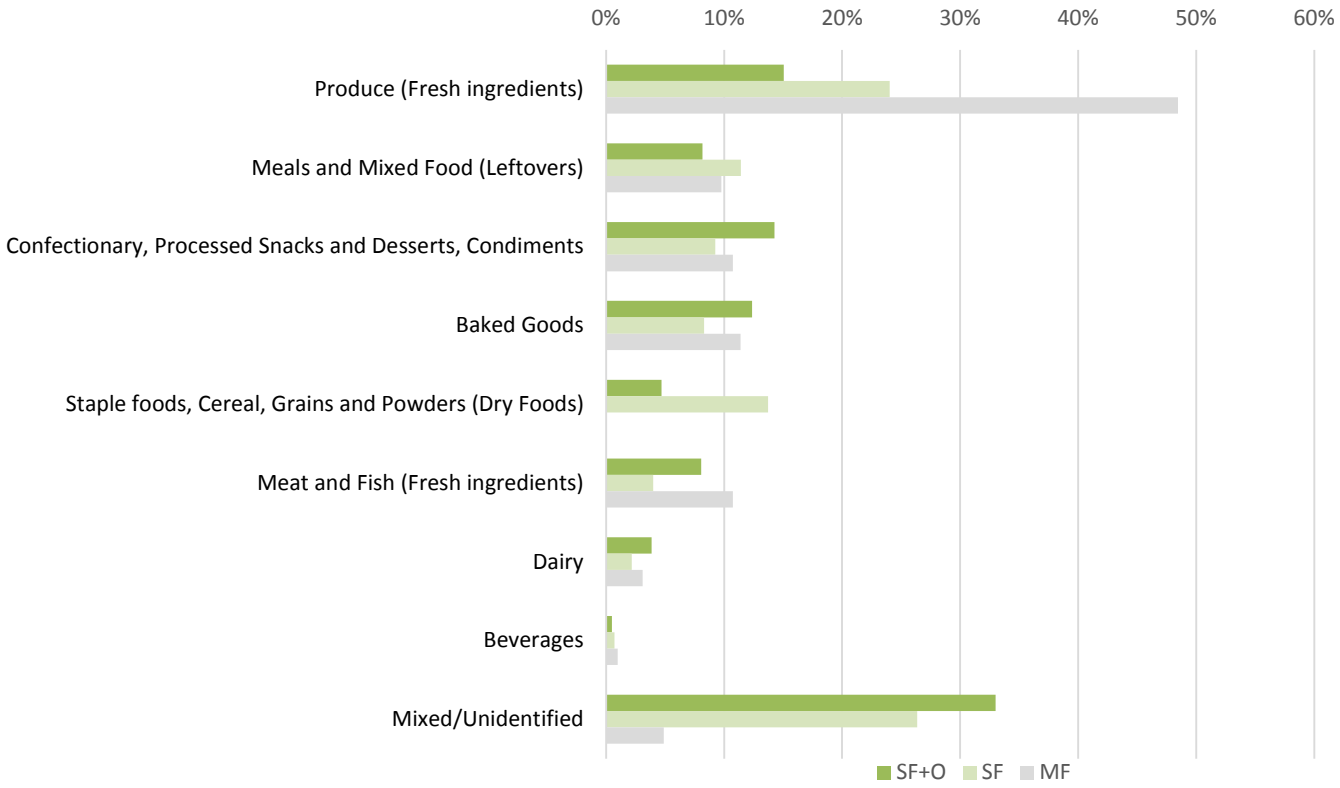

Figure 3: Avoidable Food Waste in Garbage Categories Comparison

Avoidable food waste was further sorted into 10 additional categories, as shown in Figure 3, to identify the types of food that are typically thrown away in the garbage. Produce, which included fresh food such as vegetables and fruits, represented the largest proportion (15 to 45%) of avoidable food waste. The next most commonly identifiable wasted food categories were cooked meals/mixed food, confectionary/snacks, and baked goods. These categories of wasted food were most commonly disposed of in the packaging that they were purchased in. For example, baked goods included bread and other baked goods in bread bags, cooked meals/mixed food included leftovers in containers, and confectionary/snacks included condiments in jars, portions of snack food in bags, and processed food still in the original packaging. Mixed and unidentified avoidable food waste included organic materials that were too mixed and decomposed to properly categorize the organics. This was primarily due to compaction of the waste in the garbage truck

The multi-family samples had approximately twice as much produce than single family residences, likely because multi-family residences may not have the opportunity to compost at home compared to single family homes. Single family residences with curbside organics collection in place had the least amount of produce, likely because produce is easy to place in a food waste bin without de-packaging. Oher items which were represented in a higher proportion, such as processed snacks or desserts, are heavily packaged would require more effort to de-package.

3.2 Organics Composition – Primary Categories

Table 3 summarizes the overall organics composition for the residential sector. All percentages were calculated using a weighted mean combining all sample data for each sector.

Table 3: Organics Composition

Primary Category	SF+O (N = 10 Samples)	
	Average (%)	Standard Deviation (+/-)
Paper	11%	5%
Plastic	1%	2%
Compostable Organics	88%	20%
Non-Compostable Organics	0%	0%
Metal	0%	0%
Glass	0%	0%
Building Material	0%	0%
Electronic	0%	0%
Household Hazardous	0%	0%
Household Hygiene	0%	0%
Bulky Objects	0%	0%
Fines	0%	0%
Total	**100%**	

N = Number of samples sorted

Approximately 12% of the organics stream was represented by categories other than food; however, 11% was paper, all of which would be considered compostable. The remaining 1% of plastic was mostly composed of biodegradable plastic film and regular plastic bags, both of which are not compostable.

3.2.1 Organics Composition – Avoidable Food Waste

Over half of what was found in the organics stream was avoidable food waste (53%). Approximately 29% was unavoidable food waste, and the remaining 18% was other compostable materials such as compostable paper or compostable plastics. The ratio of avoidable food waste to unavoidable food waste was similar to what was found in the garbage for the single family sector, where approximately 65% of the compostable organic waste is avoidable food waste. The proportion of the organic material stream represented by avoidable and unavoidable food waste is depicted in Figure 4, and a breakdown of the types of avoidable food waste is shown in Figure 5.

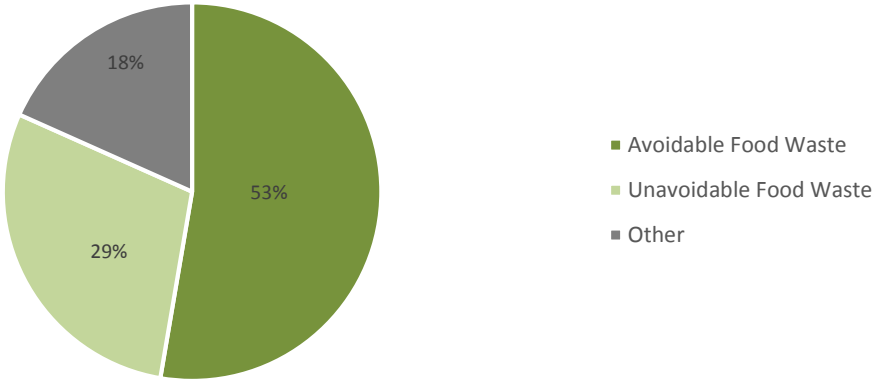

Figure 4: Avoidable and Unavoidable Food Waste Composition in the Organics

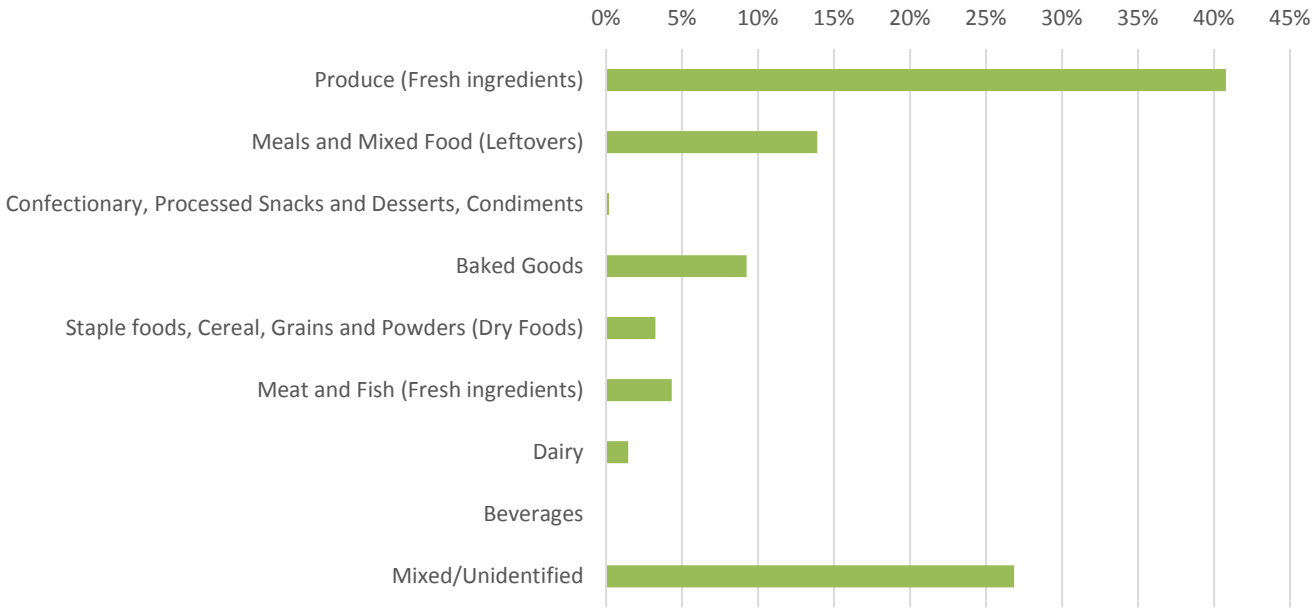

Figure 5: Avoidable Food Waste Composition

Produce constituted the highest percentage of avoidable food waste in the organics stream, as it did for garbage. Over 40% of the avoidable food waste was produce such as vegetables and fruits. Unidentified food scraps were the next most prevalent, as the amorphous nature of decomposing mixed food scraps made them more difficult to sort than those in the garbage. A majority of the mixed/unidentified material was mashed and cooked food that was too mixed together to properly sort. Cooked meals/mixed foods were the next most common, followed by baked goods, meat and fish, and staple foods, respectively. Dairy and processed foods were present only in small quantities, and no beverages could be identified. Compared to what was found in the garbage, the amount of processed foods was much lower in the organics. Residents appear to be more likely to dispose of packaged foods in the garbage within the container that the food was purchased in, instead of emptying the contents into their organics bin.

3.3 Avoidable Food Waste Generation

Table 4 summarizes the garbage, organics, and overall avoidable food waste generated per household in the communities studied. Using data collected and provided by the CVRD, the total garbage and organics collected in 2014 was divided by the number of homes on the collection routes in the various communities. Using the garbage and organics composition data presented in this report, the total avoidable food waste generated per household was calculated.

Table 4: Avoidable Food Waste Generated Per Household

	Single Family with Organics Collection (kg/household/year)[1]	Single Family without Organics Collection (kg/household/year)
Total Curbside Garbage (in 2014)	131	257
Total Curbside Organics (in 2014)	89	-
Avoidable Food Waste in the Curbside Garbage	16	62
Avoidable Food Waste in the Curbside Organics	47	-
Total Avoidable Food Waste Generated	**63**	**62**

[1]The Town of Lake Cowichan was omitted from calculations as its food waste collection program was not in place until early 2015.

Households with no organics collection program generated almost twice the amount of garbage compared to those with a curbside organics collection. This extra weight is primarily attributed to the presence of food waste within their garbage. However, when the amount of avoidable food in both the garbage and organics is taken into account, the quantity of avoidable food waste is the same calculated to be approximately 63 kg/household/year. This indicates that providing organics collection services does not impact the total amount of food waste generated per household. The act of preventing food waste is a separate learned behaviour compared to recycling and composting.

4.0 CLOSURE

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

Respectfully submitted,
Tetra Tech EBA Inc.

Prepared by:
Terry Fulton, E.I.T.
Environmental Engineer – Waste Management
Environment Practice
Direct Line: 604.608.8638
Terry.Fulton@tetratech.com

Prepared/Reviewed by:
Avery Gottfried, ME, P.Eng.
Solid Waste Planning Engineer – Waste Management
Environment Practice
Direct Line: 778.945.5749
Avery.Gottfried@tetratech.com

Reviewed by:
Wilbert Yang, P.Eng
Senior Environmental Engineer – Waste Management
Environment Practice
Direct Line: 604.608.8648
Wilbert.Yang@tetratech.com

/cgc

APPENDIX A
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This report pertains to a specific site, a specific development, and a specific scope of work. It 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 or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of Tetra Tech EBA’s client. Tetra Tech EBA 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 Tetra Tech EBA’s Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA’s instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA’s instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. The Client warrants that Tetra Tech EBA’s instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

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

3.0 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 EBA in its reasonably exercised discretion.

4.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

APPENDIX B
PHOTO LOG

Photo 1: Waste Sorting Area

Photo 2: Single Family Residential Garbage Sample—No Organics Program

Photo 3 Single Family Residential Garbage Sample—Organics Program in place

Photo 4: Organics Sample

Photo 5: Organics Sample

Photo 6: Sorting

Photo 7: Printed Paper (Category 3)

Photo 8: Paper Packaging—Hot and cold takeout cups (Category 8)

Photo 9: Plastic Packaging—Film #2 and #4 (Category 14)

Photo 10: Plastic-Based Textiles (Category 17)

Photo 11: Produce (Category 21)

Photo 12: Dry Goods (Category 22)

Photo 13: Dairy (Category 23)

Photo 14: Baked Goods (Category 24)

Photo 15: Meals and Mixed Foods (Category 25)

Photo 16: Metal Food Containers and Packaging (Category 37)

Photo 17: Glass Food Containers (Category 40)

Photo 18: Electronics (Category 54)

APPENDIX C
WASTE SORT MATERIAL CATEGORIES

Waste Sort Categories: All Materials

A list of all primary and secondary categories.

Sample: **Sampling location:** **Weather:**

Date: **Time:** **Sorting Team:**

Hauler: **Source:** **Large bin tare weight** Kg

Truck Number / Licence: **Small bin tare weight** Kg

Inbound hauler mass: **Comments:**

Outbound hauler mass:

Load mass:

Sample mass (kg): **With bins**

Without bins

	Primary	Secondary	Tertiary	# Big Bins	# Small Bins	Weight 1 (kg)	Weight 2 (kg)	Weight 3 (kg)	Weight 4 (kg)
	PAPER								
1	Paper	Beverage Container	Tetra Pak						
2	Paper	Packaging	Aseptic and gable top - Soup, broth, etc.						
3	Paper	Printed Paper	Newspaper and Other paper (office paper, magazines, telephone books, etc.), boxboard						
4	Paper	Packaging	Old Corrugated Cardboard (OCC)						
5	Paper	Packaging	Ice cream container, Hot and cold takeout cups - coffee cups, fountain pop						
6	Paper	Packaging	Composite cans - Frozen Juice Containers, Pringles, Hot Chocolate, Ice Cream Paper Containers						
7	Paper	Other Paper	Hardcover books						
8	Paper	Compostable Paper	Paper towels, napkins, paper plates, pizza boxes, food contaminated paper etc.						
9	Paper	Packaging	Waxed OCC						
10	Paper	Other Paper	Other Paper Otherwise not included above - photos, laminates						
	PLASTIC								
11	Plastic	Beverage Container							
12	Plastic	Plastic Packaging	Rigid (non beverage) #1-7 including garden plant pots and trays						
13	Plastic	Plastic Packaging	Styrofoam/Foam (#6)						
14	Plastic	Plastic Packaging	Film #2 and #4 polyethylene film- (grocery bags, packing)						
15	Plastic	Plastic Packaging	Film - all other film (PETE, PVC, LDPE Stretch and PP Films, Multi-laminated plastic packaging)						
16	Plastic	Other Plastics	Unmarked un-coded plastics - stir sticks, straws, etc.						
17	Plastic	Textiles (Plastic)	Clothing (blends, polyester, Gore-Tex, fleece, nylon, etc.)						
18	Plastic	Other Plastics	Durable plastic products						
	COMP. ORGANICS								
19	Comp. Organics	Yard and Garden	Small yard waste						
20	Comp. Organics	Avoidable food scraps	Produce (Fresh ingredients)						
21	Comp. Organics	Avoidable food scraps	Meat and Fish (Fresh ingredients)						
22	Comp. Organics	Avoidable food scraps	Staple foods, Cereal, Grains and Powders (Dry Foods)						
23	Comp. Organics	Avoidable food scraps	Dairy						
24	Comp. Organics	Avoidable food scraps	Baked Goods						
25	Comp. Organics	Avoidable food scraps	Meals and Mixed Food (Leftovers)						
26	Comp. Organics	Avoidable food scraps	Confectionary, Processed Snacks and Desserts, Condiments						
27	Comp. Organics	Avoidable food scraps	Beverages						
28	Comp. Organics	Avoidable food scraps	Unidentified, Other						
29	Comp. Organics	Unavoidable food scraps	Peels, Pits, Shells, Bones, Husks						
30	Comp. Organics	Clean wood							
31	Comp. Organics	Other Compostable Organics							

	NON-COMP. ORG			# Big	# Small	Weight 1 (kg)	Weight 2 (kg)	Weight 3 (kg)	Weight 4 (kg)
32	Non-Comp. Organics	Rubber							
33	Non-Comp. Organics	Textiles	Includes leather						
34	Non-Comp. Organics	Contaminated Wood	Composite wood, particle board, plywood						
35	Non-Comp. Organics	Other Non-Compostable Organics							
	METAL								
36	Metal	Beverage Container							
37	Metal	Metal Packaging	Steel packaging (Food Containers including non-hazardous aerosol), aluminum foil and baking containers						
38	Metal	Other Metal							
	GLASS								
39	Glass	Beverage Container							
40	Glass	Glass packaging (food containers)							
41	Glass	Other glass							
	BUILDING MATERIAL								
42	Building Material	Gypsum/drywall, plaster							
43	Building Material	Rigid Asphalt Products							
44	Building Material	Carpet Waste							
45	Building Material	Other Building Material							
	ELECTRONIC								
46	Electronic	Computers and Peripherals, TV & Audio/video equipment,							
47	Electronic	Lighting Equipment	Lighting Fixtures: table lamp, chandelier, flashlight, wall fixture etc.						
48	Electronic	Smoke/CO Alarms							
49	Electronic	Thermostats (Non-Mercury Containing)							
50	Electronic	Electronic Toys							
51	Electronic	Outdoor Power Equipment							
52	Electronic	Small Appliances and Power Tools							
53	Electronic	Major Household Appliances							
54	Electronic	Other Electronics							
	HOUSEHOLD HAZARDOUS								
55	Household Hazardous	Batteries	Other Battery Types						
56	Household Hazardous	Lighting Equipment	CFL's, light bulbs						
57	Household Hazardous	Oil and Antifreeze							
58	Household Hazardous	Solvent and Flammable Liquids	Must have a flame symbol or phrase similar to "keep away from open spark or flame" on the label						
59	Household Hazardous	Paint	fu						
60	Household Hazardous	Pesticides	Domestic Pesticides - Consumer pesticides that have both the poisonous (skull & cross bones)						
61	Household Hazardous	Fertilizers							
62	Household Hazardous	Medications	Natural Health Products - product or container						
63	Household Hazardous	Cosmetics	Nail Polish, Make-up, Health and beauty aids, Sunscreen, Bug Spray						
64	Household Hazardous	Mercury Containing Items	Thermostats						
65	Household Hazardous	Other Hazardous Waste							
	HOUSEHOLD HYGIENE								
66	Household Hygiene	Biological	Diapers						
67	Household Hygiene	Biological	Pet Waste						
68	Household Hygiene	Other Biological (sanitary napkins, tampons, needles)							
	BULKY OBJECTS								
69	Bulky Objects	Other furniture (e.g. composite furniture)							
	FINES								
70	Fines	Fines (items too small to classify efficiently. (Ex bread							

Waste Sort Categories: Detailed Compostable Organics and Avoidable Food Waste Sorting Categories

Detailed categories and descriptions for sorting compostable organics into 10 categories of preventable food waste, and unavoidable food waste.

Terminology	Definition
Unavoidable or Non-Edible Food Scraps	Waste arising from food and drink preparation or consumption that is not, and has not been, edible under normal circumstances. This includes egg shells, banana peels, pineapple skin, apple cores, meat bones, tea bags, and coffee grounds.
Avoidable Food Scraps or Preventable Food Scraps or Wasted Food	Food that was purchased to eat but has since spoiled, or food that was prepped but was not eaten and then thrown away. The vast majority of avoidable food is composed of material that was at some point prior to disposal, edible, even though a proportion is not edible at the time of disposal due to deterioration (e.g., gone mouldy). This also includes food and drink that some people eat and others do not (e.g., apple or potato skins, break crusts).

		Secondary	Tertiary	Description/Example	Notes	Sample Waste Sorting Picture
1	Compostable Organics	Avoidable food scraps	Produce (Fresh ingredients)	Fruits, Vegetables, Salads/Greens, Fresh Herbs	Includes whole fruits and vegetables even though they may contain some unavoidable waste (e.g. whole orange has flesh and peel). Includes edible peelings (e.g. apple or potato)	
2			Meat and Fish (Fresh ingredients)	Beef, Pork, Poultry, Fish, Eggs, Soy, includes Processed Meats, Fats	Includes small bones which are unavoidable. Meat/fish waste which is primarily bones should be placed in unavoidable waste category.	
3			Staple foods, Cereal, Grains and Powders (Dry Foods)	Dry Pasta, Rice, Cereal, Couscous, Quinoa, Flour, Oats , Nuts, Dried Lentils and Beans, Baking Supplies, Oil		
5			Dairy	Milk, Cheese, Yogurt, Butter, Eggs		
4			Baked Goods	Bread, Pastry, Muffins, Cakes and Baked Desserts	From the bakery (either home-made or shop bought). No overly processed snacks.	
7			Meals and Mixed Food (Leftovers)	Cooked food - homemade meals, take-away and microwave meals. All composite food including Soups, Sandwiches, Curry, Pasta dishes, Casseroles, Stir Fry, Samosa, Pizza)		
8			Confectionary, Processed Snacks and Desserts, Condiments	Candy, Processed Snacks, Confectionery, Crackers, Junk Food, Processed Desserts, Condiments, Spreads, Sauces	Items not included above that are generally packaged and processed. Chips, chocolate bars, ice cream, jam, ketchup.	
6			Beverages	Juice, Pop, Coffee, Bottled Water		
9			Unidentified, Other	Includes food that is too mixed/small or decomposed to be sorted	Includes food that was 'not sortable' during the compositional analysis and includes food that has decomposed and is no longer identifiable. It also contains semi-liquid material from meals.	
10		Unavoidable food scraps	Peels, Pits, Shells, Bones, Husks			

APPENDIX D
FOOD WASTE COMPOSITION STUDY METHODOLOGY

1.0 FOOD WASTE CHARACTERIZATION SAMPLING METHODOLOGY

Wasted food can be found in a number of different disposal routes that leave a home including:

- Residential garbage collected at the curbside;
- Residential food scraps and organics collected at the curbside;
- Residential recycling collected at the curbside (Contamination of 'dry' recycling collections (e.g., food left in packaging);
- Materials that are self-hauled to transfer stations;
- The sewer (mostly down the kitchen sink);
- Home composting; and
- Fed to animals.

Figure 1: Illustration of Quantifying Wasted Food (Source: Fusions 2012)

Wasted food at the household level can be measured using different methods to quantify the amount wasted food depending on the disposal route in the household. One method is to use food scanning and recording using a diary, where all wasted food is recorded by a resident prior to the final disposal method such as putting it into the a bin for disposal, down the sink, or into a home composter. Another, and more common method, is to complete a waste characterization study which can quantify the amount of wasted food that is put out for disposal and collected at the curbside (WRAP 2012).

Waste characterization analysis can be used for measuring wasted food that is collected for disposal in both the garbage and food scraps material streams to determine the total amount of wasted food that is being managed through the collection system. It could also be completed for the recycling stream if it is suspected that there is a measurable quantity of wasted food that is contaminating the recycling stream. Waste characterization analysis used in combination with the total mixed waste tonnage collected by a specific area or region can be used to calculate the total amount of wasted food, and determine the overall proportional composition of the waste stream for both garbage and food scraps. The diary method would be required to determine the amount of wasted food that is going down the sewer, is being composted at home, or that is fed to animals.

2.0 SAMPLE COLLECTION AND SORTING

To complete a waste characterization study for the garbage and food scraps there are two primary methods to collect the garbage and organics samples which include: a) the transfer station method; and b) the curbside method. Both methods can be used depending on the goals of the study and achieve the following:

- Obtain garbage and organic characterization data; and
- Estimate material generation rates including the amount of wasted food (weight/household/week) based on data provided for each collection route or for a region.

2.1 Transfer Station Method

The “transfer station method” relies on identifying specific collection routes in an area, and collecting samples from the identified collection vehicles at the transfer station. This approach provides characterization of the refuse and organics from the routes those vehicles collected from which could range from 400 to 800 homes. To collect a sample for waste characterization analysis, waste haulers are directed to unload approximately 500 kg to 2000 kg of waste at the transfer station in a location where a team of waste sorters can collect a sample for detailed sorting. Loads would be visually inspected by a sort supervisor to confirm the load source and ensure there was no contamination from other waste sources in mixed source loads. One sample (typically 100 kg of garbage; or 30–40 kg of organics) can then be randomly collected in a grid pattern from the waste. This sample is then sorted into bins representing each sort category that is required.

2.2 Curbside Method

The “curbside method” is where waste and organic are collected as it is set-out by residents at the curbside or back alley, as opposed to directly off collection vehicles at a transfer station. An area in a region would be selected, the same way as a specific truck from a given area is targeted for sampling at the transfer station, however, a manual collection crew would mobilize to each neighbourhood (typically with a cube van) and collect all the materials set out by residents at the curbside. This is done by re-bagging the materials, by hand, from a selected number of houses (usually a grouping of 10 households) in each neighbourhood. This method was developed to allow for direct comparison/addition of material characterization from all streams from the same households. This method can also have less cross contamination of sample material as no compaction occurs in the collection vehicle. However this method requires an additional level of effort as a separate collection crew will need to mobilize to a set number of homes and collect the waste manually from the curbside. Once all of the material from the preselected households is collected the material is amalgamated (by material stream) and sorted in aggregate from the group of households.

2.3 Sample Sorting Notes

The additional waste characterization categories used for a food waste include sorting the food scraps into additional organics categories that identify food as avoidable/preventable/waste food or unavoidable/inedible food scraps. Additional categories, definitions, and sample photos of each sort are included in this report.

During waste sorting, the sorting team typically does not take the time to manipulate the waste in a significant way, such as remove food from packaging. Food within packaging and containers can be placed into the category of the material with the highest content or significance. For example, a container that is still half-full of sauce or a bottle that is one-quarter full of liquid would be placed into the compostable organics food waste category as a majority of the weight of the item is compostable organics. If a container is almost empty, then it would be placed in the appropriate material category such as rigid plastics or beverage containers.

REFERENCES

Fusions (2014), Standard Approach on Quantitative Techniques to be Used to Estimate Food Waste Levels. Accessed online: http://www.eu-fusions.org/uploads/deliverables/Standard%20approach%20on%20quantitative%20techniques.pdf

WRAP (2012), Methods Used for Household Food and Drink Waste in the United Kingdom 2012. Accessed online: http://www.wrap.org.uk/content/household-food-and-drink-waste-uk-2012