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2017 Waste Composition Study

PRESENTED TO

Cowichan Valley Regional District

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

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- Laurie Taylor;
- Danielle Stevenson;
- Ronn Stevenson; and
- Jeremy Reid.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Cowichan Valley Regional District (CVRD) to conduct a comprehensive Waste Composition Study. This report describes the methodology employed for determining the waste composition and discusses the data analysis and results from the study. The scope of work for the Waste Composition Study included sorting municipal solid waste (MSW) that arrived at, or was directed to Bings Creek Recycling Centre (Bings Creek) during the study from the following waste generating sectors:

- Single family residential (SF) curbside programs for the municipalities and electoral areas;
- Multi-family residential (MF);
- Industrial, Commercial and Institutional (ICI);
- Garbage that was self-hauled in small loads for drop-off at Bings Creek, Peerless Road, and Meade Creek Recycling Centres (DO); and
- Construction, renovation and demolition (C&D) waste that was specially hauled from Fisher Road Recycling for analysis.

The timeline and distribution of the samples completed are summarized in Table A-1. For the study, the amount of waste arriving from each sector was estimated using the available data for the tonnage arriving from identified SF service routes and the tonnage data available for C&D materials. In 2016, the total amount disposed at all facilities in the CVRD was 23,803 tonnes. An additional 543 tonnes of painted wood and 4,759 tonnes of demo waste disposed of at other facilities brings the total to 29,105 tonnes of waste disposed.

A total of 77 samples were completed as summarized in Table A-1. This is the second waste composition study commissioned by the CVRD, with the first being a smaller study that was done in conjunction with a British Columbia Ministry of Environment (Ministry) study that was completed by Tetra Tech in 2015. In 2015, a total of 23 samples were collected and sorted from the electoral areas, municipalities, MF residents, and ICI sector. Tetra Tech discussed with CVRD staff about the potential benefits of combining the data collected in the 2015 waste audit with the 2017 data given that the collection practices for the material streams have not changed in the interim period. The data was reviewed from each study independently, and then the results were combined for presentation in this report. The data was combined and resulted in increased statistical validity, as some of the electoral areas and the MF buildings had limited numbers of samples in each audit.

Table A-1: Samples Completed by Sector

Sector	Estimated Proportion of Garbage in the CVRD[1]	Number of Samples Sorted		
Date	**2016**	**May 29 – June 20, 2017 (17 Days)**	**March 4 – March 13, 2015 (8 Days)**	**Total**
SF	18.6%	36	15	51
MF	7.8%	3	2	5
ICI	33.1%	20	6	26
DO	16.6%	17	-	17
C&D	24.0%	1 (combined sample)	-	1
Total	**100%**	**77**	**23**	**100**

[1] Values are estimated based on available data for bins, and extrapolated from identified single family service routes.

Garbage samples were hand sorted into 13 primary categories, and a total of 65 material subcategories. A combination of visual and hand-sorting was used for C&D and DO samples.

Results are presented in the report for each waste generating sector, and the overall average for the CVRD was calculated. The largest component of the garbage was compostable organics (31.7%), followed by plastics (16.2%), and paper (12.8%). Organics were comprised of avoidable food waste (14.0%), followed by non-backyard compostable (8.2%), and donatable food (5.1%). It is important to note that an additional 4.9% of the garbage was identified as compostable food soiled paper that can go into composting programs. Plastics consisted of durable plastic products (6.7%), plastic film (4.5%), and plastic packaging (2.5%).

In 2016, the estimated population in the CVRD was 83,739 and the total amount disposed at all facilities in the CVRD was 29,105 tonnes. This sum, divided by the population, equals a waste disposal rate of 347.6 kg/capita. The waste disposal rate for each sector was multiplied by the composition data to obtain the overall quantity in kg per capita of materials in the garbage for each waste sector, as can be seen in Figure A.

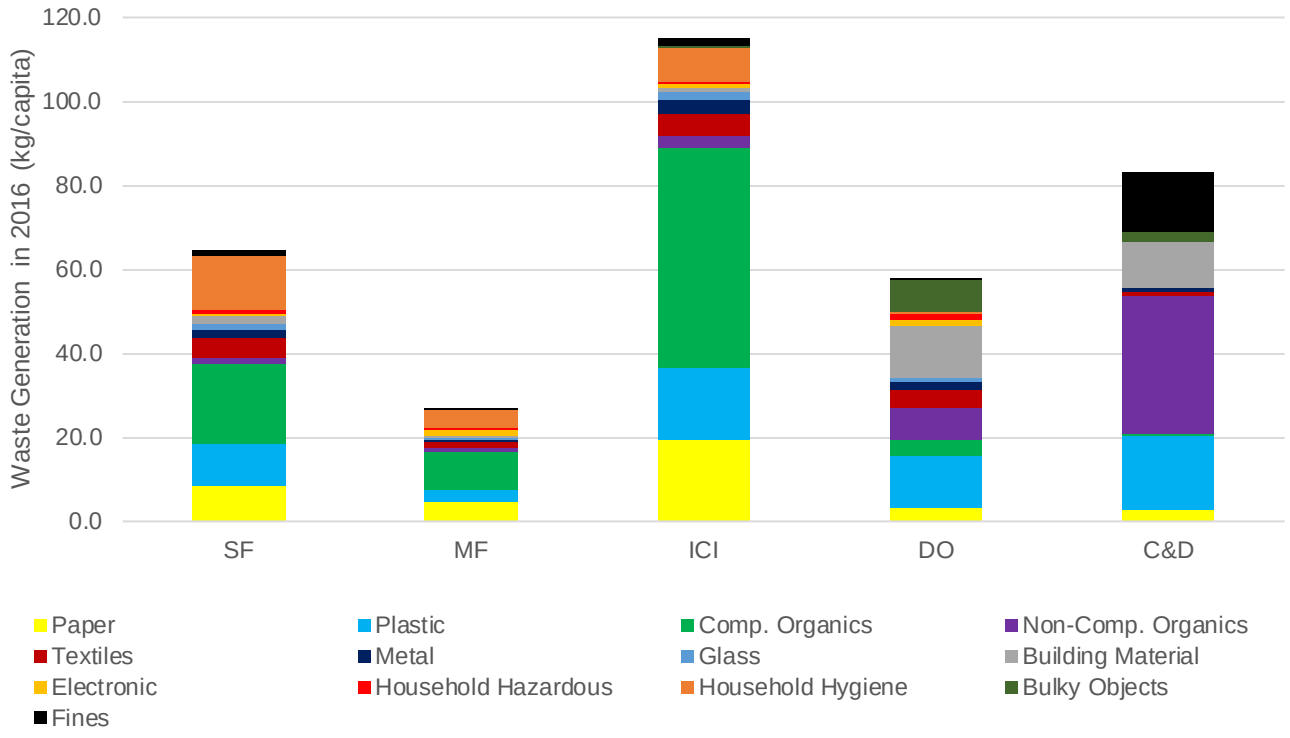

Figure A: Primary Category Waste Disposal (kg/capita) – All Sectors Combined (N=100)

Areas of high diversion potential and relevant considerations for the specific waste sectors examined in this study are summarized in Section 3.7. In total it was estimated that 40 to 50% of the SF and MF garbage that is disposed consists of materials that could be accepted in curbside recycling and organics programs. The opportunities presented provide a broad overview of the most prevalent waste categories including compostable organics, food soiled paper, recyclables, and other materials from specific sectors.

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
C&D	Construction and Demolition
DO	Drop-off (Garbage that is self-hauled to a transfer station)
EPR	Extended Producer Responsibility
ICI	Industrial, Commercial, and Institutional
MF	Multi-Family Residential
MSW	Municipal Solid Waste
N	Number of Samples
SF	Single Family Residential

Terminology	Definition
Hauler	Vehicle delivering the waste for disposal
Load	Amount of waste contained in a hauler truck
Load Source	Origin of a specific sample
Sample	Portion of the load that was sorted and weighed
Municipal Solid Waste (MSW)	As defined in the BC *Environmental Management Act*: a) refuse that originates from residential, commercial, institutional, demolition, land clearing or construction sources, or b) refuse specified by a director to be included in a waste management plan
Solid Waste Stream	The aggregate of all municipal solid waste and recyclable materials, and the process through which they move from generation to utilization or disposal
Per Capita	Per person in the designated study area
Disposal	The total amount of material that is sent to landfill or other end disposal.
Waste Disposal Rate	Disposal per unit time (typically per year) divided by the service population (per capita) for the study area or sector

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Cowichan Valley Regional District 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 the Cowichan Valley Regional District, 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 E 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 the Cowichan Valley Regional District (CVRD) to conduct the 2017 Waste Composition Study. The study was conducted over 17 days from May 29 to June 20, 2017, at the Bings Creek Recycling Centre (Bings Creek). This report describes the methodology employed for determining the waste composition and discusses the data analysis and results from the study. Results were divided by waste sector as well as represented by a regional average. Using available waste disposal data for each sector, the municipal solid waste (MSW) disposal per capita was calculated for the material categories for all waste generating sectors.

1.1 Background

The CVRD is the regional government for four municipalities and nine electoral areas on southern Vancouver Island, serving more than 80,000 citizens. The CVRD is responsible for solid waste disposal in the region.

Bings Creek is owned and operated by the CVRD and is located about 6 km northwest of Duncan. 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. Garbage collection service in electoral areas A, B, C, and H is not offered by CVRD and private haulers offer a subscription based service in some areas. Member municipalities including the City of Duncan, North Cowichan, Ladysmith, and Lake Cowichan provide their own garbage, source-separated organics, and recycling collection services for their residents.

The garbage collection and MSW sorting took place from May 29 to June 20, 2017, at Bings Creek in Duncan, British Columbia. It included a total of 77 samples comprising single family collection from electoral areas and municipalities, multi-family residences, the construction renovation, and demolition sector, public drop-off bins at Bings Creek, Peerless Road, and Meade Creek, and the industrial, commercial, and institutional (ICI) sector. This is the second waste composition study commissioned by the CVRD, with the first being a smaller study that was done in conjunction with a British Columbia Ministry of Environment (Ministry) study that was completed by Tetra Tech from March 4 to March 13, 2015. In 2015, a total of 23 samples from the electoral areas, municipalities, multi-family and ICI sector.

The CVRD has been on the forefront of waste reduction for the past 25 years when it first set an ambitious 50% waste diversion goal. These goals have been raised over the years and in 2015 the CVRD reported the lowest waste disposal rates of any municipal district in British Columbia.

1.2 Scope of Work

The scope of work for the 2017 Waste Composition Study included sorting municipal solid waste (MSW) that arrived at Bings Creek from the following waste generating sectors:

- Single family residential curbside programs (SF);
- Multi-family residential (MF);
- Industrial, Commercial and Institutional (ICI);
- Garbage that was self-hauled in small loads for drop-off at Bings Creek, Peerless Road, and Meade Creek Recycling Centres (DO); and
- Construction, renovation and demolition (C&D) waste that was specially hauled from Fisher Road Recycling for analysis.

The purpose of the study was to produce solid waste stream composition profiles for:

- Each of the waste-generating sectors in CVRD; and
- An overall waste stream profile for the CVRD.

To accomplish this, garbage samples were primarily hand sorted into 13 primary categories, and a total of 65 material subcategories. A combination of visual and hand-sorting was used for C&D and DO samples.

2.0 METHODOLOGY

This section provides an overview of the work completed including how waste was collected and sampled. Sampling and sorting was conducted 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 1999). Detailed category descriptions are included in Appendix A.

2.1 Number of Samples

Tetra Tech prepared a sampling framework and protocol customized for this study, working from data completeness, scheduling, safety, and budgetary perspectives. The study took place over four consecutive weeks, as the amount of waste received at the CVRD's transfer stations is relatively consistent each month, and similar studies in neighbouring regional districts have not shown noticeable seasonal variability in the waste composition. Table 1 summarizes the total number of garbage samples completed for each sector in both the 2017 and 2015 studies.

Table 1: Samples Completed by Sector

Sector	Estimated Proportion of Garbage in the CVRD[1]	Number of Samples Sorted		
Date	**2016**	**May 29 – June 20, 2017 (17 Days)**	**March 4 – March 13, 2015 (8 Days)**	**Total**
SF	18.6%	36	15	51
MF	7.8%	3	2	5
ICI	33.1%	20	6	26
DO	16.6%	17	-	17
C&D	24.0%	1 (combined sample)	-	1
Total	**100%**	**77**	**23**	**100**

[1] Values are estimated based on available data for bins, and extrapolated from identified single family service routes.

The total number of samples from each sector was chosen by taking into account the total proportion of garbage received from each sector in the region in 2016, the overall variation of the waste stream expected from each sector, and the amount of existing information about the composition of the waste streams. For the 2017 study, the amount of waste arriving from each sector was estimated using the available data for the tonnage arriving from identified SF service routes and the tonnage data available for C&D materials. Waste arriving at Bing's Creek is often a mixture of sources from MF, ICI and DO. This data was extrapolated based on the existing number of MF households and an average disposal rate for MF households of 411 kg/unit/year that is used by the Capital Region and Metro Vancouver for planning purposes. The amount of DO waste dropped off at Bings Creek was estimated

by assuming an average bin weight of 2.2 tonnes/bin to come up with the estimates that are presented in Table 1. It was assumed the ICI waste made up the remainder of the tonnage not accounted for in the other waste sectors.

Typically, the waste composition of DO, ICI, and C&D samples have higher variability. SF garbage was sampled from every municipality and electoral area in the region. The CVRD jurisdictions use different haulers from each other and provide varying levels of organics service.

There was initial consideration to include targeted agricultural waste samples in the study; however, during the sampling period at Bings Creek, there were no loads that arrived, or material identified as being from large agricultural operations.

To obtain the desired number of samples from each sector the following methods were employed for each sector:

- For SF samples, a list of targeted SF collection routes was prepared prior to commencement of the sampling period to ensure samples were from a distribution of a majority of the municipalities. The number of SF samples from each municipality was determined based on the total amount of waste that was estimated to be disposed for each municipality and the amount of samples required for statistical relevance. In addition, arrangements were made with a private hauler to drop off loads for several electoral areas at Bings Creek.
- ICI samples were selected at random as they arrived and were not selected based on their area of generation.
- DO samples were acquired through coordination with CVRD staff at Bings Creek to ensure loads from the regional drop-off depots as well as Bings Creek were included in the study. The material arriving from the Meade Creek and Peerless Road Recycling Centres was selected at random as they arrived and were not selected based on their area of generation.
- MF and C&D samples were specially arranged with private haulers, as MF waste can normally be mixed in loads with ICI waste, or they are normally hauled to other facilities in the CVRD.

In total, 77 samples were completed. For SF households, a total of 36 garbage samples were collected from 4 municipalities and 8 electoral areas in the CVRD. No samples were collected from Area H, as there was no separated garbage collection to sample from for this Electoral Area. For MF households, a total of 3 samples were completed, all of which were generated in the City of Duncan. A total of 20 ICI samples were completed from a selection of haulers which were generated throughout the region, including several First Nations groups. A total of 17 DO samples were completed, with 7 originating from Bings Creek, 5 from Peerless Road and 5 from Meade Creek Recycling Centre. The C&D sample that represented one to two full days of material destined for disposal from sorted C&D loads that arrive at Fisher Road Recycling.

2.1.1 2015 and 2017 Data Synthesis

Tetra Tech discussed with CVRD staff about the potential benefits of combining the data collected in the 2015 waste audit with the 2017 data given that the collection practices for the material streams have not changed in the interim period. The data was reviewed from each study independently, and then the results were combined for presentation in this report. The data was combined mainly to increase statistical validity, as some of the electoral areas and the MF buildings had limited sample sizes due to collection restrictions. Data was combined as follows:

- Data was combined directly with the 2017 data using the same weighted average technique on an individual sample basis;
- There were some category changes with reference to textiles from 2015 to 2017. Previously, textiles were nested underneath the plastics and non-compostable organics categories. For incorporation with the 2017 data, the plastics subcategory became the clothing category, and the non-compostable organics subcategory was

split up 20% to "footwear" and 80% to "all other textiles", which was based on the distribution of textiles in the 2017 data; and

- Food waste categories from the Ministry study in 2015 were aligned and combined with the 2017 categories of Food Waste – donatable, avoidable, unavoidable non-backyard compostable, and unavoidable backyard-compostable.

2.2 Sampling Categories

Garbage samples were sorted into 13 primary categories and a total of 65 material subcategories. Categories used were the same as those used in the 2015 study, with the exception of food waste. The 2015 study had funding from the Ministry for a specific focus on avoidable food waste and thus included specific types of food (e.g., meat, dairy). This project used four food categories, identifying food as avoidable, avoidable-donatable, unavoidable-non-backyard-compostable or unavoidable-backyard-compostable shown in Table 2.

Table 2: Secondary Material Categories for Compostable Organics

Category Number	Secondary	Description
18	Yard and Garden	Grass, leaves, branches < 3 inches diameter
19	Food waste – unavoidable-backyard compostable	Fruit and vegetable peelings, carrot tops, egg shells, tea bags.
20	Food waste – unavoidable-non-backyard compostable	Food waste that is not typically compostable in the backyard (e.g., bones, cartilage, etc.)
21	Food waste – avoidable	Leftovers, plate scrapings, usable parts of fruits and vegetables, baked goods, candy, snacks, condiments, and meats
22	Food waste – avoidable-donatable	Food waste that is not past the expiration date, unused ready-made, whole meats/fish, baked goods, deli, liquids (like oil in package)
23	Clean wood	Dimensional lumber, pallets, chopsticks
24	Other Compostable Organics	Small animals

In addition, in 2015 the textiles category was included in the non-compostable organics primary category. Textiles is a separate primary category in the 2017 composition methodology to clearly identify the quantity of textiles being disposed in the waste stream. Please see Appendix A for a description of all categories.

2.3 Load Identification and Sample Selection

Sample collection was completed with the assistance of Bings Creek staff and sorting was completed by a Tetra Tech site supervisor, along with three waste sorters who were trained by Tetra Tech according to current waste characterization standards on safety and material sorting procedures prior to the fieldwork. Personal protective equipment (PPE) was used by staff according to the specifications of Tetra Tech's Health and Safety Plan, which factored in special requirements for working at Bings Creek. Safety meetings were conducted daily to emphasize key concerns including how to handle material hazards such as sharp or hazardous materials, safe lifting procedures, and working around vehicles.

The Tetra Tech site supervisor worked closely with Bings Creek staff to coordinate identification and selection of the loads to be sampled as they arrived with a focus on minimally interrupting Bings Creek daily operations. Select sample photographs can be found in Appendix C.

A copy of the sampling plan was reviewed with Bings Creek staff each day to determine what samples were needed based on known truck arrival schedules. As the sorting team completed a sample, or as selected loads for sampling arrived at Bings Creek, Tetra Tech and Bings Creek staff would confirm with the hauler the source of the load to determine if it was suitable for sampling. A copy of the truck identification and selection procedure for each waste sector is included in Appendix B. The hauler would empty the load in the transfer building as normal. For SF, MF, ICI, and selected DO samples which were hand-sorted, Tetra Tech staff would communicate via radio with the loader operator to ensure that one loader bucket (approximately 200 kg to 300 kg) of material collected from the load and delivered to the sorting area for manual sorting (methodology further described in Section 2.4.1).

C&D (and some DO) samples were visually audited as the garbage consists of mostly large items which cannot be manually lifted and weighed. Visual audits occurred in the transfer building. Tetra Tech staff would be in radio communication with the loader operator to ensure that the load was left available for auditing. Furthermore, heavy machinery activity was limited during the visual audits.

Once the loader was outside of the transfer building and any trucks had exited, Tetra Tech staff would enter the transfer building to perform a visual audit as described in Section 2.4.2. During visual audits, Tetra Tech staff would move to a protected location if trucks came in to the building to empty their loads and resume the visual audit after vehicle activity had ceased.

2.4 Sample Sorting

Sampling and sorting was conducted in accordance with the methodology set out in the Provincial Waste Characterization Framework.

Depending on the visible composition of the load, one of the following methodologies was used:

1. **Manual Sort** – A random sample of 100 kg was pulled from the load and sorted by hand. This method was used for loads that were primarily composed of bagged garbage, such as the SF, MF and ICI loads.

2. **Visual Audit** – The entire load was visually audited. This method was typically only used for C&D and DO samples, which were primarily composed of large items and very little bagged garbage.

3. **Visual Audit and Manual Sort** – The entire load was visually audited, then a random sample was hand-sorted. This method was used for loads that had a mix of large items and bagged garbage.

Typically, waste composition studies use only the first two methods described above. However, the third method was developed by Tetra Tech to account for the large amount of loads that had a mix of bagged household garbage and large items that could not be hand-sorted (e.g., furniture, building materials, large amounts of cardboard, etc.). The number of samples sorted using each method is described by Table 3. Materials were classified as 1 of 13 primary categories, which were further broken down into 65 subcategories. These categories were identified with District staff at the outset of the project.

Table 3: Sampling Methods Used

Sorting Methodology	Number of Samples Sorted (2017)	Number of Samples Sorted (2015)
Manual Sort	59	23
Visual Audit	15	-
Visual Audit and Manual Sort	3	-

The primary categories included paper, plastics, compostable organics, non-compostable organics, textiles, metals, glass, building material, electronics, household hazardous, household hygiene, bulky objects, and fines. Visually audited samples had an additional category which was 'bagged garbage.' A complete list of the categories along with their descriptions can be found in Appendix A.

2.4.1 Manual Sorting

The supervisor would confirm the area of origin with the truck driver and the scale house and request an additional copy of the scale ticket from Bings Creek staff to be set aside in the scale house for retrieval by Tetra Tech staff at the end of the day. Tetra Tech staff would then communicate via radio with the loader operator to acquire a 200 kg to 300 kg bucket of garbage and bring it to the sorting location. The field team then assisted the supervisor in collecting a sample which consisted of 100 kg of garbage using a rough grid pattern to minimize potential bias. The sample was photographed and pre-weighed prior to sorting. The materials were then sorted into 65 different categories and placed in separate bins.

At the end of the sample sorting, each categorized bin was weighed and the bin tare weight was subtracted to obtain the net sample weight. Selected photographs of the process can be found in Appendix C.

2.4.2 Visual Audits

Tetra Tech's methodology for the visual audit was based on CalRecycle's "Method of Visual Characterization of Disposal Waste from Construction and Demolition Activities."[1] This method is used for samples that consist of primary large and heavy items that cannot be safely hand-sorted.

Prior to visual auditing, the transfer building was cleared of heavy machinery activity to ensure safe access to the sample, which enabled staff to inspect the load and see all of the materials. Both the field supervisor and field assistant visually estimated the contents of the load by volume percentage. This was accomplished by first estimating the amount of material by primary categories, and then further estimating the amount of materials in each secondary category. Estimates derived by each person were compared and discussed to determine acceptability and were adjusted until consensus was reached. Selected photographs of the process can be found in Appendix D.

For the DO visual audits, if black garbage bags were in the load, they would be cut open if easily and safely accessible to view the contents, otherwise they were placed in the "black bags" category.

2.4.3 Visual Audits and Manual Sorting

For three DO samples, Tetra Tech staff visually audited the load (according to Section 2.4.2) and then acquired 100 kg samples of the black bags present in the load to hand sort (according to Section 2.4.1). These hand sorts were to provide additional context to the black bag composition and ensure that the overall data includes proportionate representation from the garbage that was bagged and put into the bins. For the DO samples, three samples were visually audited and black bag-hand sorted and the other 14 samples were visually audited.

2.5 Data Analysis and Statistical Evaluation

Data was compiled electronically throughout the course of the field work for garbage that was manually sorted, and data was manually recorded on clipboards for visual audits. Data collection logs and scale tickets (if applicable) were reviewed daily to ensure accuracy. Quality assurance and quality control methods were then employed for

[1] CalRecycle. October 2006. Method of Visual Characterization of Disposed Waste from Construction and Demolition Activities. Prepared under contract by Cascadia Consulting Group.

accuracy including ensuring the difference between pre-sorting weights of each sample with the calculated final sample weight after sorting was within an acceptable margin of accuracy (<3% of total sample weight).

The weight-based averages were calculated using a weighted mean for each waste sector and material category to account for the different sector and sample weights to accurately reflect the solid waste stream composition. The data for the manual sorting is weight based and does not take into account the volume of the material. Therefore, heavier dense objects such as kitty litter can represent a small portion of the volume of a waste stream, but can represent a larger portion of the calculated waste composition; whereas light bulky objects such as plastic film can represent a larger volume, but do not have a high density and therefore represent a smaller portion of the calculated waste composition.

Standard deviations and 90% confidence intervals were calculated for primary material categories by waste sector to evaluate the results. These parameters were determined using waste composition percentages to normalize the data set, as each sample can have a different total sample weight. A large standard deviation does not necessarily indicate that the data is unreliable; instead it could indicate that the data from a particular sector is highly variable depending on the source, with different institutions or businesses producing different composition of waste.

3.0 WASTE COMPOSITION RESULTS

The waste composition results are reported as net weight percentages by primary material category in the following sections. The data includes all samples sorted in both the 2015 and 2017 study combined. Net weight percentages were calculated by combining all sample data for each sector. A summary of the results for all 65 material categories is included in Table A at the end of the report. Selected photographs from the field auditing are included in Appendix C and Appendix D.

3.1 Residential

Residential waste targeted both SF collection routes which have curbside service, and MF garbage collected by haulers from dumpsters at apartment buildings and condos.

3.1.1 Single Family

Single family collection included four municipalities and eight electoral areas. Area H was not included as there is no curbside garbage collection route that can be selected for sampling. The percent of net weight results and 90% confidence interval calculations for the samples from the municipalities and the samples form the electoral areas are summarized in Tables 4, 5, and 6. Table A following the report includes detailed data for all material categories.

Table 4: Waste Composition for Single Family Municipalities

Primary Category	Single Family			
	City of Duncan (N=4)	District of North Cowichan (N=11)	Town of Lake Cowichan (N=5)	Town of Ladysmith (N=6)
Paper	13.4%	12.3%	18.0%	12.8%
Plastics	15.3%	16.0%	19.1%	16.9%
Compostable Organics	21.9%	23.2%	24.5%	23.0%
Non-Compostable Organics	4.0%	1.6%	1.2%	4.2%
Textiles	8.5%	8.3%	6.5%	7.6%
Metals	3.6%	3.0%	2.7%	2.3%
Glass	2.4%	4.1%	1.9%	1.6%
Building Material	6.4%	1.0%	0.5%	1.3%
Electronics	2.9%	1.0%	1.3%	1.3%
Household Hazardous	0.6%	1.9%	2.1%	1.4%
Household Hygiene	17.3%	24.9%	19.9%	25.0%
Bulky Objects	1.1%	0.0%	0.0%	0.0%
Fines	2.7%	2.7%	2.1%	2.6%

[1]N = number of samples completed for the sector.

The largest component of the garbage for the municipalities was compostable organics ranging from 21.9% to 24.5%. The total amount of compostable organics was fairly consistent between all municipalities. The next largest portion was household hygiene for a majority of the municipalities. In the City of Duncan household hygiene was primarily diapers, whereas in the other municipalities household hygiene had larger quantities of pest waste, followed by diapers. Higher quantities of paper were reported for Lake Cowichan, and this was primarily food soiled paper and compostable paper such as paper plates, paper towel and tissues.

Table 5: Waste Composition for Single Family Electoral Areas

Primary Category	Single Family Electoral Areas							
	Electoral Area A (N=2)	Electoral Area B (N=2)	Electoral Area C (N=2)	Electoral Area D (N=4)	Electoral Area E (N=6)	Electoral Area F (N=3)	Electoral Area G (N=3)	Electoral Area I (N=3)
Paper	13.4%	15.0%	11.4%	12.6%	13.1%	11.4%	12.8%	12.3%
Plastics	8.9%	14.8%	16.2%	15.0%	13.6%	15.2%	16.2%	14.5%
Compostable Organics	30.2%	29.1%	30.8%	40.4%	36.7%	33.4%	40.2%	31.3%
Non-Compostable Organics	0.5%	1.7%	1.4%	2.5%	1.6%	1.3%	3.5%	5.3%
Textiles	3.0%	6.2%	9.1%	6.8%	5.4%	11.9%	5.4%	6.9%
Metals	1.6%	2.5%	3.1%	3.1%	2.6%	4.6%	3.2%	2.8%
Glass	2.4%	0.9%	3.0%	1.0%	1.5%	2.6%	2.0%	2.4%
Building Material	0.8%	2.1%	3.8%	1.1%	2.4%	3.2%	6.6%	8.9%
Electronics	0.2%	1.4%	2.2%	1.2%	0.9%	0.6%	0.7%	1.0%
Household Hazard.	0.7%	4.5%	2.3%	1.4%	1.4%	0.8%	0.5%	0.9%
Household Hygiene	36.7%	20.1%	14.6%	13.9%	18.5%	13.2%	6.5%	10.4%
Bulky Objects	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Fines	1.6%	1.6%	2.1%	1.1%	2.4%	1.8%	2.5%	3.1%

The largest component of the garbage for the electoral areas was compostable organics ranging from 29.1% to 40.4%. Electoral areas A, B, C, F, and I had lower amount of organics compared to areas D, E, G, and G had higher amounts of organics in the garbage. All electoral areas had a higher percentage of organics when compared to the municipalities. Part of this discrepancy can be explained by the source-separated organics collection that occurs in the municipalities compared to some of the electoral areas. The next largest portion was household hygiene for a majority of the electoral areas. While there are significant differences in composition between some electoral areas (e.g. Electoral Area A household hygiene was 36.7% and Electoral Area G had 6.5%), the low sample size for any one Electoral Area limits the statistical strength of the data. The average across Electoral Areas provides more reliable and significant data from which to determine trends and inferences. Specific samples can include material from homes with young children or pets that produce large quantiles of heavy household hygiene waste, and a number of samples is required to achieve a good distribution of samples and identify overall trends. Electoral Areas G and I identified qualities of building material at 6.6% and 8.9% respectively. This included samples that contained a bag of gypsum, and another sample that identified carpet and asphalt shingles.

Figure 1 presents the weighted average primary material composition for all SF residential garbage. The largest component of residential garbage was compostable organics (29.0%), followed by household hygiene (19.4%), plastics (15.6%), and paper (13.2%). Compostable organics mainly comprised food waste (26.4%), broken further down into: 12.1% avoidable food waste, 9.8% unavoidable-non-backyard-compostable, and 3.7% donatable food waste. The largest component of household hygiene waste was pet waste (9.8%), followed by diapers (7.8%), and other hygiene products (1.8%). The largest portion of plastics was other film packaging (7.3%), followed by non-beverage rigid plastic packaging (2.5%), and durable plastic products (2.2%). The largest component of paper was compostable paper at 7.8% followed by printed paper (2.8%), and other paper (0.8%).

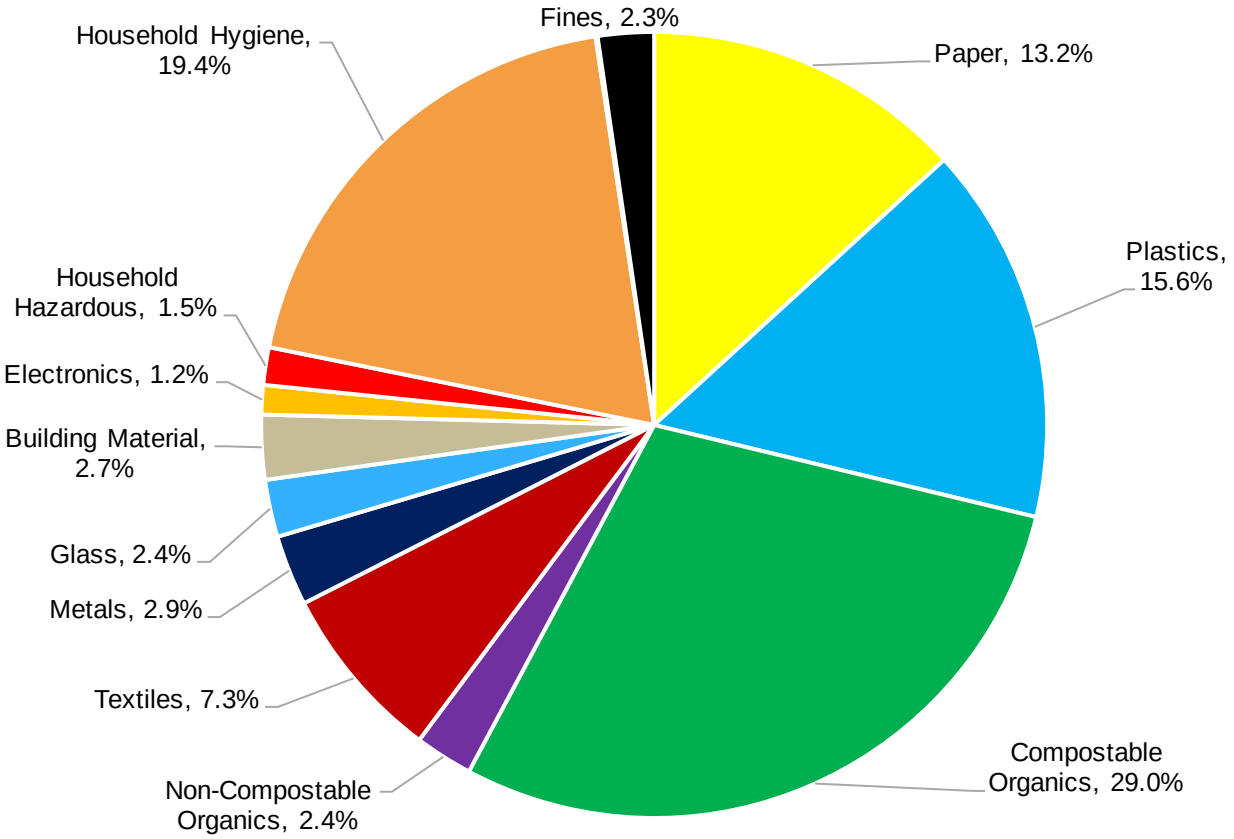

Figure 1: Primary Category Composition – Single Family Garbage (N=51)

Table 6 shows the amount of each primary category identified in Figure 1 that have been designated by Recycle BC for curbside collection or are typically collected in organics curbside collection. The region has been split up into three groups based on the distinctions in collection services. For example, Electoral Areas A, B, and C have some residents who have opted for organics collection provided by Pan-Disposal, whereas Electoral Areas D through I do not have any organics collection. Overall it is estimated that 40% to 50% of the current material disposed could be included in a curbside recycling program if full participation and all materials were sorted properly. There is an identifiable trend, with a greater than 10% difference in the percentage of organics in the garbage between the Municipalities with organics collection and the Electoral Areas with no organics collection.

Table 6: Curbside Collectable Recyclables and Organics in Single Family Garbage

Category	Municipalities (N=26)	Electoral Areas A, B & C (N=6)	Electoral Areas D,E,F,G, & I (N=19)
Recyclable Paper	5.1%	3.1%	3.4%
Recyclable Plastics	2.8%	1.9%	2.3%
Recyclable Metals	1.6%	1.0%	1.4%
Curbside Recyclables Subtotal	**9.5%**	**6.0%**	**7.1%**
Compostable Organics	23.2%	30.1%	36.4%
Compostable Paper	7.7%	7.8%	8.2%
Compostable Subtotal	**30.8%**	**37.9%**	**44.6%**
Total	**40.3%**	**43.9%**	**51.8%**

3.1.2 Multi-Family Residential

Figure 2 presents the weighted average primary material composition for MF residential garbage. The largest component of the garbage was compostable organics (32.9%), followed by paper (17.1%), household hygiene (14.9%), and plastics (11.0%). Compostable organics mainly comprised food waste (25.4%), broken down into 14.0% avoidable food waste, 8.1% unavoidable and backyard compostable, and 3.2% donatable food waste. The largest component of household hygiene waste was diapers (7.8%), followed by pet waste (5.8%), and other hygiene products (1.5%). The largest component of paper was printed paper (7.7%), followed by compostable paper (6.9%), and packaging - liquid containers (0.7%). The largest portion of plastics was other film packaging (3.7%), followed by non-beverage rigid plastic packaging (2.8%), and durable plastic products (2.3%).

In total, five samples were completed from the MF sector. Typical MF waste is mixed with ICI waste and it is hard to identify loads that contain primarily MF waste for sampling. In the 2017 study, a hauler was engaged to deliver specific MF samples from their MF buildings during the study for sampling. The amount of electronic waste observed is believed to be higher than normal due to one of the five samples that had a Microwave in the garbage. More samples would need to be completed to lower the standard deviation for this category. Overall the standard deviation for the electronic waste results is high, and the amount of electronic waste in the garbage could be lower than what was observed in the five samples audited.

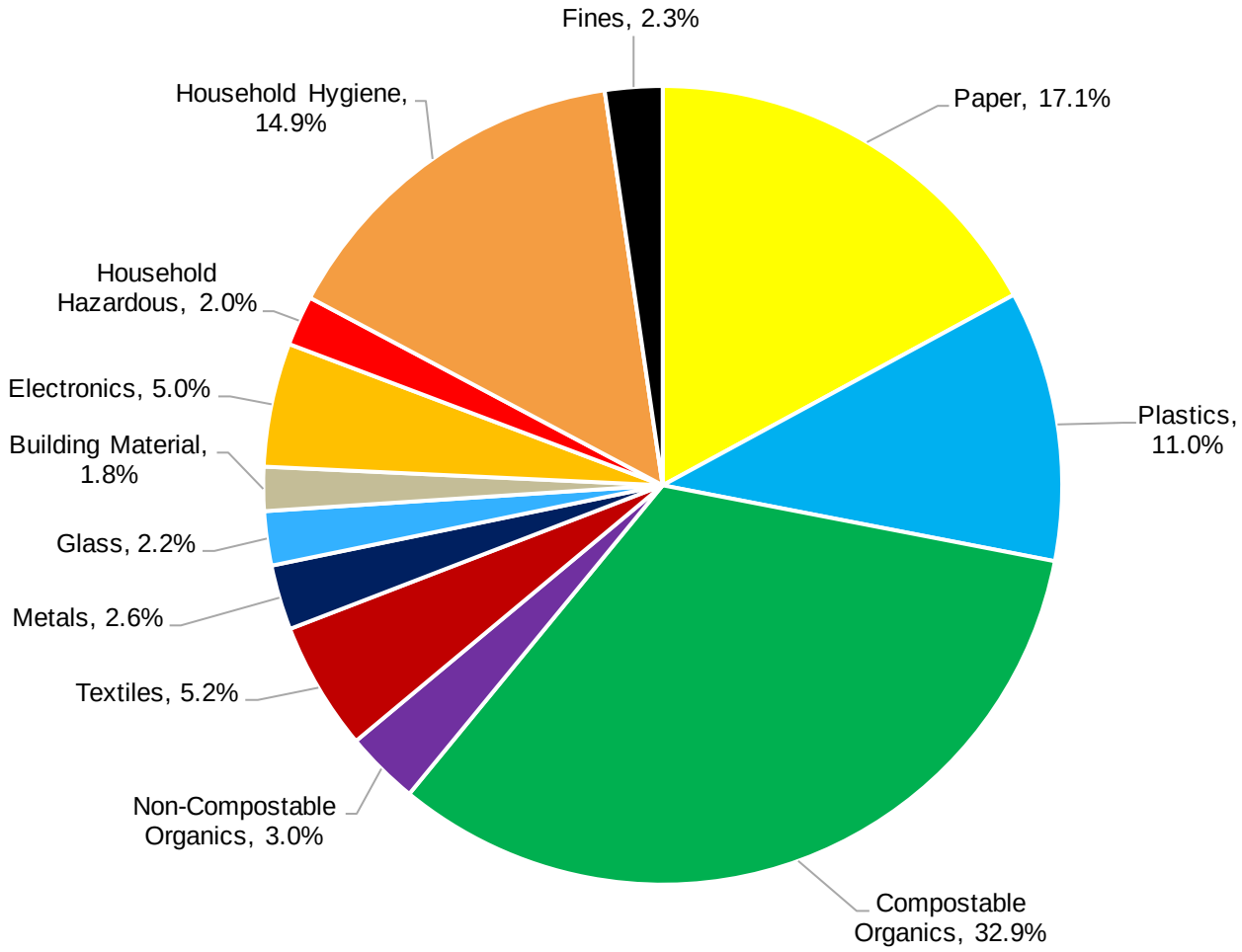

Figure 2: Primary Category Composition – Multi-family Garbage (N=5)

Table 7 shows the amount of each primary category identified in Figure 2 that have been designated by Recycle BC for curbside collection or are typically collected in organics curbside collection. It highlights that greater than 50% of the waste stream currently going to landfills is recyclable or compostable and could be diverted through source separated collection programs.

Table 7: Curbside Collectable Recyclables and Organics in Multi-family Garbage

Category	Multi-family (N=5)
Recyclable Paper	9.5%
Recyclable Plastics	2.8%
Recyclable Metals	1.8%
Recycling Subtotal	**14.1%**
Compostable Organics	32.9%
Compostable Paper	6.8%
Compostable Subtotal	**39.7%**
Total	**53.8%**

3.1.3 Summary of Residential Results

The percent of net weight results and 90% confidence interval calculations for SF and MF sectors are summarized in Table 8. Table A following the report includes detailed data for all material categories.

The 90% confidence intervals for the SF data are low (±~1%), indicating that there was good consistency to the data. Compostable organics (±2.2%) and household hygiene (±2.6%) are still relatively small, but these larger intervals are likely a result of variance between electoral areas and municipalities with and without organics collection as well as the presence of large amounts of pet waste in some loads. The MF data has significantly larger 90% confidence intervals. While some categories such as metals (±0.6%), glass (±0.9%), and building material (±1.0%) show relatively good consistency, many of the categories show high variance that is reflective of the low number of MF samples sorted. The largest composition difference between the two residential sectors was the larger quantity of household hygiene items in the SF garbage. This increase was primarily more animal feces and cat litter. The proportion of diapers was the same for both SF and MF sectors. Garbage from the MF buildings had slightly higher amounts of paper, metals, plastics and organics. These items were typically recyclable items such as newsprint, cardboard and plastic containers. Other notable difference were the larger amount of textiles in the SF garbage, and the larger amount of wood products (primarily wood furniture) in the MF garbage.

Table 8: Waste Composition for Single Family and Multi-Family Sectors

Primary Category	Single Family		Multi-family	
	Average (N=51)[1]	90% Confidence Interval[2]	Average (N=5)[1]	90% Confidence Interval[2]
Paper	13.2%	±0.9%	17.1%	±3.7%
Plastics	15.6%	±0.9%	11.0%	±3.0%
Compostable Organics	29.0%	±2.2%	32.9%	±5.1%
Non-Compostable Organics	2.4%	±0.7%	3.0%	±3.1%
Textiles	7.3%	±0.7%	5.2%	±1.3%
Metals	2.9%	±0.3%	2.6%	±0.6%
Glass	2.4%	±0.4%	2.2%	±0.9%
Building Material	2.7%	±1.0%	1.8%	±2.0%
Electronics	1.2%	±0.4%	5.0%	±6.9%
Household Hazardous	1.5%	±0.3%	2.0%	±1.4%
Household Hygiene	19.4%	±2.6%	14.9%	±5.3%
Bulky Objects	0.1%	±0.1%	0.0%	±0.0%
Fines	2.3%	±0.4%	2.3%	±0.7%

[1]N = number of samples completed for the sector.
[2]Only 90% confidence intervals greater than 1% are commented on.

3.2 Industrial, Commercial and Institutional

Table 9 summarizes the average primary material results, along with the 90% confidence intervals for each primary category. Table A following the report includes detailed data for all material categories.

Table 9: Waste Composition for Industrial, Commercial, and Institutional Sector

Primary Category	Industrial, Commercial, and Institutional	
	Average (N=26)[1]	90% Confidence Interval[2]
Paper	16.9%	±2.3%
Plastics	14.7%	±1.5%
Compostable Organics	45.6%	±4.0%
Non-Compostable Organics	2.7%	±0.5%
Textiles	4.5%	±1.8%
Metals	2.8%	±0.4%
Glass	1.7%	±0.3%
Building Material	1.1%	±0.8%
Electronics	0.6%	±0.2%
Household Hazardous	0.6%	±0.1%
Household Hygiene	7.0%	±2.1%
Bulky Objects	0.4%	±0.0%
Fines	1.5%	±0.6%

[1]N = number of samples completed for the sector.
[2]Only 90% confidence intervals greater than 1% are commented on.

The 90% confidence intervals for many of the categories are ±~2% or lower, indicating good consistency in the data. The larger confidence intervals for paper (±2.3%), compostable organics (±4.0%), textiles (±1.8%), and household hygiene (±2.1%) reflects the difference between the two primary ICI load sources. Most ICI samples were collected from private haulers servicing restaurants, grocery stores and other businesses (that would have high concentrations of compostable organics and paper as a result of their operations) and some samples were from First Nations communities hauling their waste to Bings Creek (which more closely resembled SF samples in their composition).

Figure 3 presents the weighted average primary material composition for the ICI garbage. The largest component of the garbage was compostable organics (45.6%), followed by paper (16.9%), plastics (14.7%), household hygiene (7.0%) and textiles (4.5%). Compostable organics mainly comprised food waste (44.0%), divided into avoidable (24.5%), donatable food waste (10.0%), and unavoidable and backyard compostable (9.0%). The second largest category was paper, which included compostable paper (6.8%), printed paper (4.8%), and other paper (1.6%). Plastics included non-beverage rigid plastic packaging (3.1%), other film packaging (7.0%), durable plastic products (1.5%), and #6 Styrofoam, foam (1.2%). Household hygiene comprised diapers (4.7%), pet waste (1.5%), and other hygiene products (0.8%). Textiles were composed of other textiles (2.6%), clothing (1.5%), and footwear (0.4%).

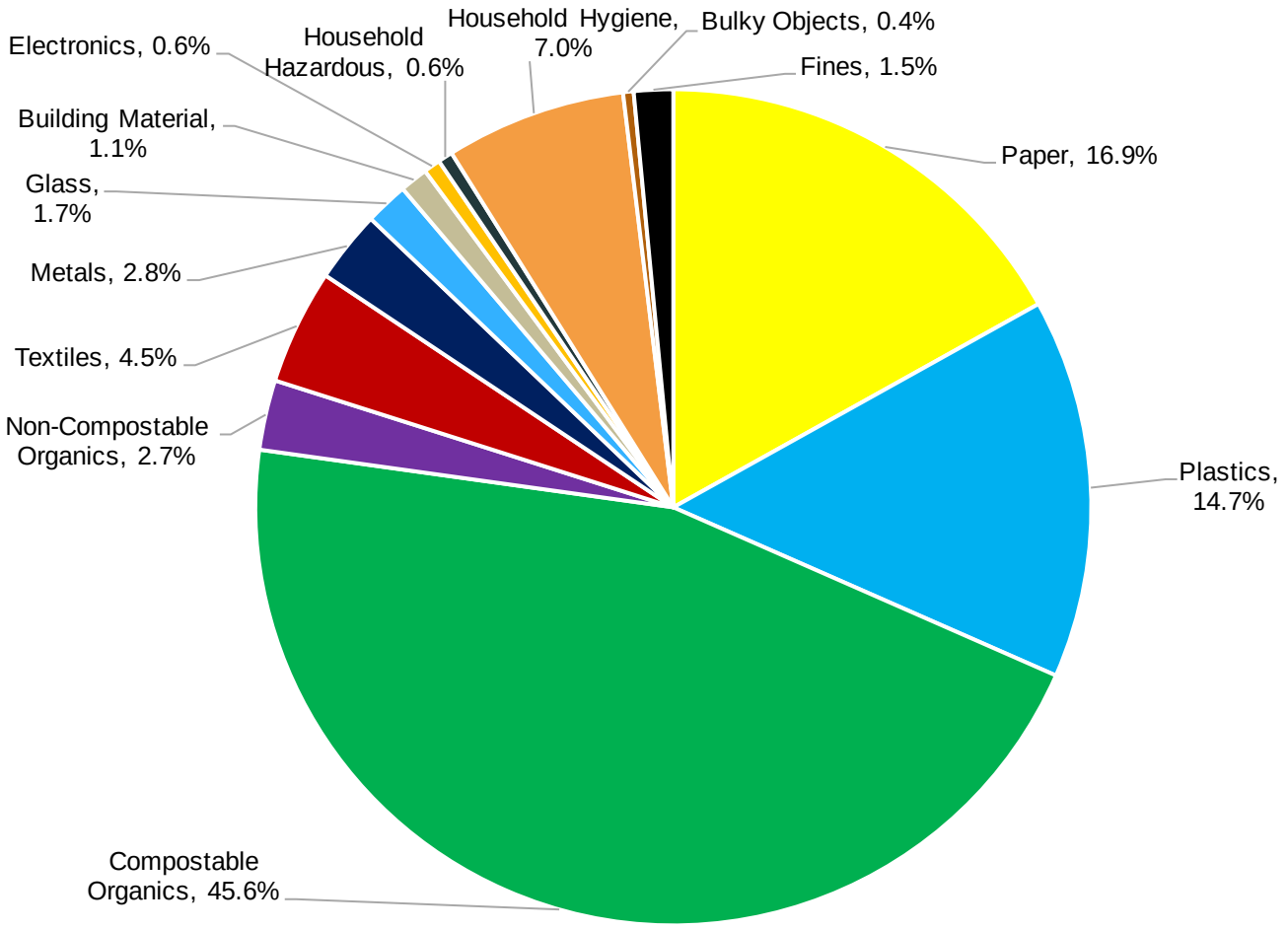

Figure 3: Primary Category Composition – Industrial, Commercial and Institutional Garbage (N=26)

3.3 Drop-off

Table 10 summarizes the average primary material results for each drop-off facility and the overall average, along with the standard deviation for each primary category. Table A following the report includes detailed data for all material categories.

Table 10: Waste Composition for Drop-Off

Primary Category	Drop-Off				
	Bings Creek (N=7)	Meade Creek (N=5)	Peerless Road (N=5)	Average (N=17)[1]	90% Confidence Interval[2]
Paper	2.0%	1.3%	2.5%	5.4%	±1.2%
Plastics	17.6%	18.7%	12.7%	21.4%	±2.6%
Compostable Organics	6.9%	2.8%	2.4%	6.6%	±1.7%
Non-Compostable Organics	13.0%	9.2%	11.2%	13.0%	±2.8%
Textiles	1.3%	2.5%	4.1%	7.7%	±1.6%
Metals	2.0%	1.2%	3.8%	3.4%	±0.9%
Glass	1.6%	1.6%	1.1%	1.9%	±0.5%
Building Material	16.3%	13.7%	18.5%	21.6%	±3.4%
Electronics	1.9%	1.4%	1.4%	2.5%	±0.7%
Household Hazardous	0.9%	1.8%	2.9%	2.1%	±0.6%
Household Hygiene	0.2%	0.0%	0.6%	0.8%	±0.2%
Bulky Objects	9.3%	24.6%	6.4%	12.9%	±6.3%
Fines	0.4%	0.3%	0.7%	0.7%	±0.3%

[1]N = number of samples completed for the sector.
[2]Only 90% confidence intervals greater than 1% are commented on.

The 90% confidence intervals for most of the categories are ±~2% or lower, indicating relatively good consistency in the data across the samples. However, the larger 90% confidence intervals for plastics (±2.6%), non-compostable organics (±2.8%), building material (±3.4%), and bulky objects (±6.3%) reflects a variance in the most prevalent primary categories in DO samples. This variance is explained and illustrated in the data and pictures collected during the audit, which document some loads primarily composed of bulky objects, or contaminated wood and building materials, or mostly durable plastic products.

Figure 4 presents the weighted average primary material composition for the drop-off garbage. The drop-off garbage is any garbage that is self-hauled by residents and small commercial loads to the drop-off depot area at Meade Creek, Peerless Road, and Bings Creek. The largest component of the garbage was building material (21.6%), followed by plastics (21.4%), non-compostable organics (13.0%), bulky objects (12.9%), and textiles (7.7%). Building materials primarily consisted of other building material (8.2%), carpet waste (7.7%), and gypsum/drywall, plaster (5.6%), with small amounts of rigid asphalt products (0.2%) Plastics was mostly composed of durable plastics products (16.7%), #6 Styrofoam, foam (1.6%), and non-beverage rigid plastic packaging (1.2%). Non-compostable organics comprised contaminated wood (11.9%), with small amounts of rubber (0.9%) and other non-compostable organics (0.2%). Bulky objects involved a wide range of items including hot tubs, boats, lawn furniture, indoor furniture, large household appliances. Textiles mostly consisted of other textiles (5.1%) such as cushions and bedding, with some clothing (1.4%) and footwear (1.1%).

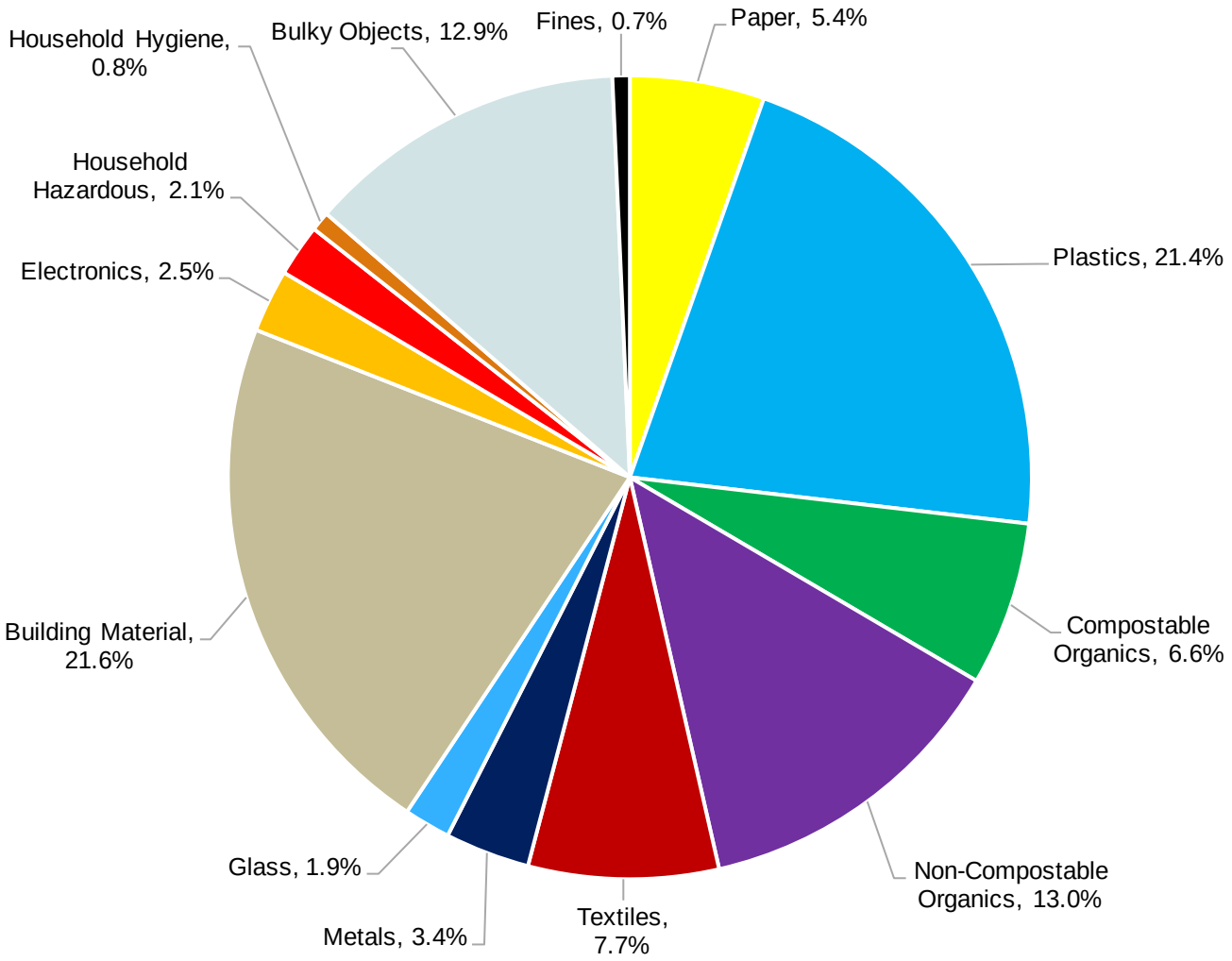

Figure 4: Primary Category Composition – Drop-Off Garbage (N=17)

3.4 Construction and Demolition

Table 11 summarizes the average primary material results, along with the 90% confidence intervals for each primary category. Table A following the report includes detailed data for all material categories.

Table 11: Waste Composition for Construction and Demolition

Primary Category	Construction, Renovation, and Demolition	
	Weighted Average (N=1)[1]	90% Confidence Interval[2]
Paper	3.2%	N/A
Plastics	20.9%	N/A
Compostable Organics	1.1%	N/A
Non-Compostable Organics	39.5%	N/A
Textiles	1.1%	N/A
Metals	1.0%	N/A
Glass	0.0%	N/A
Building Material	12.8%	N/A
Electronics	0.0%	N/A
Household Hazardous	0.0%	N/A
Household Hygiene	0.0%	N/A
Bulky Objects	3.3%	N/A
Fines	17.1%	N/A

[1]N = number of samples completed for the sector.
[2]Only 90% confidence intervals greater than 1% are commented on.

The 90% confidence interval for C&D waste composition is impossible to estimate from this study as only one C&D sample was diverted from Fisher Road Recycling and brought to Bings Creek for the field staff to visually audit.

Figure 5 presents the net weight percentage primary material composition for the C&D garbage. The C&D load was specially organized and delivered to Bings Creek. A majority of C&D material in the region is dropped off at Fisher Road Recycling, or Coast Environmental. C&D loads at these facilities are sorted, and recyclable materials are removed by staff, with only non-recyclable residual waste being sent for disposal. The bin that was re-directed to Bings Creek represents the discard material that is combined from a large number of C&D loads that were brought to Fisher Road. The largest component of the garbage was non-compostable organics (39.5%), plastics (20.9%), and building materials (12.8%). Non-compostable organics largely consisted of contaminated wood (37.3%) with some rubber (2.2%). Plastics mostly comprised durable plastic products (20.0%), with trace amounts of other plastic film (0.9%). The fines category is large due to their being black bags in the sample that were unable to be safely accessed for this load so the contents remain unknown. Building materials were entirely categorized as other building materials (12.8%), which includes concrete and insulation among other materials.

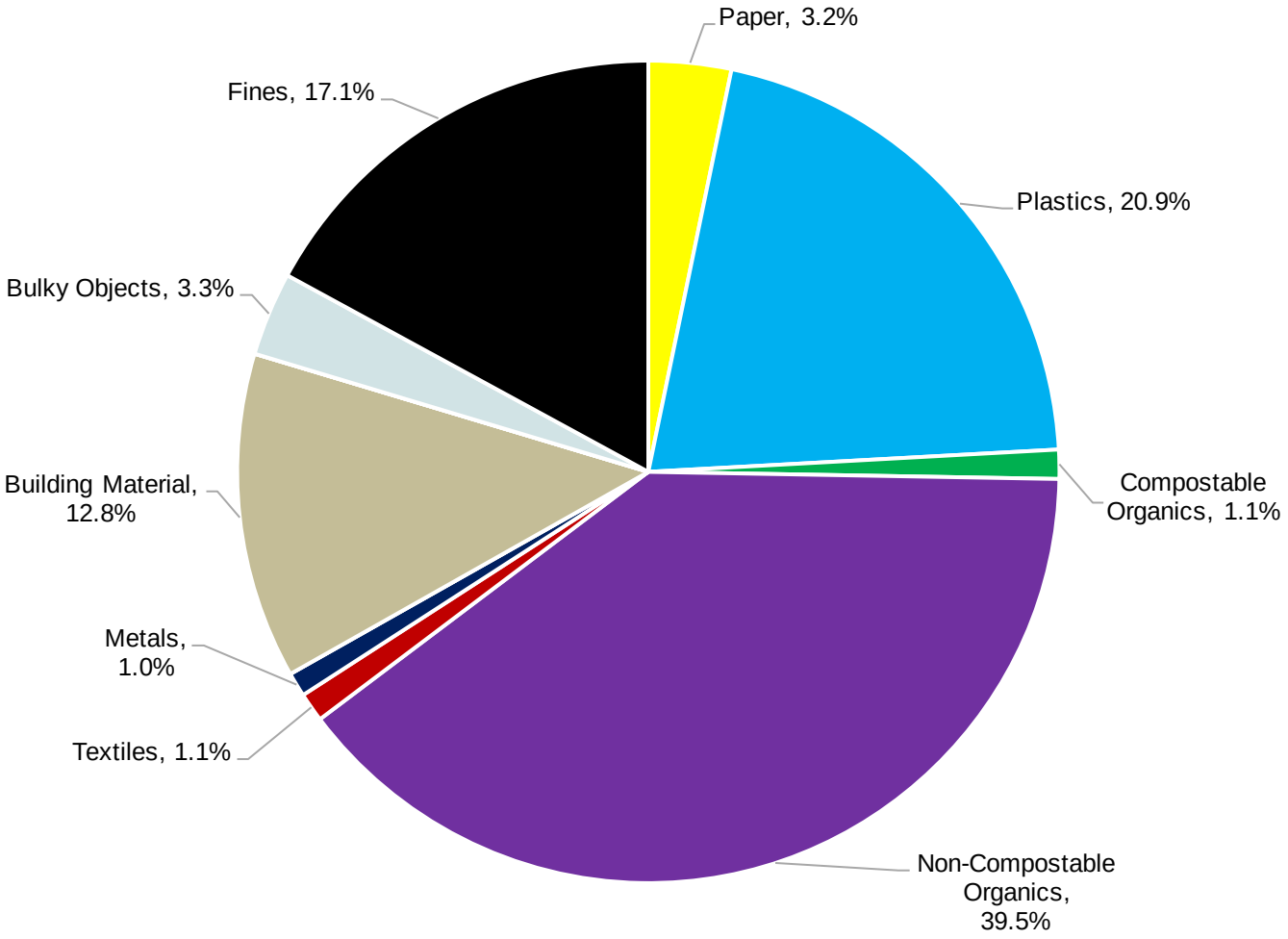

Figure 5: Primary Category Composition – Construction and Demolition (N=1)

3.5 Combined Waste Composition Results

Table 12 summarizes the average primary material results for each sector, along with the calculated overall average for all waste in the CVRD. Table A following the report includes detailed data for all material categories. The overall average was calculated by taking into account the total amount of waste that arrives at all facilities for each waste stream in 2016 as summarized in Table 1 in Section 2.0 of the report.

Table 12: Waste Composition by Sector and Overall Regional District Average (%)

Primary Category	SF	MF	ICI	DO	C&D	Overall Sector Weighted Average
Weighting (% of total waste)	**18.6%**	**7.8%**	**33.1%**	**16.6%**	**24.0%**	
Paper	13.2%	17.1%	16.9%	5.4%	3.2%	**11.1%**
Plastics	15.6%	11.0%	14.7%	21.4%	20.9%	**17.2%**
Compostable Organics	29.0%	32.9%	45.6%	6.6%	1.1%	**24.4%**
Non-Compostable Organics	2.4%	3.0%	2.7%	13.0%	39.5%	**13.2%**
Textiles	7.3%	5.2%	4.5%	7.7%	1.1%	**4.8%**
Metals	2.9%	2.6%	2.8%	3.4%	1.0%	**2.5%**
Glass	2.4%	2.2%	1.7%	1.9%	0.0%	**1.5%**
Building Material	2.7%	1.8%	1.1%	21.6%	12.8%	**7.7%**
Electronics	1.2%	5.0%	0.6%	2.5%	0.0%	**1.2%**
Household Hazardous	1.5%	2.0%	0.6%	2.1%	0.0%	**1.0%**
Household Hygiene	19.4%	14.9%	7.0%	0.8%	0.0%	**7.2%**
Bulky Objects	0.1%	0.0%	0.4%	12.9%	3.3%	**3.1%**
Fines	2.3%	2.3%	1.5%	0.7%	17.1%	**5.3%**

The combined (SF, MF, ICI, DO, and C&D) weighted average primary material composition results are presented on Figure 6. The largest component of the garbage was compostable organics (31.7%), followed by plastics (16.2%), and paper (12.8%). Compostable organics were comprised of avoidable food waste (14.0%) followed by non-backyard compostable (8.2%) and donatable food (5.1%). It is important to note that 4.9% of the garbage was identified as compostable food soiled paper that can go into composting programs. Plastics consisted of durable plastic products (6.7%), plastic film (4.5%) and plastic packaging (2.5%).

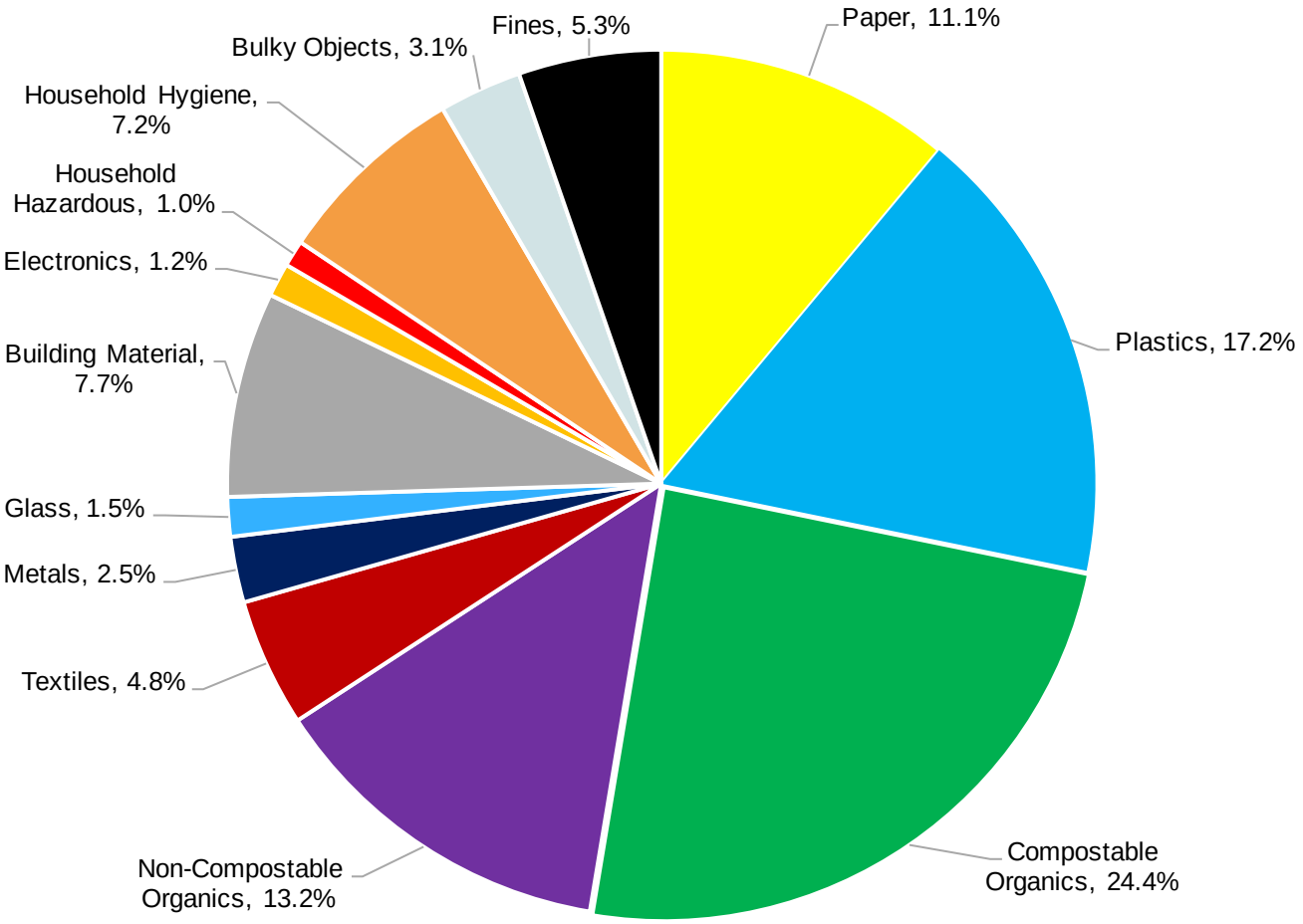

Figure 6: Primary Category Composition – All Sectors Combined (N=100)

3.6 Waste Disposal Per Capita

In 2016, the estimated population in the CVRD was 83,739, and the total amount disposed at all facilities in the CVRD was 23,803 tonnes. An additional 543 tonnes of painted wood and 4,759 tonnes of demo waste disposed of at other facilities brings the total to 29,105 tonnes of waste disposed. This sum divided by the population equals a waste disposal rate of 347.6 kg/capita. The waste disposal rate per capita and the waste disposal rate for each category was calculated and is summarized in Table 13. The waste disposal rate for each category is calculated by taking the overall average waste composition, multiplying by the total amount of waste disposed in 2016, and dividing this by the total population for the CVRD.

Table 13: Waste Composition by Sector and Overall Regional District Average (kg/capita)

Primary Category	SF	MF	ICI	DO	C&D	2016 Waste Disposal (kg/person/year)	2016 Waste Disposal Rate (tonnes/year to landfill)
Paper	8.5	4.6	19.5	3.1	2.7	38.4	3,218
Plastics	10.0	3.0	16.9	12.4	17.4	59.6	4,995
Compostable Organics	18.8	8.9	52.5	3.8	1.0	84.9	7,106
Non-Compostable Organics	1.5	0.8	3.1	7.5	32.9	45.8	3,835
Textiles	4.7	1.4	5.1	4.4	1.0	16.6	1,391
Metals	1.9	0.7	3.2	2.0	0.8	8.5	714
Glass	1.5	0.6	1.9	1.1	0.0	5.1	428
Building Material	1.7	0.5	1.2	12.5	10.7	26.6	2,227
Electronics	0.8	1.4	0.7	1.5	0.0	4.3	363
Household Hazardous	1.0	0.5	0.7	1.2	0.0	3.4	285
Household Hygiene	12.6	4.0	8.0	0.5	0.0	25.1	2,098
Bulky Objects	0.1	0.0	0.5	7.5	2.7	10.7	898
Fines	1.5	0.6	1.7	0.4	14.2	18.5	1547
Total	**64.6**	**27.0**	**115.0**	**57.7**	**83.3**	**347.6**	**29,105**

Using the waste composition data approximately 85 kg of organics are disposed per person, with the largest portion disposed by the ICI sector, followed by smaller amounts from the SF and MF sectors. The second largest portion of the waste stream is approximately 60 kg of plastics which originates from all sectors. The third largest portion is non-compostable organics at 46 kg, and this is primarily contaminated and painted wood from the C&D and DO waste streams. Figure 7 shows the same waste disposal data as Table 11 to show the quantity and composition of garbage that comes from each waste stream.

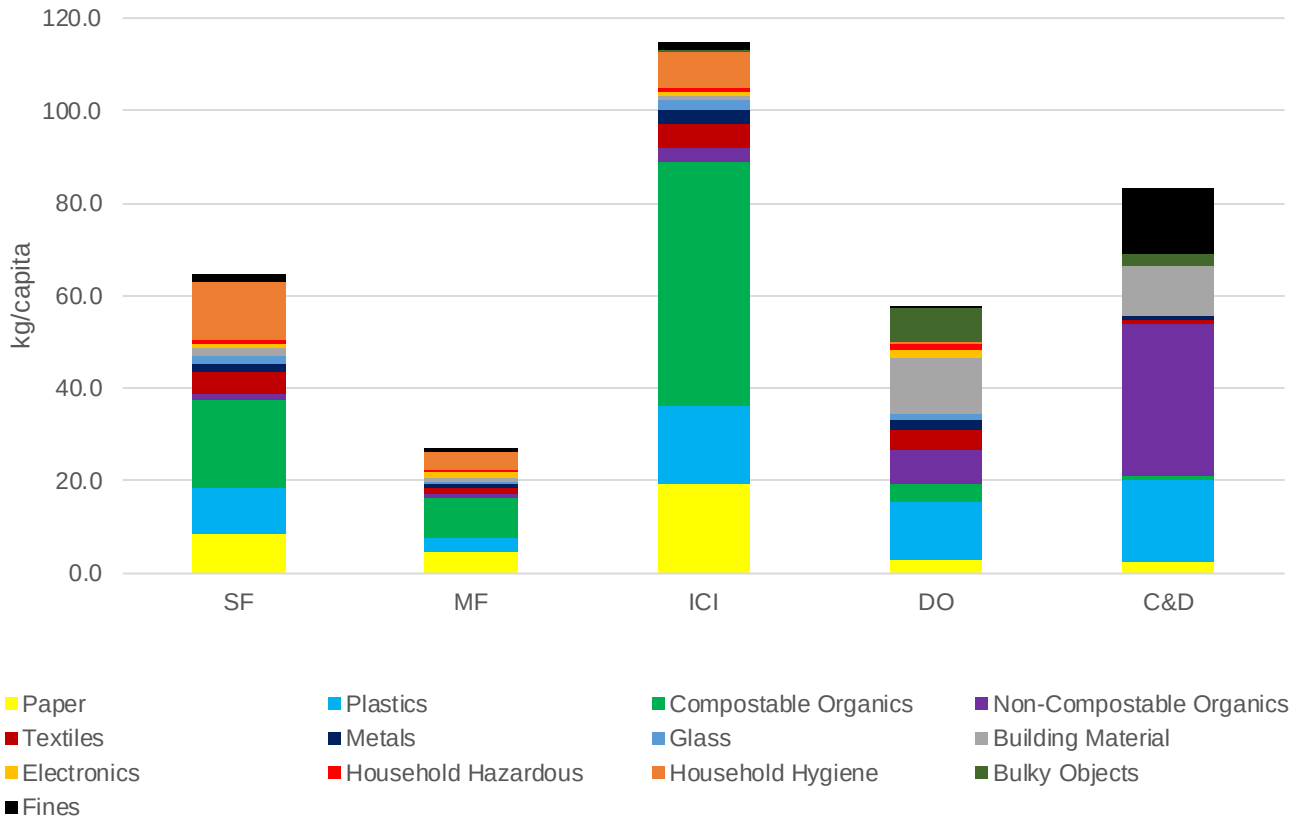

Figure 7: Primary Category Waste Disposal (kg/capita) – All Sectors Combined (N=100)

3.7 Considerations and Opportunities

Areas of high diversion potential and relevant considerations for each of the waste sectors examined in this study are summarized below. The opportunities presented are meant to provide a broad overview of the most prevalent waste categories in each waste sector along with context from the auditing team as to the materials they were commonly seeing in the garbage. Overall both behavior change programs along with targeted education and training will be required to improve performance and further divert or eliminate more materials from the garbage. Additionally, Table 6 and Table 7 highlight the significant portion of materials entering the landfill that are classified as curbside recyclable material by Recycle BC or typically diverted in curbside organics collection programs.

Compostable Organics

- There is significant potential to reduce food waste going to the landfill across the SF, MF, and ICI sectors through broader implementation and regulation of organics programs. The lowest amount of organics in garbage was seen in the municipalities, with higher amounts in the Electoral Areas without organics collection and MF garbage. The highest amount of organics in the garbage was in ICI garbage.

- Additionally, education and awareness campaigns on food waste reduction that involve information such as keeping food fresh, buying appropriate amounts, and storing and using leftovers could help lower the amount of avoidable and donatable food waste currently in the waste stream.

- Building relationships between ICI stakeholders and food rescue organizations could reduce the high amount of donatable food going to waste from sources such as grocery stores and restaurants.

Compostable Paper

- Compostable and food soiled paper represented 4.1% of the total waste stream. Targeted education notifying residents about the ability to place compostable paper in the organics can help increase participation.
  - The representation of compostable and food soiled paper is approximately 7% and 8% in the SF and MF streams respectively.

Recyclables

- There were significant amounts of recyclables across the entire waste stream.
  - The most common recyclable material was printed paper at 3.0%. This includes flyers, old mail, office paper, receipts, paper tags and paper bags. Printed paper accounted for 7.2% of MF garbage.
  - Cardboard was present in some ICI and DO loads, and measureable amounts of metal and plastic packaging that is recyclable is observed in all sectors.
- Additionally, there were significant amounts of curbside recyclables present in the SF and MF waste streams.
  - Paper curbside recyclables composed approximately 3.8% and 9.0% respectively.
  - Plastic curbside recyclables composed approximately 2.5% and 2.8% respectively.
  - Metal curbside recyclables composed approximately 1.5% and 1.8% respectively.

Other Materials

- Non-compostable organics comprising of treated and painted wood account for 11.5% of the waste stream, and finding a market for these materials other than disposal represents a significant opportunity.
- Textiles represents 5.0% of the waste stream, and expanded textile programs could help divert more material.
- Pet waste and diapers continues to be a heavy item in the garbage that accounts for 6.4% of the total waste.

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 Canada Inc.

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

Reviewed by:
Avery Gottfried, ME, P.Eng.
Solid Waste Planning Engineer
Solid Waste Management Practice
Direct Line: 604.830.6989
Avery.Gottfried@tetratech.com

/bvb/sy

TABLES

Table A: Waste Composition Results – All Categories by Sector and Overall Average

Category	ICI	MF	SF	DO	C&D	Average	kg/capita
Paper							
Beverage Container - deposit	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.2
Packaging – liquids	0.3%	0.5%	0.3%	0.1%	0.0%	0.2%	0.7
Printed Paper	4.8%	7.7%	2.8%	1.7%	0.0%	3.0%	10.4
Packaging – OCC	1.0%	0.4%	0.3%	1.0%	0.9%	0.8%	2.8
Packaging – liquid containers (beverage cups)	1.2%	0.7%	0.6%	0.6%	0.0%	0.6%	2.2
Packaging – composite cans	0.2%	0.1%	0.1%	0.0%	0.0%	0.1%	0.3
Books	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.2
Compostable Paper	6.7%	6.8%	7.8%	1.2%	0.0%	4.4%	15.3
Packaging – Waxed OCC	1.0%	0.0%	0.3%	0.0%	0.0%	0.4%	1.3
Other Paper	1.6%	0.6%	0.8%	0.8%	2.4%	1.4%	5.0
Subtotal	**16.9%**	**17.1%**	**13.2%**	**5.4%**	**3.2%**	**11.1%**	**38.4**
Plastics							
Beverage Container - deposit	0.3%	0.2%	0.1%	0.3%	0.0%	0.2%	0.6
Plastic Packaging - Non-beverage #1-7	3.1%	2.8%	2.5%	1.2%	0.0%	1.9%	6.7
Plastic Packaging - #6 Styrofoam, foam	1.2%	0.5%	1.1%	1.6%	0.0%	0.9%	3.2
Plastic Packaging - Film, #2, #4 (grocery bags, packing)	0.9%	1.0%	2.0%	0.4%	0.0%	0.8%	2.8
Plastic Packaging - Other films	7.0%	3.7%	7.3%	0.8%	0.9%	4.3%	15.0
Other Plastics - Uncoded (straws, forks)	0.6%	0.4%	0.4%	0.4%	0.0%	0.4%	1.3
Other Plastics - Durable plastic products	1.5%	2.3%	2.2%	16.7%	20.0%	8.7%	30.1
Subtotal	**14.7%**	**11.0%**	**15.6%**	**21.4%**	**20.9%**	**17.2%**	**59.7**
Compostable Organics							
Yard and Garden	0.7%	6.7%	2.0%	0.4%	1.1%	1.5%	5.1
Food waste – non-backyard compostable (unavoidable) - bones/cartilage	8.9%	8.1%	9.8%	0.7%	0.0%	5.5%	19.2
Food waste – backyard compostable (unavoidable)	0.6%	0.1%	0.8%	0.2%	0.0%	0.4%	1.3
Food waste – avoidable	24.5%	14.0%	12.1%	1.4%	0.0%	11.7%	40.6
Food waste – donatable	10.0%	3.2%	3.7%	0.7%	0.0%	4.3%	15.1
Clean wood	0.9%	0.4%	0.6%	2.8%	0.0%	0.9%	3.1
Other Compostable Organics	0.0%	0.4%	0.1%	0.5%	0.0%	0.1%	0.5
Subtotal	**45.6%**	**32.9%**	**29.0%**	**6.6%**	**1.1%**	**24.4%**	**84.9**
Non-Compostable Organics							
Rubber	0.8%	0.1%	0.9%	0.9%	2.2%	1.1%	3.9
Contaminated Wood	1.7%	2.7%	1.2%	11.9%	37.3%	11.9%	41.4
Other Non-Compostable Organics	0.2%	0.1%	0.3%	0.2%	0.0%	0.2%	0.5
Subtotal	**2.7%**	**3.0%**	**2.4%**	**13.0%**	**39.5%**	**13.2%**	**45.8**

Category	ICI	MF	SF	DO	C&D	Average	kg/capita
Textiles							
Clothing	1.5%	3.2%	4.0%	1.4%	0.1%	1.7%	6.0
Footwear	0.4%	0.6%	0.7%	1.1%	0.0%	0.5%	1.7
All other textiles	2.6%	1.4%	2.6%	5.1%	1.0%	2.5%	8.9
Subtotal	**4.5%**	**5.2%**	**7.3%**	**7.7%**	**1.1%**	**4.8%**	**16.6**
Metals							
Beverage Container	0.6%	0.3%	0.1%	0.1%	0.1%	0.3%	1.0
Metal Packaging	1.4%	1.8%	1.5%	0.3%	0.0%	0.9%	3.3
Other Metals	0.7%	0.6%	1.4%	3.0%	0.9%	1.2%	4.3
Subtotal	**2.8%**	**2.6%**	**2.9%**	**3.4%**	**1.0%**	**2.5%**	**8.5**
Glass							
Beverage Container	0.3%	0.4%	0.3%	0.3%	0.0%	0.3%	0.9
Glass packaging (food containers)	0.7%	0.8%	1.0%	0.2%	0.0%	0.5%	1.8
Other glass	0.6%	0.9%	1.0%	1.4%	0.0%	0.7%	2.4
Subtotal	**1.7%**	**2.2%**	**2.4%**	**1.9%**	**0.0%**	**1.5%**	**5.1**
Building Material							
Gypsum/drywall, plaster	0.0%	0.0%	0.6%	5.6%	0.0%	1.0%	3.6
Rigid Asphalt Products	0.0%	0.0%	0.3%	0.2%	0.0%	0.1%	0.3
Carpet Waste	1.0%	0.6%	0.7%	7.7%	0.0%	1.8%	6.1
Other Building Material	0.1%	1.2%	1.1%	8.2%	12.8%	4.8%	16.6
Subtotal	**1.1%**	**1.8%**	**2.7%**	**21.6%**	**12.8%**	**7.7%**	**26.6**
Electronics							
Computers and Entertainment	0.2%	2.0%	0.2%	0.7%	0.0%	0.4%	1.2
Lighting Equipment	0.1%	0.5%	0.2%	0.3%	0.0%	0.2%	0.6
Smoke/CO Alarms	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Thermostats (Non-Mercury Containing)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Electronic Toys	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Outdoor Power Equipment	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0
Small Appliances and Power Tools	0.3%	0.1%	0.3%	1.2%	0.0%	0.4%	1.3
Major Household Appliances	0.0%	2.4%	0.0%	0.0%	0.0%	0.2%	0.7
Other Electronics	0.1%	0.0%	0.4%	0.3%	0.0%	0.1%	0.5
Subtotal	**0.6%**	**5.0%**	**1.2%**	**2.5%**	**0.0%**	**1.2%**	**4.3**

Category	SF	MF	ICI	DO	C&D	Average	kg/capita
Household Hazardous							
Batteries	0.1%	0.1%	0.1%	0.0%	0.0%	0.1%	0.2
Lighting Equipment	0.1%	0.1%	0.0%	0.1%	0.0%	0.1%	0.2
Oil and Antifreeze	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1
Solvent and Flammable Liquids	0.0%	0.0%	0.2%	0.4%	0.0%	0.1%	0.4
Paint	0.1%	0.2%	0.3%	0.6%	0.0%	0.2%	0.7
Pesticides	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Fertilizers	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.1
Medications	0.0%	0.2%	0.1%	0.0%	0.0%	0.1%	0.2
Cosmetics	0.3%	1.3%	0.4%	0.2%	0.0%	0.3%	1.0
Mercury Containing Items	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0
Other Hazardous Waste	0.0%	0.0%	0.2%	0.5%	0.0%	0.1%	0.4
Subtotal	**0.6%**	**2.0%**	**1.5%**	**2.1%**	**0.0%**	**1.0%**	**3.4**
Household Hygiene							
Biological – Diapers	4.7%	7.7%	7.9%	0.3%	0.0%	3.7%	12.7
Biological – Pet Waste	1.5%	5.8%	9.8%	0.4%	0.0%	2.8%	9.8
Other Biological	0.8%	1.5%	1.8%	0.0%	0.0%	0.7%	2.5
Subtotal	**7.0%**	**14.9%**	**19.4%**	**0.8%**	**0.0%**	**7.2%**	**25.1**
Bulky Objects							
Bulky Objects	0.4%	0.0%	0.1%	12.9%	3.3%	3.1%	10.7
Subtotal	**0.4%**	**0.0%**	**0.1%**	**12.9%**	**3.3%**	**3.1%**	**10.7**
Other							
Fines	1.5%	2.3%	2.3%	0.7%	1.1%	1.5%	5.2
Subtotal	**1.5%**	**2.3%**	**2.3%**	**0.7%**	**1.1%**	**1.5%**	**5.2**
Grand Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**347.6**

APPENDIX A

GARBAGE SORTING CATEGORIES

Categories for Cowichan Valley Waste Composition Study

Primary	Secondary	Description
Category 1: Paper		
1	Beverage Container - deposit	Gabletop cartons and Aseptic boxes – juice and other
2	Packaging – liquids	Gabletop cartons and Aseptic box - soup, broth, milk, and milk substitutes, etc.
3	Printed Paper	Newspaper and other paper (office paper, magazines, telephone books, etc.), boxboard, Kraft paper, wrapping paper
4	Packaging	Old corrugated cardboard (OCC)
5	Packaging - liquids	Hot and cold takeout cups - coffee cups, fountain pop, ice cream containers, etc.
6	Packaging	Composite cans – frozen juice containers, Pringles, hot chocolate
7	Books	Hard and soft covered books
8	Compostable Paper	Paper towels, napkins, paper plates, pizza boxes, food contaminated paper etc.
9	Packaging	Waxed OCC
10	Other Paper	Other paper otherwise not included above – photos, laminates, sand paper (non-compostable and non-recyclable)
Category 2: Plastic		
11	Beverage Container – deposit	
12	Plastic Packaging	Rigid (non-beverage) #1-7 including garden plant pots and trays
13	Plastic Packaging	Styrofoam/Foam (#6)
14	Plastic Packaging	Film #2 and #4 polyethylene film - (grocery bags, packing)
15	Plastic Packaging	Film - all other film (PETE, PVC, LDPE Stretch and PP Films, multi-laminated packaging)
16	Other Plastics	Unmarked un-coded plastics - stir sticks, straws, forks, spoons etc.
17	Other Plastics	Durable plastic products, laundry basket, toys, plastic objects, etc.
Category 3: Compostable Organics		
18	Yard and Garden	Grass, leaves, branches < 3 inches diameter
19	Food waste – unavoidable-backyard compostable	Fruit and vegetable peelings, carrot tops, egg shells, tea bags.
20	Food waste – unavoidable-non-backyard compostable	Food waste that is not typically compostable in the backyard (e.g. bones, cartilage, etc.)
21	Food waste – avoidable	Leftovers, plate scrapings, usable parts of fruits and vegetables, baked goods, candy, snacks, condiments, and meats
22	Food waste – avoidable-donatable	Food waste that is not past the expiration date, unused ready-made, whole meats/fish, baked goods, deli, liquids (like oil in package)

Primary	Secondary	Description
23	Clean wood	Dimensional lumber, pallets, chopsticks
24	Other Comp. Organics	Small animals
Category 4: Non-Compostable Organics		
25	Rubber	Tires, disposable gloves, bike tubes
26	Contaminated Wood	Painted or treated wood
27	Other Non-Compostable Organics	Wax candles, crayons
Category 5: Textiles		
28	Clothing	Shirts, pants, socks, jackets, gloves, belts
29	Footwear	All shoes, boots, sandals
30	Other Textiles	Blankets, sheets, curtains, backpacks, suitcases, bags, rags
Category 6: Metal		
31	Beverage Container	
32	Metal Packaging	Steel packaging (food containers including nonhazardous aerosol), aluminum foil and baking containers
33	Other Metal	Household metal, sports equipment
Category 7: Glass		
34	Beverage Container	
35	Glass packaging (food containers)	
36	Other glass	Ceramic plates, mirrors, windows
Category 8: Building Materials		
37	Gypsum/drywall, plaster	
38	Rigid Asphalt Products	
39	Carpet Waste	
40	Other Building Material	Building siding, insulation

Primary	Secondary	Description
Category 9: Electronics		
41	Computers and Entertainment	Computers and peripherals, TV & audio/video, telephones
42	Lighting Equipment	Lighting fixtures: table lamp, chandelier, flashlight, wall fixture etc.
43	Smoke/CO Alarms	
44	Thermostats (Non-Mercury Containing)	
45	Electronic Toys	
46	Outdoor Power Equipment	
47	Small Appliances and Power Tools	Electric shavers, cordless drills
48	Major Household Appliances	Dishwashers, Microwaves
49	Other Electronics	Miscellaneous cords and wires
Category 10: Household Hazardous		
50	Batteries	Other battery types
51	Lighting Equipment	CFL's, light bulbs
52	Oil and Antifreeze	
53	Solvent and Flammable Liquids	Must have a flame symbol or phrase similar to "keep away from open spark or flame" on the label
54	Paint	Paint containers
55	Pesticides	Domestic pesticides - consumer pesticides that have both the poisonous (skull and cross bones)
56	Fertilizers	
57	Medications	Natural health products - product or container
58	Cosmetics	Nail polish, make-up, health and beauty aids, sunscreen, bug spray
59	Mercury Containing Items	Thermostats
60	Other Hazardous Waste	

Primary	Secondary	Description
Category 11: Household Hygiene		
61	Biological	Diapers
62	Biological	Pet waste
63	Other Biological	Sanitary napkins, tampons, needles
Category 12: Bulky Objects		
64	Bulky Objects	Other furniture Composite furniture, etc.
Category 13: Fines		
65	Fines	Items too small to classify efficiently. (Ex. bread tabs, twist ties, typically <1")
--	Black Bags	Black bags whose contents are inaccessible to the auditors (Only used in Visual Audits)

APPENDIX B

TRUCK IDENTIFICATION AND SELECTION

Truck and Sample Identification

Source	Source Definition for Truck Identification and Sampling Collection Method
Single Family Residential (SF)	**Definition** Large municipal or contracted private haulers with loads from curbside residential garbage routes. Primarily detached single-family, duplex, triplex, and fourplex homes, where each residential unit has their own garbage container. **Sample Collection** Samples were collected from four different municipalities and eight electoral areas, with the number of samples from each area predetermined by CVRD and Tetra Tech staff. Haulers identified to meet the definition above and from the appropriate source were asked to be sampled randomly.
Multi-family Residential (MF)	**Definition** Private paid account haulers with loads collected from dumpsters into front loading hauling trucks or roll-off compactor bins from primarily residential garbage pick-up routes. Primarily apartments and condominiums with five or more units. Waste is collected from dumpsters, or roll-off compactor bins. **Sample Collection** Private haulers were contacted by CVRD staff and arranged to drop off samples at Bings Creek to be sorted by the auditors.
Industrial, Commercial, Institutional (ICI)	**Definition** Load > 1,500 kg. Large paid account haulers for commercial businesses, institutions and industries. **Sample Collection** Haulers identified by random selection at the transfer station. If primarily >25% mixed source the load was not sampled, if the load was “commercial or mostly commercial” >75% the driver was instructed to deliver a sample and the site supervisor confirmed if a ICI sample could be obtained. The ICI haulers coming to Bings Creek were predominantly ICI-only haulers so mixed source loads were not an issue.
Drop-off (DO)	**Definition** All loads directed to the Bings Creek, Peerless Road, and Meade Creek Bin areas. Generally these loads are loads with gross vehicle weight < (less than) 5,500 kg, small pick-up trucks or small vehicles with trailers. These loads are Non-account residential AND non-account commercial drop-off. **Sample Collection** Samples collected from the bins are they are brought into the transfer building at Bings Creek. Field supervisor communicated with CVRD staff to identify the origin of the DO load (Bings Creek, Peerless Road, or Meade Creek).
Construction and Demolition (C&D)	**Definition** Open top roll-off bins or hydraulic dumping trucks and trailers. Loads are primarily large, heavy or bulky items, no bagged municipal waste **Sample Collection** Loads were arranged by Tetra Tech and CVRD staff to be brought to Bings Creek (normally C&D loads go to Fisher Road Recycling Depot, or COAST Environmental locations). Loads were visually audited in the transfer building.

APPENDIX C

MANUAL SORTING SELECT PHOTOGRAPHS

Photo 1: CVRD Roll-off truck dumping in the Transfer Building.

Photo 2: Organizing the bins for weigh-out.

Photo 3: Field staff recording the bin weights during weigh-out.

Photo 4: Weighing the sorted bins during weigh-out.

Photo 5: Field staff securing sampled loads for storage overnight.

Photo 6: Modified sorting setup using a roll-off bin for greater wind protection.

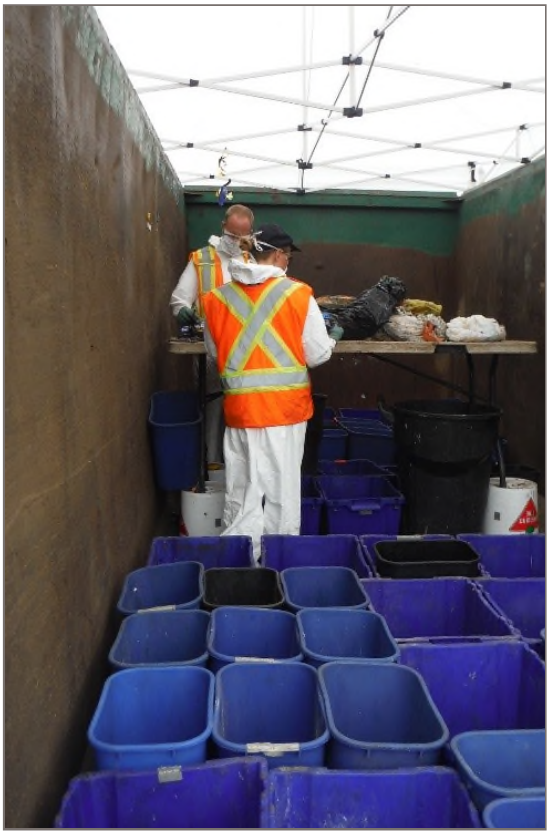

Photo 7: Staff sorting with the new setup inside of the roll-off bin.

Photo 8: Sample Photograph Prior to Sample Collection and Sorting (SF).

Photo 9: Sample Photograph Prior to Sample Collection and Sorting (SF).

Photo 10: Sample Photograph Prior to Sample Collection and Sorting (MF).

Photo 11: Sample Photograph Prior to Sample Collection and Sorting (ICI).

Photo 12: Sorted secondary category #1 – tetrapaks.

Photo 13: Sorted secondary category #3 – printed paper.

Photo 14: Sorted secondary category #8 – compostable paper.

Photo 15: Sorted secondary category #13 - #6 Styrofoam

Photo 16: Sorted secondary category #14 – Recyclable plastic film

Photo 17: Sorted secondary category #15 – Other plastic film

APPENDIX D

VISUAL AUDIT SELECT PHOTOGRAPHS

Photo 1: RDO-04 – Black bags, bulky objects, plastic among others identified.

Photo 2: RDO-04 – Bulky objects, durable plastics, contaminated wood, rubber, among others identified.

Photo 3: RDO-05 – Carpet waste, contaminated wood, textiles, building material among others identified.

Photo 4: RDO-08 – Cardboard, durable plastics, carpet waste, black bags among others identified.

Photo 5: RDO-10 – Cardboard, other textiles, bulky items, metal, durable plastics among others identified.

Photo 6: RDO-13 – Bulky items, clean wood, durable plastics, black bags among others identified.

Photo 7: RDO-16 – Durable plastics, carpet waste, Styrofoam, metals, contaminated wood among others identified.

Photo 8: RDO-18 – Other textiles, major household appliances, clean wood, other building material, and durable plastics, among others identified.

Photo 9: C&D – Contaminated wood, clean wood, durable plastics, metals, other building material (insulation) among others identified.

Photo 10: C&D – Other textiles, contaminated wood, clean wood, other building material, and durable plastics, among others identified.

Photo 11: C&D – Large piece of contaminated wood, black bags, durable plastics, and bulky objects identified.

Photo 12: C&D – Clean wood, durable plastics, plastic film, black bags, other textiles among other identified.

Photo 13: C&D – Durable plastics, other building material, drywall/gypsum, contaminated wood, among others identified.

Photo 14: C&D – Durable plastics, clean wood, cardboard, and contaminated wood identified.

APPENDIX E

TETRA TECH'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOENVIRONMENTAL REPORT

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

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