Waste and Recyclable Materials Audit 2016
Thompson Rivers University
Kamloops, British Columbia

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Executive Summary

Thompson Rivers University (TRU) engaged the services of Waste Naught BC in March 2016 to undertake a second waste audit of the university's solid waste stream. The purposes of performing the audit were to: 1) measure the university's current waste diversion performance, 2) compare current waste reduction and diversion performance to performance in 2015, 3) determine the composition of waste going to landfill in order to determine the types and sources of waste generated on campus, and 4) identify waste diversion and reduction opportunities within the operations of the university.

From Summer 2015 through Winter 2016, TRU generated an estimated 437 tonnes of material, sending 195 tonnes to landfill and diverting 242 tonnes through various waste diversion initiatives. TRU's diversion rate increased from 41% in 2015 to 55% in 2016, primarily due to a decrease in total landfill waste of 316 tonnes in 2015, and also from an increase in diverted materials of 216 tonnes in 2015.

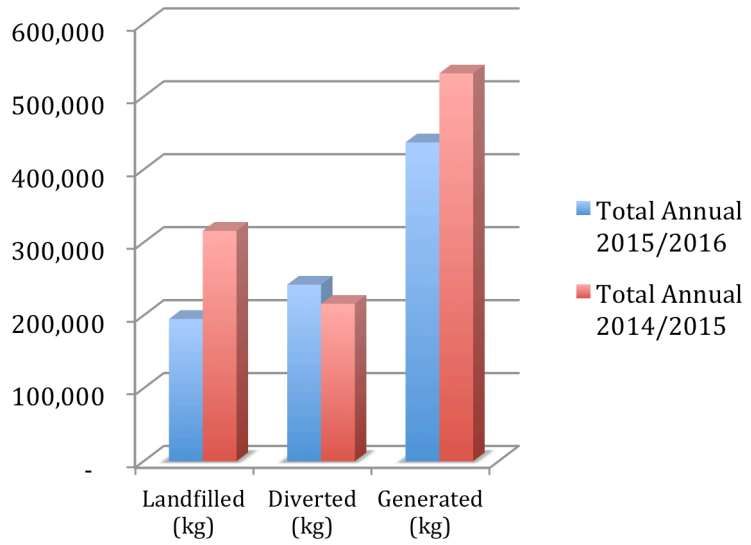

Figure 1 - Total Annual Landfill and Diversion

Weekly per capita landfill rates significantly decreased from 1.73 kg in 2015 to 1.03 kg in 2016. Weekly per capita diversion rates increased from 1.18 kg in 2015 to 1.28 kg in 2016. Total weekly per capita waste generation rate (landfill and diversion) decreased from 2.91 kg in 2015 to 2.31 kg in 2016.

Capture rates for diverted materials were calculated, and all rates increased over 2015 levels. Food waste capture rate significantly increased from 4% in 2015 to 60% in 2016. Mixed recycling has the lowest capture rate, however the rate increased from 35% in 2015 to 40% in 2016. No batteries or electronic waste was found during the audit, resulting in the highest capture rates (100%) in 2016.

The audit also measured the composition of materials from several sources of waste. The overall results show that 20% of the waste stream cannot be diverted through recycling or composting. The most abundant materials in the waste stream by weight were food waste (34%) and compostable paper (12%), which can be diverted through composting. Recyclable materials including plastics, paper, metals, refundable beverage containers and coffee cups, comprised 27% of the waste stream.

The greatest opportunities for waste reduction at TRU are with improved source separation of food waste and recyclable material through improved collection, staff and student education, as well as implementing on-site composting for compostable paper packaging. Source separating wood and drywall in the Trades and Facilities buildings would result in higher diversion rates.

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1 Background and Introduction

Background

In 2014 TRU Sustainability Office set an aggressive goal of becoming a zero waste campus. In order to measure progress towards this goal, TRU engaged the services of Waste Naught BC (WNBC) to conduct a solid waste audit at the McGill campus in Kamloops, British Columbia in March 2016. WNBC conducted a previous audit in March 2015, which showed that the campus was diverting approximately 41% of the 532[1] tonnes of material generated on campus through composting, recycling and sale of reusable items.

Several new waste diversion initiatives were implemented since the 2015 audit, initiated by the Sustainability Office, and by TRU staff in various departments including: clean wood, Styrofoam, coffee grounds, and meat trimmings. TRU also doubled its capacity for on-site composting, expanded zero waste stations throughout campus, and implemented coffee cup recycling stations[2].

Purpose

The purpose of the waste audit was to provide TRU with:

- Weekly measurements for each type of waste;
- Estimated total annual waste and recyclable material output, as well as per capita waste generation rates;
- Estimated the solid waste diversion rate for the facility by calculating the total weight of diverted materials as a percentage of the total waste stream for the materials audited;
- Composition of waste of each of the 13 sources of waste audited;
- Capture rates of diverted wastes audited, and
- Comparison of audit results with 2015 results.

Scope

To satisfy the purpose of the audit, the following scope of work was performed:

- Communication with TRU staff to acquire data pertaining to diverted wastes;
- Communication with TRU staff to obtain samples of waste pertaining to specific waste sources;
- Collection of waste from specific waste sources in order to obtain true and representative samples;
- Measure the main waste streams over a one-week period, including landfill, mixed recycling, cardboard, and refundable beverage containers;
- Audits of landfill and zero waste station samples; and
- Compiled information into spreadsheets and summarized into a written report with recommendations.

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[1] The 2015 audit reported 543 tonnes of total waste output generated over the 2015 audit period. Staff population was adjusted to FTE to better reflect actual population, resulting in a lower total waste output of 532 tonnes of total waste output generated over the 2015 reported in 2016.

[2] Coffee cup recycling stations were not audited.

2 Methodology

Quantification of Waste Streams

In order to quantify TRU's waste stream, data about the entire campus waste output was estimated through a combination of direct sample measurements over the audit period (March/ April 2016), actual measurements over the one-year period of the audit cycle, as well as estimations provided by staff

Measured Over One-Week Period	Data Provided By Staff/ Contractor	Data Estimated By Staff/ Contractor
• 'Black bag' or landfill waste; • Mixed Recycling; • Cardboard; • Refundables; • Coffee grounds; • Meat trimmings; and • Batteries[3].	• Compost (from zero waste stations and offices); and • Scrap metal (from trades).	• Compost scraps in the Culinary Arts; • Electronic waste; • Yard waste; • Reusable items; • Wood waste; and • Styrofoam.

Composition of Waste Sources

Waste from 13 different sources was audited for composition. The following sources of waste were included in the audit:

1. Zero waste station (landfill stream);
2. Stand-alone garbage bins;
3. Washrooms;
4. Science labs;
5. Offices with composting;
6. Offices without composting;
7. Kitchens;
8. Café operations;
9. Animal Health Technology (AHT);
10. Daycare;
11. Trades;
12. Construction; and
13. Zero waste stations (mixed recycling, compost, plastic bags, and refundable beverage containers).

Sampling methods differed in 2015 and 2016 for zero waste stations, stand-alone garbage bins, science labs, and washrooms. In 2015, 24-hour waste samples were labeled by janitorial staff for each waste source for the entire campus and placed in dumpsters. In 2016, WNBC obtained samples of waste directly from zero waste stations, stand alone garbage bins, washrooms, and science labs. The resulting sample sizes in 2016 were much smaller than 2015. [4]

[3] Batteries were measured over a one-month period.

[4] The purpose of changing sampling methodology was to reduce source mixing, which was believed to have occurred in 2015 with the zero waste stations, stand-alone and washroom waste streams.

Office waste is collected twice a week, on Tuesdays and Fridays. Samples from offices were obtained with the help of the janitorial staff. For offices with composting, a sample was obtained by selecting a convenient sample from a list of offices with composting. Janitorial staff also assisted with obtaining the sample of office waste by placing labels on waste from offices in three different buildings. The buildings were selected through convenience sampling by choosing the buildings with higher volumes of office waste.

Samples from kitchens, cafes, and the daycare were obtained over a 24-hour period with the assistance of staff and contractors, in the same manner as the 2015 audit through a labeling system.

Trades, Animal Health Technology (AHT) and construction waste samples were obtained from the dumpsters used exclusively by these waste sources. The AHT sample was obtained by randomly selecting a sample from the dumpster. Trades waste was audited by sorting a 24-hour sample of loose waste from the trades dumpster.

Construction waste was audited at the Mission Flats landfill from a load of waste generated during a renovation project. The methodology used for this sample was to spread out the load of waste and estimate the percent of each material found in the sample - a method commonly used to audit heavy and bulky loads of waste.

While an audit of materials was not performed in the Warehouse building, observations and quantities of materials specific to the Warehouse were noted and discussion included in this report.

Calculations

An Ohaus SD series bench scale was used to measure weights in kilograms during the audit. Volume measurements were estimated in both cubic yards (dumpster measurements) and in litres (waste composition measurements). Weight measurements are more accurate than volume measurements, however some volume units are provided in the report below.

Each sample of waste was sorted into 26 material categories. The samples were weighed and volumes recorded on data sheets. The data sheets were input into spreadsheets and the following calculations were performed.

Source Waste Composition Calculations

Source waste compositions were calculated by the adding up all the samples from each source. The percent composition was calculated by dividing the material output by the total weight of the sample. Material categories were condensed into 14 broad categories, as shown in the charts and tables included in this report.

Overall Waste Composition Calculations

In order to accommodate for the changes in sampling methods used in the 2016 study, the calculations to determine the overall composition differed in 2016 from the 2015 audit. In 2015, the samples were added up and overall composition of materials was a straightforward calculation of dividing the sum of each material category by the total sample size.

The variable samples sizes in the 2016 study required using a weighting system to normalize the data so that the overall composition would not be skewed towards the larger samples.

To normalize the data, the following steps and calculations were performed for the volume and weight metrics:

1. The total weight and volume for each dumpster for the week was calculated to give the total weekly output for each dumpster. The total weekly output for each dumpster was divided by the total weekly output for all dumpsters to give the percent of each dumpster, as shown in Appendix A, Tables 6 and 7, Columns 1 and 2.

2. The percent of each dumpster was divided across the sources of waste identified in each dumpster to assign a percentage to each source of waste in each dumpster. The assignment to each source was based on estimates and available data from both the 2015 and 2016 audits. Appendix A, Tables 6 and 7, Columns 3 - 12 of shows the allocation to each source.

3. The total percent allocated to each source of waste was calculated by adding up the allocated percentages for each source of waste in each dumpster. Appendix A, Tables 6 and 7, Row 11 shows the total allocation to each source of waste by weight and volume.

4. The total percent for each source of waste was multiplied by the total waste output for the week to provide the total weekly output for each source of waste. Appendix A, Tables 6 and 7, Row 12 show the total weekly waste output for each source of waste.

5. The total weekly output for each source of waste (Appendix A, Tables 6 and 7, Row 12) was multiplied by the percent composition of each material in each source of waste (Appendix B, Tables 7 and 8, Even Columns) to give the total weekly output of material for each source of waste, shown in Appendix B, Tables 9 and 10, Rows 1 - 11.

6. The weekly output of material for each source of waste (Appendix B, Tables 9 and 10, Columns 1 - 10) was added up to give the overall output of each material (Appendix B, Tables 9 and 10, Columns 11).

7. The overall output of each material was divided by the total material output to give the overall composition of waste.

Total Annual Waste Output, Waste Generation and Diversion Rate Calculations

The following calculations were performed to determine the total annual waste output for the period from Summer 2015 through Winter 2016 for weight data only.

1. The weekly per-capita waste output (kg/person) was calculated by dividing the total weekly waste output (measured during the audit) by the total population in the winter semester.
2. The weekly per-capita waste diversion (kg/person) was calculated by dividing the total weekly diverted materials (estimated and actual) by the total population in the winter semester.

3. Weekly waste and diversion outputs for the fall and summer semesters were calculated by multiplying the per-capita waste diversion and output rates by the total population counts in each semester.
4. Waste and diversion outputs for each semester were calculated by multiplying the weekly waste and diversion outputs by the number of weeks in each semester.
5. The total annual waste output and waste diversion was calculated by adding the waste output and waste diversion for each semester.
6. The diversion rate was calculated by dividing the total weight of diverted materials by the total weight of waste and diverted materials.

Assumptions

The data gathered during the audit is a snapshot of the waste stream during the audit period. In estimating total annual waste output, it is assumed that the sample period is representative of the waste stream over the year.

Limitations and Sources of Error

Waste generation and composition is variable and will fluctuate depending on the season and activities. It should be noted that this audit is only a snapshot of the waste stream at the McGill Campus over the audit period and that the data should be applied with discretion. Some limitations and sources of error to note, in addition to errors based on assumptions, are discussed as follows.

Firstly, because the sampling occurred over a one-week period, the audit may not have captured variations in waste that may occur as a result of different events, maintenance, and construction activities, or seasonal variations (e.g. refundable beverage containers tend to be higher in summer months). Construction projects typically generated large volumes of heavy waste. Construction and renovation projects that occurred over the year were not included in waste output totals reported in the audit. The results of the audit are likely lower than the actual waste generated on campus.

Another limitation occurs due to cross-contamination of wastes. Food waste tends to get on everything; while sorting waste, high contamination was present in the compostable paper, plastic packaging, and garbage bags. Actual quantities for compostable paper, plastic packaging and garbage bags would have been lower, and actual quantities for food waste and liquids would have been higher than reported due to cross-contamination.

3 Waste Audit Results

Waste Outputs

Weight and volume measurements for each dumpster were recorded during the audit. Each dumpster was measured on collection day, prior to collection. Table 1 shows the results of the weights and volume measurements over the week. A total of 4508 kg and 110 cubic yards of landfill waste was generated over a one-week period across 10 dumpsters.

Table 1 also shows the capacity of the dumpsters based on the current collection schedule in cubic yards and the calculated utilization rate based on the volume measured over the week divided by the capacity of the dumpsters based on the collection schedule at the time of the audit.

According to the data, the dumpster outside the Culinary Arts building receives the most waste and is the dumpster that is most efficiently utilized, receiving 978 kg and 26.5 cubic yards of material each week. With a capacity of 30 cubic yards per week, it the Culinary Arts dumpster has a utilization rate of 88%.

The dumpster outside the Animal Health Technology building receives the lowest amount of waste and is the dumpster with the lowest utilization rate, receiving approximately 129 kg and 1.5 cubic yards per week. With a weekly capacity of four cubic yards, it has a utilization rate of 38%.

Adjustments made to the dumpster collection schedule in 2015 resulted in an increase in average dumpster utilization rate from 49% in 2015 to 63% in 2016.

Table 1 - Weekly Waste Outputs by Dumpster

Waste by Dumpster	Weekly Weight (kg)	Weekly Volume (cu.y)	Weekly Capacity (cu.y)	Utilization rate (Weekly Volume/ Weekly Capacity)
Culinary Arts (CA)	977.7	26.5	30	88%
Old Main (OM)	802.9	22.5	30	75%
Campus Activity Centre (CAC)	705.4	15.3	30	51%
Trades DLC	526.9	8	18	44%
Daycare	426.9	7.5	12	63%
Science/ Gym (SC)	287.4	8.5	12	71%
Arts & Education (AE)	224.8	5.7	8	71%
Trades (black bag)	222.6	7.8	18	43%
Warehouse	203.9	7	12	58%
Animal Health Technology (AHT)	129.2	1.5	4	38%
Total (Average)	**4507.7**	**110.3**	**174**	**(63%)**

Diverted Wastes

Table 2 shows the waste streams for diverted materials, the calculated outputs for 2016 and 2015, and the method for gathering the audit data in 2016. Volume data was not available for all diverted materials and therefore volume metrics are not shown below. Several waste streams were calculated using rough estimations. Improvements to data collection are discussed in the recommendations section of this report.

Table 2 - Weekly Diverted Materials Output Summary and Diversion Rate

Diverted Material	Weight (kg) per week (2016)	Weight (kg) per week (2015)	% Change	Data collection methodology
Scrap metal	1844.9	1812.7	1.8%	Actual records provided by faculty in the Trades department over the one-year period.
Compost (yard waste)	1533.0	1745.0	-12.2%	Head of grounds tracked the number of loads to yard waste depot over the year = 344 at an estimated 500 lbs per load. 78182 kg per year divided by 51 weeks.
Mixed Recycling	635.8	705.3	-9.9%	Measured over two-week period.
Cardboard	484.4	389.3	24.4%	Measured over one-week period.
Compost (meat waste)	326.6	0.0	N/A	Measured over one-week period.
Compost (coffee grinds)	220.8	0.0	N/A	Measured over one-week period.
Compost (zero waste stations)	140.5	156.6	-10.3%	TRU Sustainability Office provided weights over two-month period. A per-day rate was calculated for each measurement provided by dividing the total output by the number of days since the previous collection.
Electronic Waste	128.3	67.5	90.1%	Owner (Steve) of the Lorne St Bottle Depot—who picks up the TRU e-waste said that there are no exact records of # of Gaylord bags of e-waste picked up each month. But he estimates x2/month, for a total of 24/yr. Estimation confirmed by TRU Warehouse staff.
Clean Wood	79.2	0.0	N/A	TRU Trades staff estimates 6 cu.y. per month. A sample of wood waste from Trades bin audit revealed a loose wood waste density of 52.8 kg/cu.y. x 6 cu.y/month x ¼ months/week = 79.2 kg / week
Refundable beverage containers	59.3	78.0	-24.0%	Measured two samples. The first sample weighed 27.2 kg and was over a one-week period, however the sample was likely not representative of a week's worth of waste according to the person doing the collection. The second sample covered a period of two days and weighed 22.8 kg. An attempt for a third sample was made, but was missed due to timing issues. The estimated weight was roughly calculated by multiplying the sample by 2.5 to account for the 5 days when TRU is in full operation and adding 10% of the sample to account for the weekend.
Compost (veg scraps Culinary Arts)	84.6	53.5	58.1%	TRU Culinary Arts staff provided bin sizes and counts over a one-month period. 0.46 kg/l density food waste was multiplied by the volume to estimate the weight. Farmers collect food scraps roughly every two weeks. Food scraps are collected in three sized bins (90 - 125 litres). 53.5 kg estimated to be one week sample size.
Reusable (sold)	35.7	121.8	-70.7%	TRU Sustainability Office obtained records of items sold through TRU Procurement and provided an estimate of 4000 lbs per year.
Styrofoam	22.0	0.0	N/A	TRU Sustainability Office staff reported two loads of Styrofoam collected over the year. Dimensions of truck = 5'x7.5'x16' so approximately 17,000 litres or 600 cubic feet. Styrofoam denisty is 0.05 kg/litre. Two loads of 17,000 @ 0.05 kg/litre and assuming 33% airspace = 1122 kg per year
Batteries	2.0	3.1	-34.1%	Measured over a one-month period.
Compost (keurig Cups)	5.1	5.1	0.0%	VanHoutte staff provided total weight of k-cup sales to TRU over the period from Oct 2014 to end Sept 2015. The total weight was adjusted based on 41 used cups = 1 lb and 50 new cups = 1 lb.
Total Weekly Diverted Waste (kg)	**5595.0**	**5129.7**	9.1%	

Capture Rates

Table 3 below shows the amount of diverted materials measured during the audit over a week, the estimated amount of diverted materials found in the overall waste stream each week, the estimated total output of each material over a week, and the capture rates of each diverted material as a percent of the total weekly waste output. The weight for each material found in the overall waste stream per week is shown in Appendix B, Table 10, Column 11.

Table 3 - Capture Rates For Diverted Materials

Diverted Material	Weight diverted per week 2016 (kg)	Weight found in waste per week 2016 (kg)	Total output per week 2016(kg)	Capture rate 2016	Capture rate in 2015
Scrap metal	1844.9	191.1	2036.0	91%	91%
Mixed Recycling	635.8	947.4	1583.2	40%	35%
Cardboard	484.4	13.9	498.3	97%	73%
Compost (yard waste)					
Compost (meat waste)					
Compost (coffee grinds)					
Compost (zero waste stations)					
Compost (veg scraps Culinary Arts)	2305.4	1548.6	3854.0	60%	4%
Electronic Waste	128.3	0.0	128.3	100%	
Batteries	2.0	0.0	2.0	100%	66%
Clean Wood	79.2	66.2	145.4	54%	0%
Refundables	59.3	22.2	81.5	73%	47%
Reusable (donated/sold)	35.7	0.0	35.7	100%	26%

Total and Per-Capita Waste Output

TRU's total waste stream for the 2016 audit period was approximately 437,273 kg, consisting of 195,089 kg landfill and 242,184 kg of diverted materials. Table 4 shows 2016 per capita landfill rate of 1.03 kg/person/week was significantly lower than 2015 rate of 1.73 kg/person/week. Per capita diversion rate of 1.28 kg/person/week in 2016 was higher than 2015 rate of 1.18 kg/person/week.

Table 4 - Annual Waste and Diversion 2016 and 2015

	Annual 2015/2016	Annual 2014/2015[5]
Weekly per capita landfill waste rate (kg/person/week)	1.03	1.73
Weekly per capita diverted materials rate (kg/person/week)	1.28	1.18

[5] Staff population data from 2015 audit was adjusted to FTE, and the changes are reflected in the per capita and total output data shown in Table 4. The per capita figures shown are higher than reported in 2015, however due to a lower total population, the total waste output figures reported in Table 4 are lower than the 2015 reported outputs.

Total landfill waste (kg)	195,089	315,982
Total diverted materials (kg)	242,184	215,876
Total landfill and diverted materials (kg)	**437,273**	**531,858**
Diversion rate	**55.4%**	**40.6%**

The diversion rate increased by 27% from 2015 to 2016, from 41% in 2015 to 55% in 2016, primarily due to a decrease in total weekly landfilled waste, and also from an increase in total diverted material.

Table 5 shows the calculated waste and diversion output projections based on the population data provided by TRU and using the measured waste outputs over the sampling period, which occurred the Winter 2016 semester. Based on waste outputs of 4507 kg and diverted materials of 5495 kg measured over the week, and a total population of 4364 FTE staff and students, TRU's waste generator rates were 1.03 kg/person/week landfill and 1.28 kg/person/week diverted.

Table 5 - Population Waste and Diverted Materials By Semester

	Summer 2015	**Fall 2015**	**Winter 2016**
Number of weeks	20	15	16
Landfill waste per week	2,599	4,473	4,507
Diverted materials per week	3,379	5,815	5,495
FTE students	1,500	3,374	3,265
FTE staff	1,099	1,099	1,099
Total population	2,599	4,473	4,364
Total population relative to sampling period (Winter 2016)	60%	102%	100%
Landfill weekly waste per capita (kg/person/week)	1.03	1.03	1.03
Diverted materials weekly per capita rate (kg/person/week)	1.28	1.26	1.26
Landfill waste per semester (kg)	53,683	69,294	72,112
Diverted materials per semester (kg)	66,643	86,021	89,520
Total waste and diversion	**120,326**	**155,315**	**161,632**

Overall Waste Stream Composition

The overall waste stream compositions are presented below for both weight and by volume. Figures 2 and 3 show the overall composition by weight of waste in the 2016 and 2015 audits, respectively. The most abundant material in the waste stream by weight was food waste, contributing to 34%of the overall waste stream. Food waste consisted of food scraps, uneaten food, and coffee grounds. 20% of the waste stream by weight was remainder/ landfill waste, which included garbage bags, diapers, and materials that cannot be readily recycled or composted. A major source of the landfill waste came from the Trades DLC waste stream (see Appendix B, Table 10, Column 10 Source and Overall Weekly Waste Output by Weight).

30% of the waste stream consisted of recyclable materials, including paper (6%), coffee cups (6%), plastics (10%) and metals (4%). No electronic waste or reusable items were captured in the samples of audited waste, and very few batteries were found during the audit. While reusable items were not found in the samples that were sorted, reusable items were found when the dumpsters were weighed, specifically in the Warehouse dumpster (a large amount of Christmas ornaments) and in the Culinary Arts dumpster (office supplies).

Figure 2 - Overall Landfill Waste Composition by Weight 2016

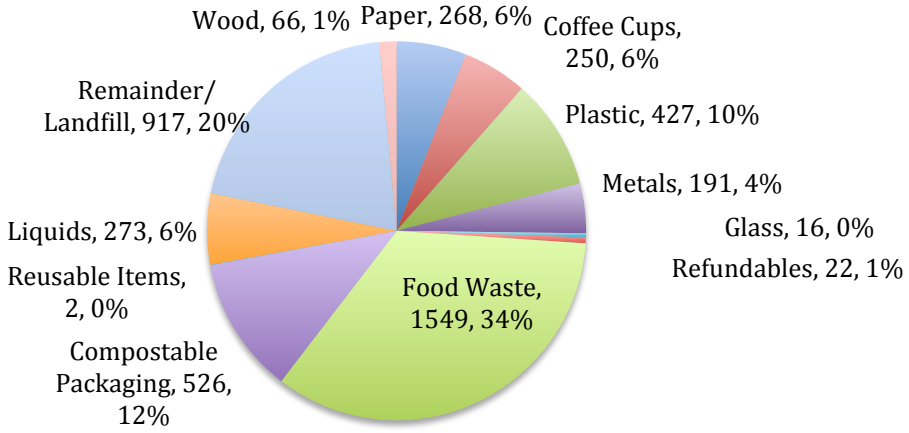
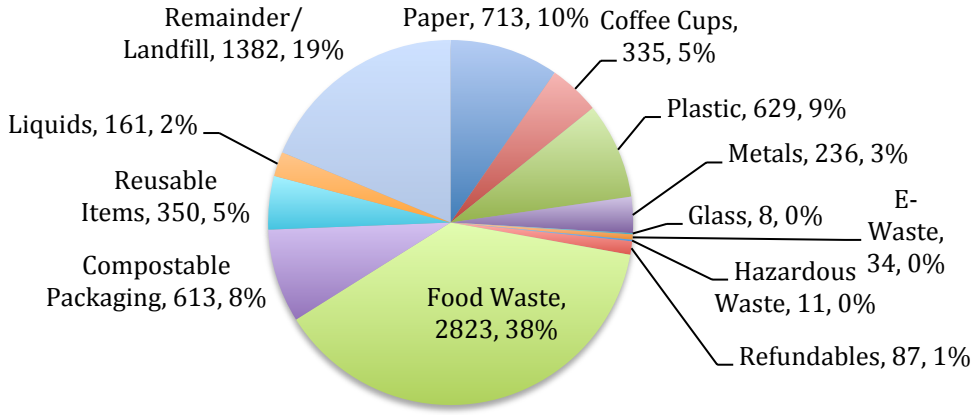


Figure 3 - Overall Landfill Waste Composition by Weight 2015



Figures 4 and 5 below show the overall composition of waste by volume for the 2016 and 2015 audits, respectively. The most abundant material category by volume was remainder/ landfill waste. The major source of remainder/ landfill waste came from the Trades was source (see Appendix B, Table 11, Column 10 Source and Overall Weekly Waste Output by Volume), accounting for nearly half of the overall output for this waste category.

Recyclable materials consisting of paper (14%), coffee cups (10%), plastics (21%) and metals (4%) accounted for nearly half (49%) of the overall volume of landfill waste in 2016 - a decrease of nearly 10% over 2015 levels.

Figure 4 - Overall Landfill Waste Composition by Volume 2016

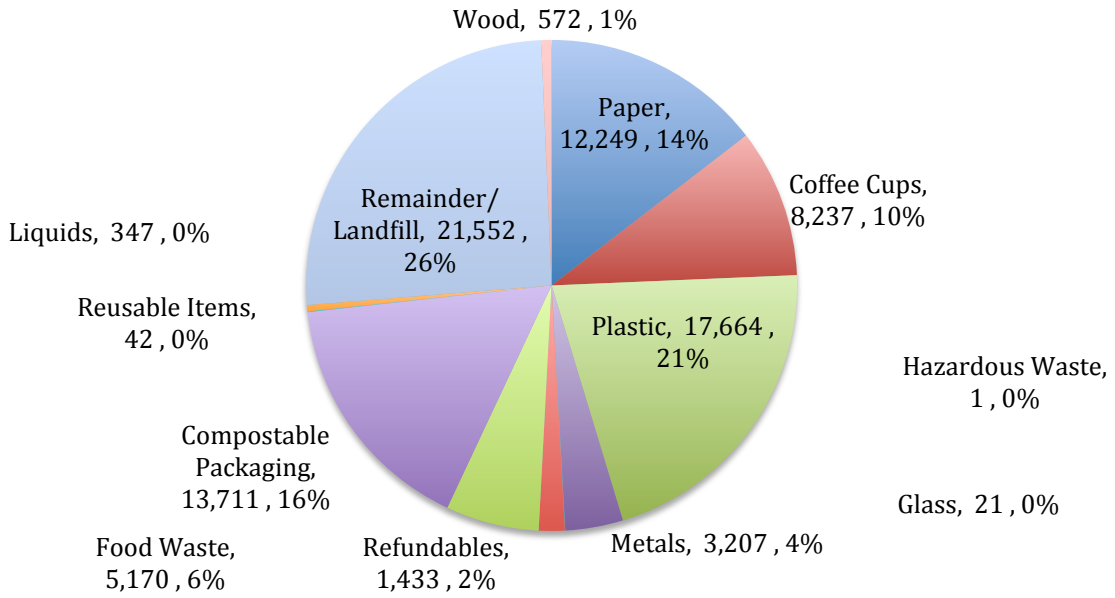
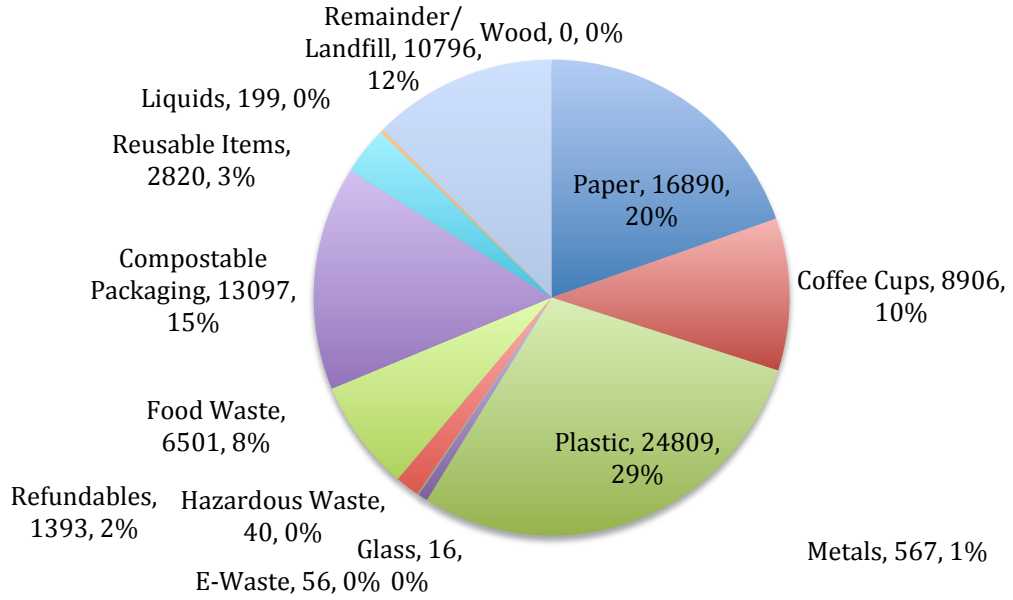


Figure 5 - Overall Landfill Waste Composition by Volume 2015



Waste Stream Composition By Source

The audit consisted of sorting samples of waste from 13 different sources on campus. The following section shows the composition of waste from each of the sources identified in the audit, the composition from the 2015 audit, and lists the most abundant materials found in each source from the 2016 audit.

Zero Waste Station Landfill

Figures 6 and 7 show the waste stream composition from the zero waste stations landfill stream on campus from 2016 and 2015, respectively. The most abundant material by weight in both 2015 and 2106 audits was food waste, accounting for about one quarter of this waste stream. Compostable packaging was the next most abundant material, followed by plastics. Also noted is the amount of plastic and paper packaging from to-go containers generated on campus.

The most abundant materials found in the zero waste station landfill stream by weight were:

1. Uneaten foods - 19.0%
2. Compostable paper packaging - 16.6%
3. Liquids - 12.3%
4. Coffee cups - 9.5%
5. Plastic packaging - 9.5%
6. Remainder/ miscellaneous - 8.5%

To-go packaging:

- Paper containers - 3.8%
- Plastic containers - 3.3%

Figure 6 - Zero Waste Station Landfill Composition 2016

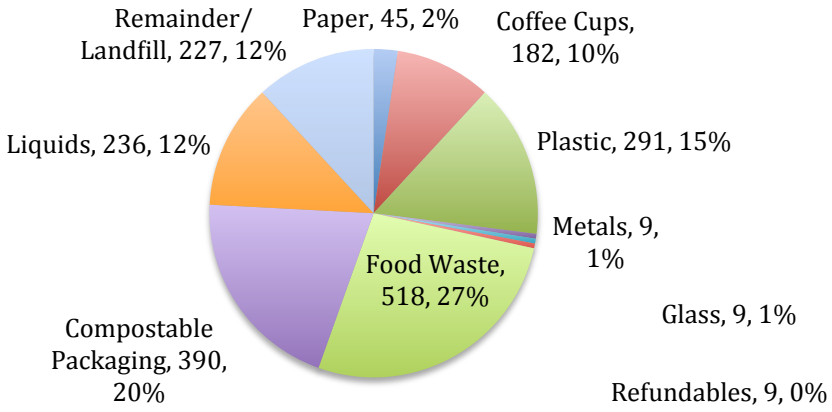
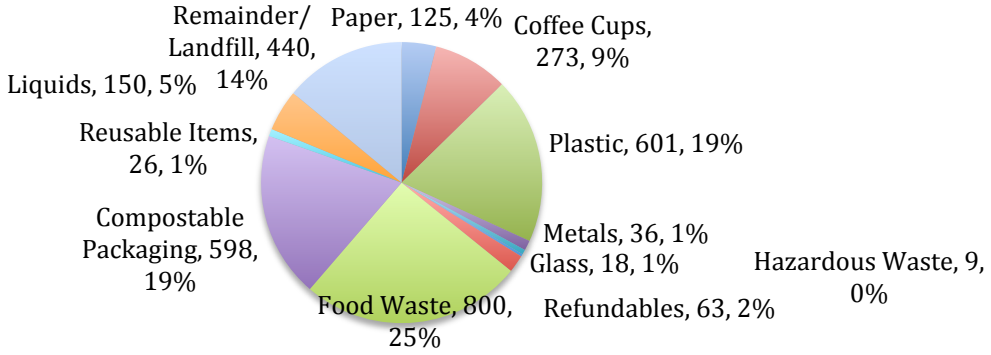


Figure 7 - Zero Waste Station Landfill Composition 2015



Stand Alone Landfill Composition

Several stand-alone garbage bins are present on campus. Sample compositions from the stand-alone bins are shown in Figures 8 and 9. The 2016 samples were obtained from stand-alone bins located in the House of Learning, Old Main, International Building and outdoor waste bins. Differences in compositions from 2015 and 2016 are likely attributed to the different sampling methods used in the audits. The 2016 audit samples were smaller, however the composition is known to come from stand-alone bins.[6][7]

The most abundant materials found in the stand-alone waste bins in 2016 were:

1. Remainder/ miscellaneous - 20.7%
2. Uneaten foods - 13.8%
3. Compostable paper - 13.8%
4. Coffee cups - 10.3%
5. Liquids - 10.3%
6. Garbage bags - 6.9%

To-go packaging:

- Paper containers - 5.2%
- Plastic containers - 0.0%

Figure 8 - Stand Alone Landfill Composition 2016

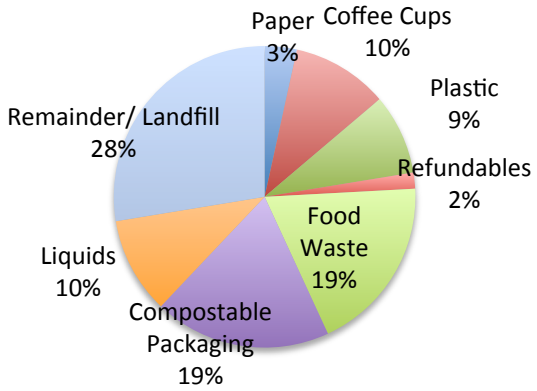
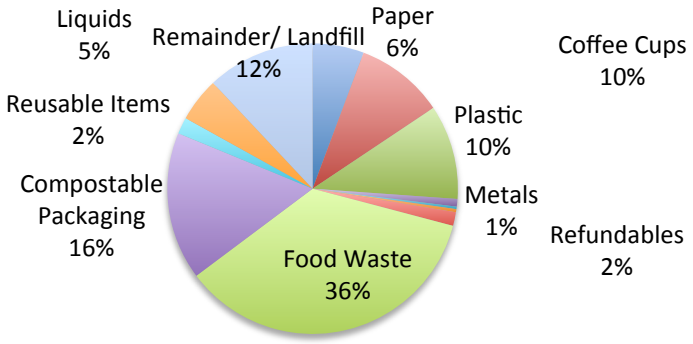


Figure 9 - Stand Alone Landfill Composition 2015



[6] The 2015 audit relied on janitors to label samples of waste. It was believed that source mixing occurred in 2015.

[7] Stand alone bins were not allocated a portion of the waste stream (see Appendix A) and therefore estimates for total waste output are not provided.

Offices Without Composting Composition

Office waste was separated into two sectors: offices with compost and offices without compost bins. The composition of office waste from offices that do not have compost bins from the 2016 and 2015 audits are shown in Figures 10 and 11 below. In 2016 the most abundant material by weight in the office waste stream was paper (39%), while the most abundant material found in 2015 was food waste (32%). There was a significant increase in the amount of paper found in office waste from 19% in 2015 to 39% in 2016.

The most abundant materials found in the 2016 waste audit were:

1. Office paper - 18.7%
2. Food scraps - 17.0%
3. Paper towel - 13.2%
4. Coffee cups - 8.2%
5. Uneaten food - 8.2%
6. Other recyclable paper - 7.1%

To-go packaging:

- Paper containers - 0.5%
- Plastic containers - 1.1%

Figure 10 - Offices Without Composting Landfill Waste Stream Composition 2016

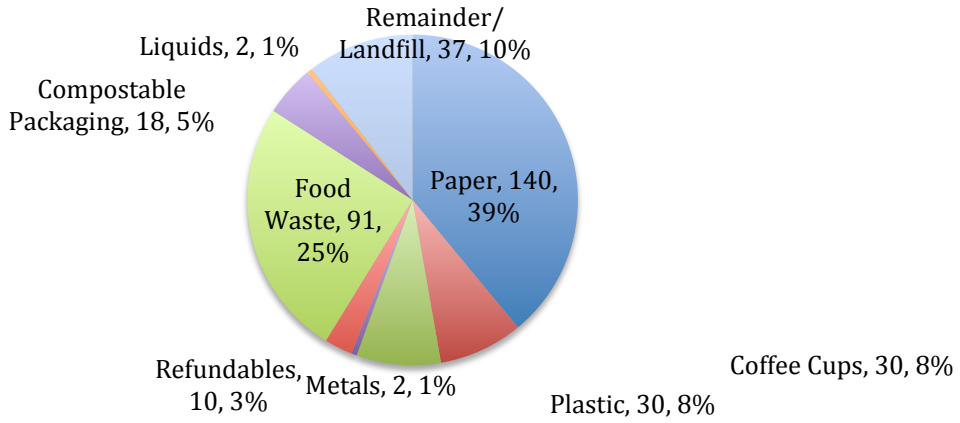
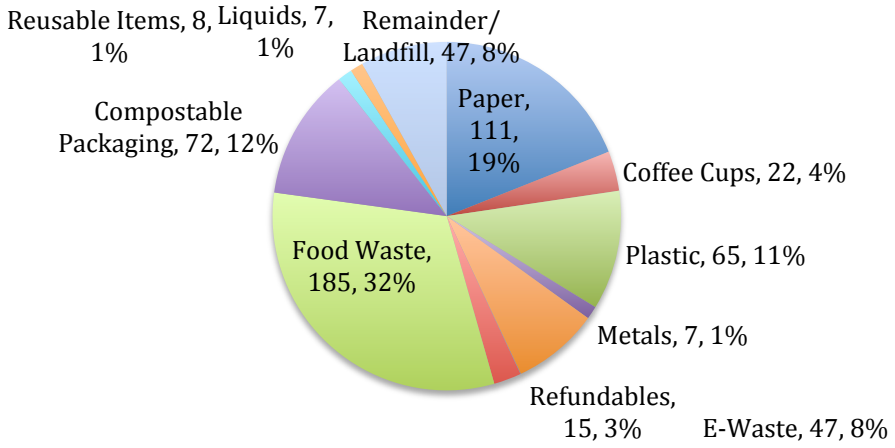


Figure 11 - Offices Without Composting Landfill Waste Stream Composition 2015



Offices With Composting Composition

Figures 12 and 13 show the composition of waste from offices with composting from the 2016 and 2015 audits. The most abundant materials by weight in both the 2016 and 2015 audits were food waste (36% and 41%, respectively). Paper was the second most abundant material found in the 2016 audit, comprising 30% of the waste stream, another significant increase over 2015 levels of 9% of office waste composition.

The most abundant materials found in the 2016 waste audit were:

1. Food scraps - 17.9%
2. Uneaten food - 17.9%
3. Compostable paper - 16.1%
4. Other recyclable paper - 10.7%
5. Office paper - 8.9%
6. Paper towel - 8.9%

To-go packaging:

- Paper containers - 0.0%
- Plastic containers - 0.0%

Figure 12 - Offices With Composting Landfill Waste Stream Composition 2016

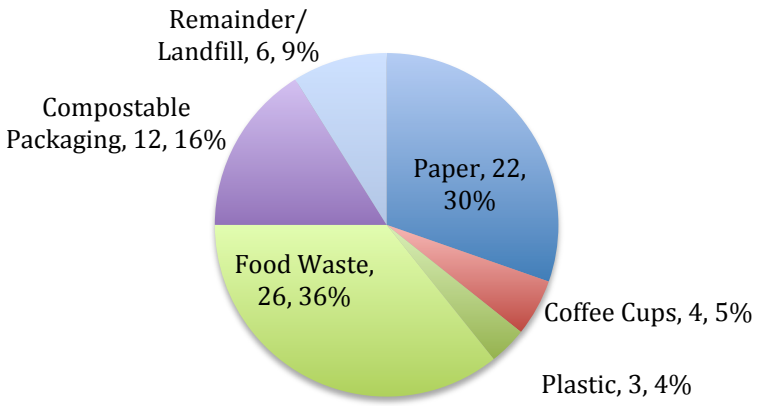
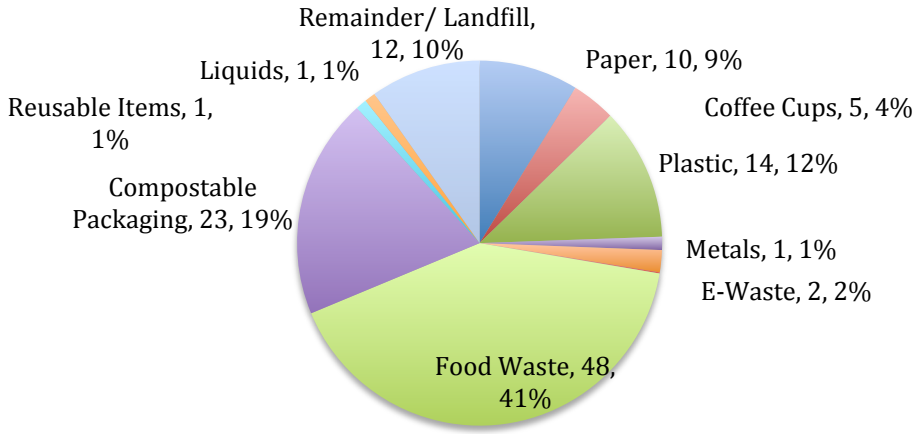


Figure 13 - Offices With Composting Landfill Waste Stream Composition 2015



Kitchen Waste Composition

In 2015, café and kitchen area waste was considered a single waste source. In 2016, kitchen waste was considered a unique waste source. Figure 14 shows the composition of waste comes from food prep and post-consumption waste.

The 2015 audit did not specifically look at kitchen waste; Figure 15 shows a sample of waste from the 2015 audit collected from the Campus Activity Centre. The results show that 2016 had higher levels of food waste and lower levels of recyclable materials (paper and plastic) than 2015.

The most abundant materials found in the 2016 waste audit were:

1. Uneaten food - 66.7%
2. Food scraps - 18.8%
3. Compostable paper - 3.9%
4. Remainder/ miscellaneous - 2.3%
5. Plastic film - 1.9%
6. Garbage bags - 1.2%

To-go packaging:

- Paper containers - 0.4%
- Plastic containers - 0.0%

Figure 14 - Kitchen Landfill Waste Composition 2016

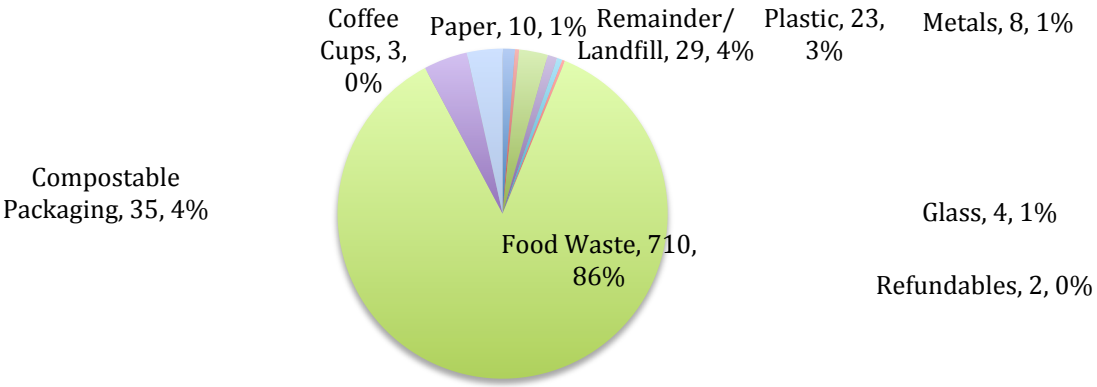
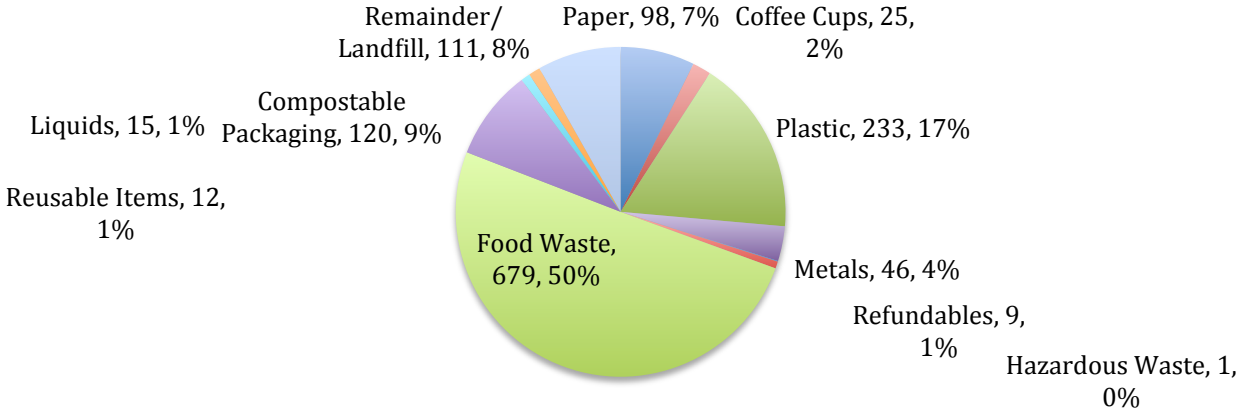


Figure 15 - Kitchen Landfill Waste Composition 2015



Trades, Construction and Warehouse Waste Composition

Trades, construction and warehouse activities generate bulky waste materials and are therefore audited differently than bagged waste. During auditing, samples were spread out and if possible, sorted and weighed by material category.

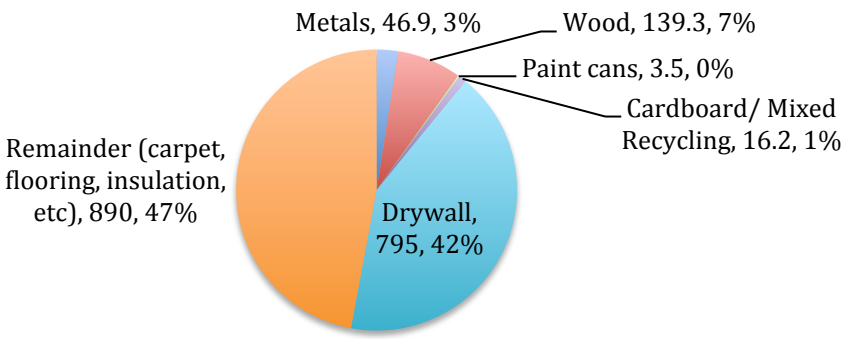
Construction Waste

Construction and renovation waste is typical on campus, however data about the amount of waste generated during construction and renovation projects is not tracked and therefore not included in the total waste output described in this report.

During the waste audit, a load of construction material was disposed and the sample was sorted at the Mission Flats Landfill. To audit the sample, the load was sorted into piles of material types, as shown in the far-right image in Figure 16. Drywall was the single most abundant material in the sample (approximately 42% or 795 kilograms). The wood material weighed 139 kg and was 7% of the sample. Metals consisted of 3% of the sample and weighed 47 kg, however the actual amount of metals would be higher as there was a number of nails and screws that were not sorted during the audit. Recyclable materials found in the sample were mainly cardboard, plastic film and paint cans, which weighed 20 kg and comprised of 1% of the waste stream. Figure 17 below shows the composition of waste found in the sample. Wood, metals, paint cans and recyclable materials were weighed on a scale. The remainder and drywall material categories were estimated based on the total sample size of 1890 kg and approximately 12.8 cubic yards.

Figure 16 - Construction Waste Images at Mission Flats Landfill

Figure 17 - Construction Landfill Waste Composition and material weight (kg) 2016



Warehouse Waste

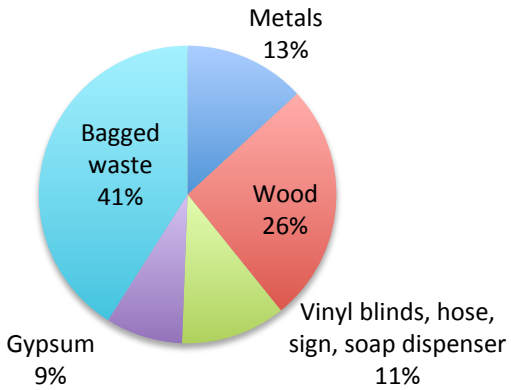
The warehouse generates a highly variable waste stream consisting of bagged office-type waste as well materials generated from maintenance activities on campus. This maintenance-type waste is also found across all dumpsters, and includes items such as furnishings, building supplies, air filters, light bulbs, as well as construction-type waste (e.g.: wood, drywall) from smaller projects.

Figure 18 shows images taken of the warehouse bin during the audit.

Figure 18 - Warehouse Waste Images

Figure 19 shows the composition of materials in the warehouse dumpster from one sample. This composition is not necessarily an accurate depiction of the warehouse waste stream. Bagged waste from the warehouse was not sorted, and consisted of 41% of the total sample. Wood was the single most abundant material in the sample, comprising 26% of the sample. It should be noted that only one sample over the week contained wood. [8]

Figure 19 - Warehouse Landfill Waste Composition 2016



[8] The warehouse bins were not allocated a portion of the waste stream (see Appendix A) and therefore estimates for total waste output are not provided.

Trades Waste Composition

The trades waste stream is highly variable, and therefore it was difficult to capture the true composition of this waste stream in the manner in which it was audited (one sample). The audit of the trades bin occurred on a Monday, however when weighing the dumpsters on the Wednesday and Friday, most of the contents from trades-activities were wood, as shown in the image on the right in Figure 20. The image on the left is the material that was sorted during sampling. Figures 21 and 22 shows the composition of the sample from the trades bin in 2016 and 2015, respectively. The majority of waste audited was from the remainder/ landfill category (69%) and consisted of mechanical parts, oil-contaminated absorbent, oil rags, a chunk of rubber and a seat from a car. The sample also had a significant amount of metals (27%), mainly copper wires, welding rods, and other small metal items.

Figure 20 - Trades Waste Images With Variable Waste Compositions

Figure 21 - Trades Landfill Waste Composition 2016

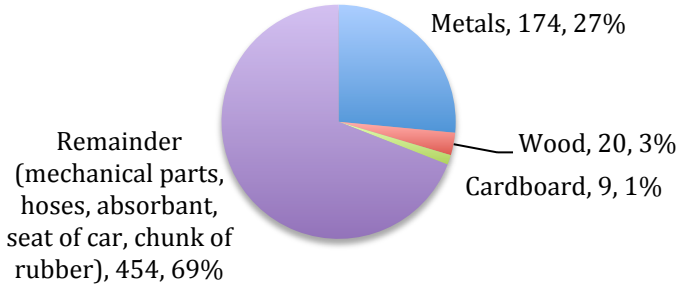
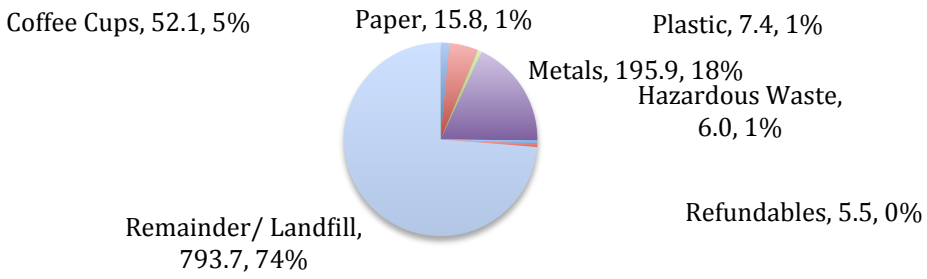


Figure 22 - Trades Landfill Waste Composition 2015



Cafe Waste Composition

In 2015, café and kitchen area data was presented as a single waste source. In the 2016, the audit considered café areas separate from kitchens. Figures 23 and 24 show the composition of waste from café areas from the 2016 and 2015 audits. The 2015 data was adjusted to include only the samples of waste from café areas.

The most abundant material in the café waste stream by weight in 2016 was food waste (45%), a decrease over 2015 levels (61%). Remainder / landfill waste levels increased in 2016, from 5% to 22%, which could partly be attributed to food waste contamination.

The most abundant materials found in the 2016 waste audit were:

1. Coffee grounds - 23.0%
2. Remainder/ miscellaneous - 19.3%
3. Uneaten foods - 16.9%
4. Plastics 1-7 containers - 11.8%
5. Compostable paper - 6.9%
6. Food scraps - 5.1%

To-go packaging:

- Paper containers - 0.9%
- Plastic containers - 0.0%

Figure 23 - Cafe Landfill Waste Composition 2016

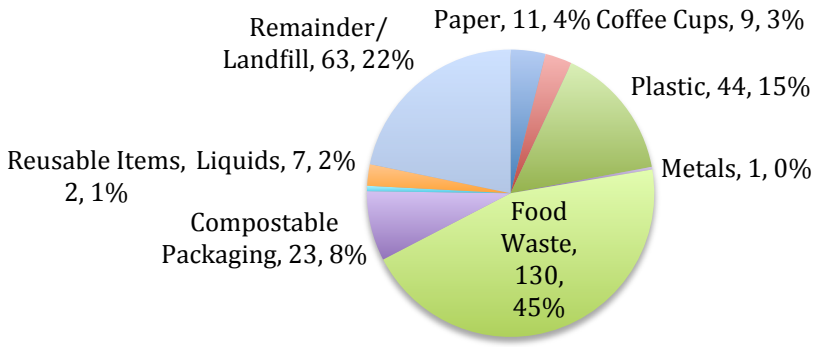
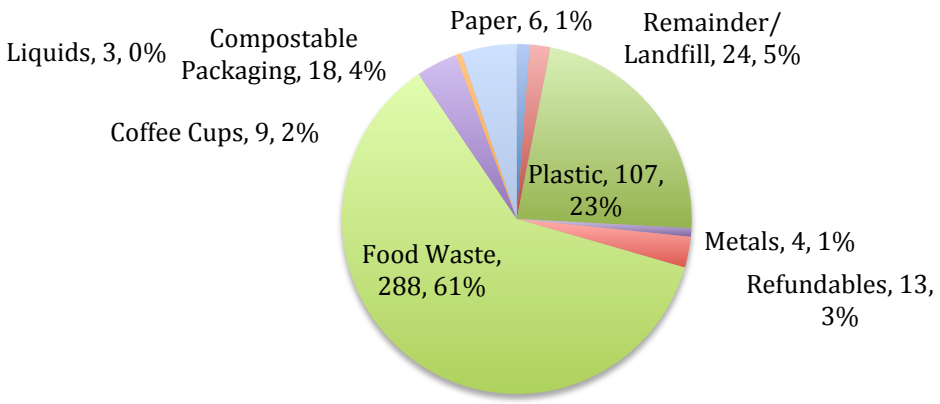


Figure 24 - Cafe Landfill Waste Composition 2015



Washroom Waste Composition

Figures 25 and 26 below show the composition of waste from the washrooms in 2016 and 2015. Paper was the most abundant material in both 2015 and 2016, levels decreased from 70% in 2015 to 49% in 2016. Remainder/ Landfill category was the next most abundant material in both 2016 (16%) and 2015 (15%). Food waste levels were much higher in 2016 than in 2015, likely due to the smaller sample size and location of the sample.

The most abundant materials found in the 2016 waste audit were:

1. Paper towel - 45.9%
2. Remainder/ miscellaneous - 10.8%
3. Coffee cups - 8.1%
4. Food scraps - 8.1%
5. Plastic packaging - 5.4%
6. Uneaten foods - 5.4%

To-go packaging:

- Paper containers - 0.0%
- Plastic containers - 0.0%

Figure 25- Washroom Landfill Waste Composition 2016

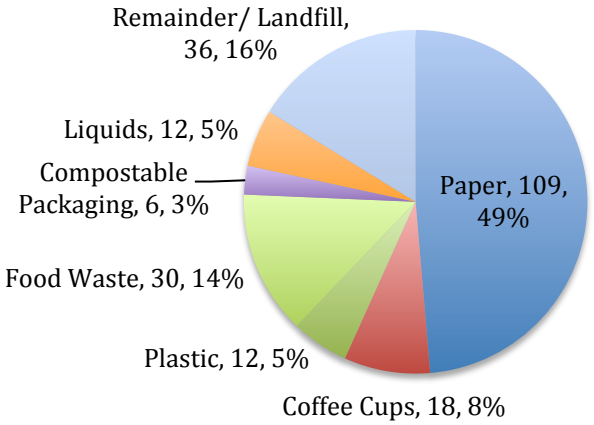
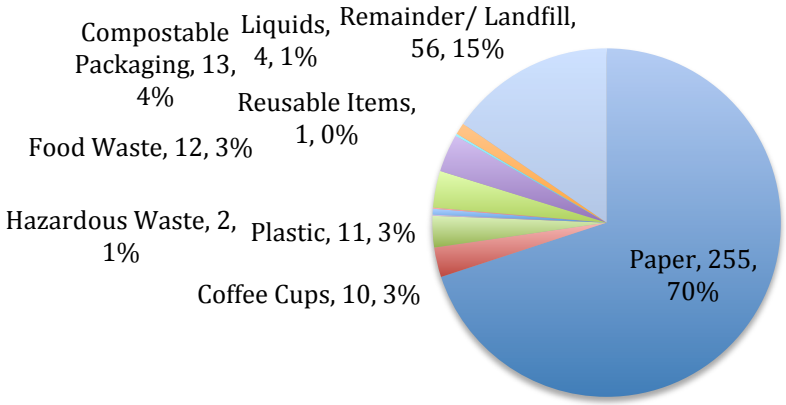


Figure 26 - Washroom Landfill Waste Composition 2015



Animal Health Technology Waste Composition

Figures 27 and 28 below show the composition of waste from Animal Health Technology building in 2016 and 2015 audits.

The most abundant materials found in the 2016 waste audit were:

1. Remainder /miscellaneous - 79. 9%
2. Paper towel - 6.8%
3. Food scraps - 3.4%
4. Compostable paper - 2.3%
5. Uneaten foods - 1.7%
6. Garbage bags - 1.7%

To-go packaging:

- Paper containers - 0.0%
- Plastic containers - 0.0%

Figure 27 - Animal Health Technology Waste Composition 2016

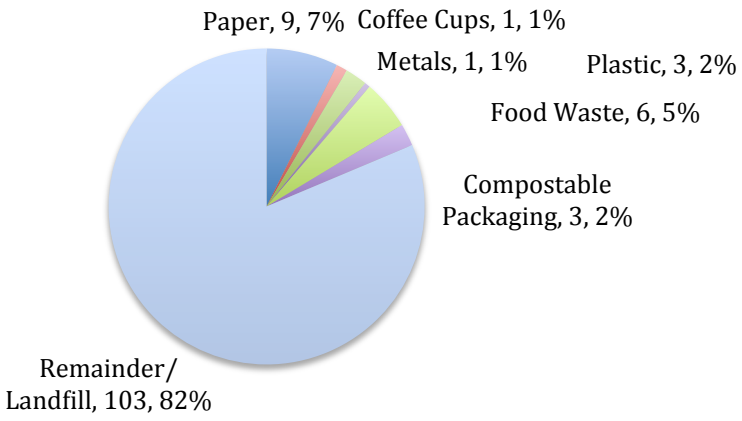
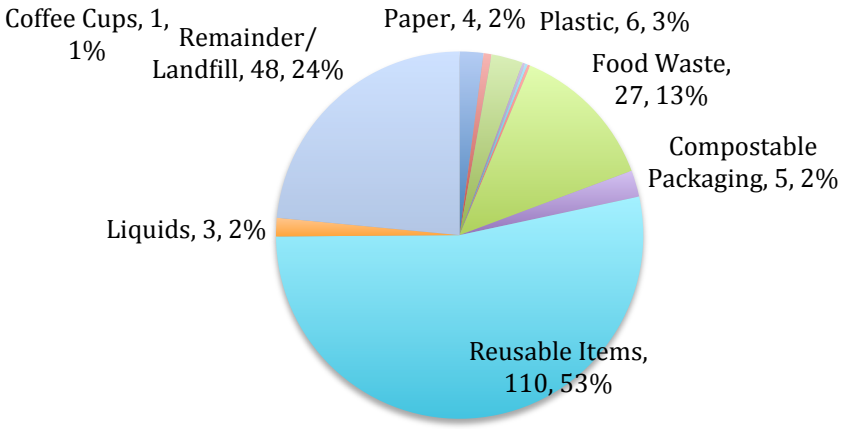


Figure 28 - Animal Health Technology Waste Composition 2015



Coffee Station Waste Composition

Stand alone waste bins adjacent to cafes on campus were also included in the audit. The composition of waste from the coffee stations is shown in Figure 29 below. The most abundant materials found in this waste stream were compostable packaging (35%) and plastic (24%).

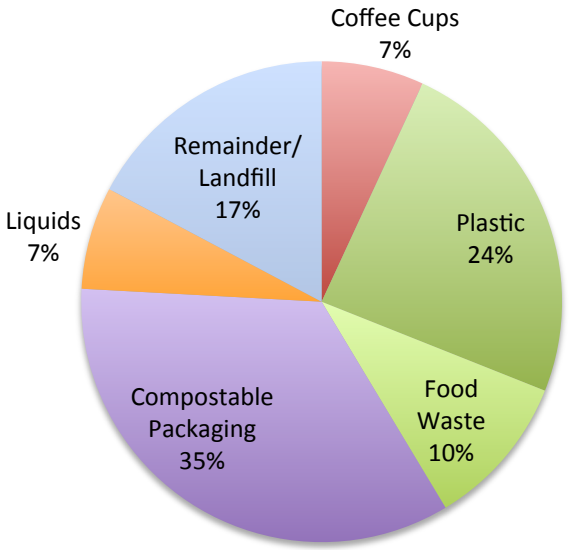
The most abundant materials found in the 2016 waste stream were:

1. Compostable packaging - 34.5%
2. Plastic packaging - 17.2%
3. Remainder/ miscellaneous - 10.3%
4. Coffee cups - 6.9&
5. Uneaten food - 6.9%
6. Garbage bags - 6.9%
7. Liquids - 6.9%

To-go packaging:

- Paper containers - 0.0%
- Plastic containers - 3.4%

Figure 29 - Coffee Station Landfill Waste Composition 2016



Science labs and the daycare were included as unique waste streams, however the results are not shown, as they comprise less than 1% of the campus waste stream. The compositions of the daycare and science lab are shown in Appendix B, Table 10, Column 2 and 8, respectively.

Diverted Materials Waste Composition

Samples from zero waste stations were also collected during the audit for mixed recycling, compost, plastic film and refundable beverage containers. Figures 30 to 33 shows the composition for zero waste station waste streams for mixed recycling, compost, plastic film and refundable beverage containers.

Figure 30 - Mixed Recycling Composition 2016

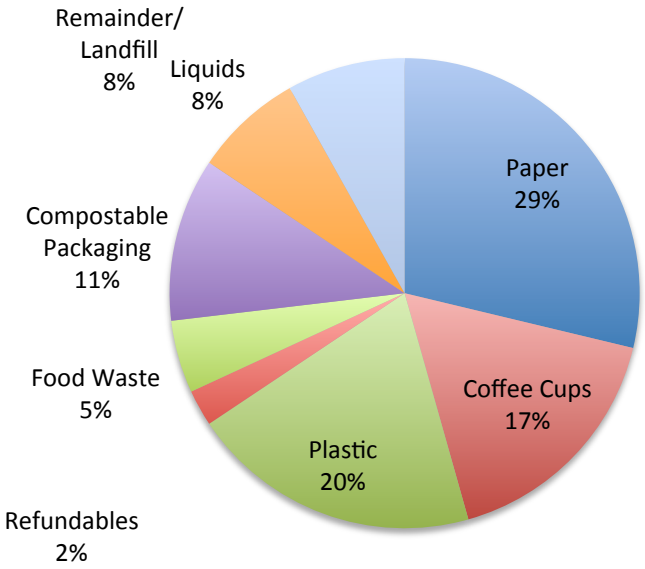


Figure 30 shows the composition of the mixed recycling bins by weight. The most abundant materials in mixed recycling were paper (29%), plastic (20%) and coffee cups (17%). Contamination of mixed recycling was 34% by weight. The most common contaminant in mixed recycling was compostable paper packaging. In samples where liquids were present, paper was very contaminated, rendering the paper unrecyclable.

Figure 31 - Compost Composition 2016

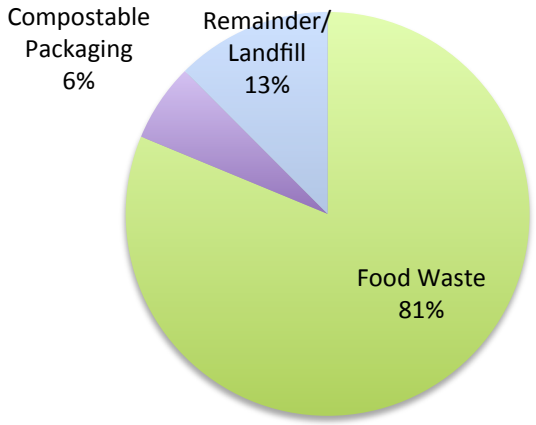


Figure 31 shows the composition of the compost bins by weight. The compost waste stream had very low contamination, with 81% food waste found in the samples. The remainder/ landfill category was nearly all from garbage bags, and the remaining 6% was compostable paper packaging.

Figure 32 - Plastic Film Composition 2016

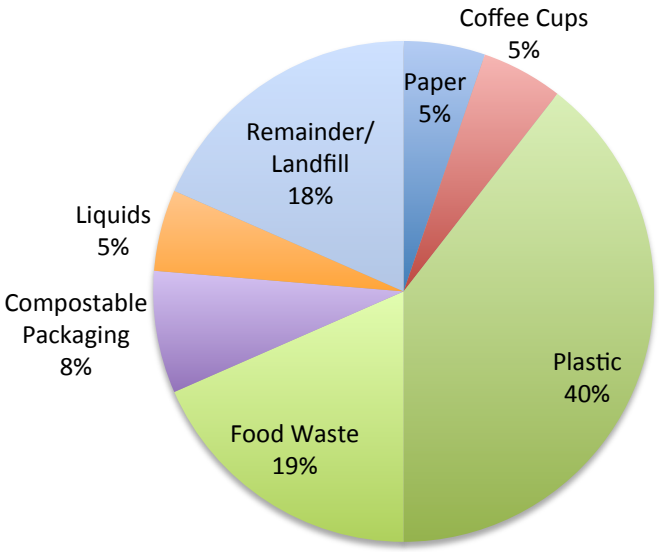


Figure 32 shows the composition from the plastic film bins. The plastic film bins were the most contaminated of all the bins in the zero waste streams. Plastic film accounted for 29% of the waste stream. Food waste was the most common contaminant, with 16% uneaten foods and 3% food scraps. 18% of the plastic film waste stream was remainder/ landfill, with 8% compostable packaging and 15% paper, coffee cups and liquids.

Figure 33 - Refundable Beverage Container Composition 2016

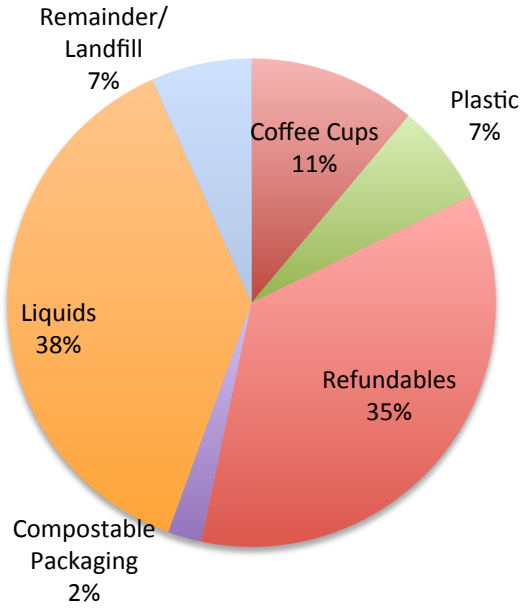


Figure 33 shows the composition from the refundable beverage container bins. This waste stream was also highly contaminated, mainly by liquids, which do not pose a major problem as the volunteers who collect the containers pour the liquids down the drain at the recycling facility. Coffee cups accounted for 11% of the waste stream, and were the next most common contaminant in the refundable beverage container stream. Contaminants in this waste stream are removed before recycling.

Conclusion and Recommendations

TRU has made considerable progress towards zero waste over the past year. The audit captured the waste stream over a short period (one week), the results can be used to identify waste reduction and diversion opportunities.

Based on the results of the audit, the following conclusions and recommendations are presented to assist TRU in realizing their waste diversion potential.

1. In 2016, TRU disposed of approximately 195 tonnes of solid waste in landfills. Approximately 242 tonnes of materials were diverted through existing reduce, reuse and recycling programs. This represents a diversion rate of 55%, an increase from 41% in 2015.
2. The results of the waste audit showed that approximately 34% of the waste stream consisted of food waste. TRU captured approximately 40% of the food waste generated on campus in 2016 (up from 4% in 2015). The highest concentrations of food waste were found in the kitchen areas (86%), cafes areas (45%), offices with composting (36%), zero waste stations (27%) and offices without composting (25%). TRU has compost collection throughout the entire campus. High amounts of food waste found during the audit indicate that improved collection and education would help to source separate this material.
    a. Food waste from the kitchen areas was mostly uneaten foods (67%). This could indicate that lack of awareness that prepared foods can be composted through TRU's system. TRU should educate staff in cafes and kitchens that uneaten foods should be composted, and if needed, improve collection of food waste in these areas.
    b. Food scraps comprised 19% of the kitchen waste. Major sources of food scraps were meat trimmings and in the Campus Activity Centre, and orange halves from freshly squeezed orange juice in the Campus Activity Centre. The Retail Meat Program adjacent to the Culinary Arts has a collection system to divert meat trimmings to dog breeders. The Culinary Arts program could divert meat trimmings through the Retail Meat program. Staff in the Campus Activity Centre should be made aware that the orange halves should be placed in the compost bins.
3. Compostable paper was another major source of waste on campus. Approximately 12% of the overall waste stream consisted of food-soiled paper packaging. The audit looked at how much of this packaging came from to-go containers generated on-campus, such as kitchens and cafes. The results showed that relatively low amounts of compostable paper were from to-go packaging, with the highest concentrations found in the zero waste stations (3.8% of zero waste station samples were from to-go containers generated on campus, vs. 16.6% other compostable paper). The majority of compostable paper was napkins.
    a. It is understood that TRU has purchased a shredder that would enable composting of this waste stream but material must be soaked in water before it can be placed in the shredder, posing several operational challenges, specifically in winter due to freezing. Stockpiling compostable material in winter and then shredding it when temperatures do not pose a risk of damaging equipment could be an option.

4. The results of the audit showed that approximately 27% of the waste stream consisted of recyclable materials, including 10% plastics, 6% paper, 6% coffee cups, 4% metals, and 1% refundable beverage containers.
    a. The highest concentration of plastics were in the café areas, zero waste stations, stand-alone bins, and offices. Many plastic containers and plastic film found in waste was food-contaminated.
    b. The highest concentration of paper was found in washrooms and offices. 49% of the washroom waste stream was paper, mostly clean paper towel that could be composted or recycled. Offices with and without composting had 30% and 39% paper, which indicates that improved collection and education would help to source separate this material. Centralized waste collection (discussed below) should be considered for offices.
    c. Coffee cups were present in all waste streams. Campaigns to educate staff and students to carry reusable mugs could help reduce coffee cups waste. As well, TRU could work with the cafes on campus to impose greater incentives for people who bring their own mug. Recycling stations for coffee cups have been rolled out and help by reduce contamination from liquids in the mixed recycling.
5. Mixed recycling from zero waste stations were highly contaminated with liquids, especially coffee, making the contaminated paper un-recyclable, according to the recycler. Source-separating paper and plastics would help reduce contamination of mixed recycling. The term "mixed recycling" is quite ambiguous and varies depending on where you live. Separate collection bins for paper and plastic may help reduce the need to educate people on what goes into mixed recycling as well as reduce the contamination of recycled paper.
6. TRU should consider replacing desk-side waste bins with centralized zero waste stations in offices. Offices with centralized waste collection have improved diversion rates for source-separated materials, reduced garbage bag use, and cleaner offices, as janitors spend less time tending to garbage and more time cleaning. According to one of the janitorial staff responsible for cleaning offices, approximately half the time cleaning offices is spent tending to garbage.
7. Wood waste in the trades and warehouse bins was not fully captured in the audit due to random sampling of these bins. Although the audit did not fully capture the amount of wood waste present, a significant amount of wood waste was witnessed over the period. The Trades building has implemented a system to divert clean wood, however short cuts of wood and plywood are disposed into the landfill waste stream. TRU should investigate the cost-benefit of source-separating wood waste in these areas. Roll-off bin rentals are available through a number of local waste haulers.
8. Reusable items were also not fully captured in the audit due to random sampling, although many items in good condition were identified over the audit period. Large Styrofoam coolers and significant amounts of office supplies and furnishings were found in the Culinary Arts dumpster. The warehouse disposed of a large supply of Christmas ornaments, and 5-gallon plastic pails in the Campus Activity Centre are items that could be sent to thrift stores. Although reusable items were not significant contributors in the waste stream, keeping reusable items out of the landfill should be a priority. TRU should consider a partnership with a thrift store such as Big Brother and Big Sisters for collection drives of reusable items at the end of semesters, when people tend to purge unwanted items.
9. Cardboard is another item that did not get fully captured in the audit due to random sampling and the bulky-nature of the material. Large amounts of cardboard were found

in Old Main, Campus Activity Centre, and Trades dumpsters. Improved education targeted at staff in the Old Main and Campus Activity Centre buildings may help improve source-separation. There are two cardboard bins located outside the Daycare, however over the audit period only one of the bins was used. TRU should consider moving the second cardboard bin to the Trades building.

10. The garbage collection schedule shows that the warehouse bin is 6 cubic yards, however the dumpster is only 4 cubic yards. TRU should follow up with the waste collector to ensure appropriate charges for the dumpster, as rates are higher for larger dumpsters.
11. During the audit, several of the mixed recycling carts outside the Campus Activity Centre were not taken to the curb and were overflowing. TRU should investigate who is responsible for taking these carts to the curb and ensure carts are taken out so that mixed recycling does not get placed in the dumpsters.
12. Waste compactors reduce operational costs by reducing the frequency of trips by the waste hauler, thus reducing emissions from waste service operations. Several universities have implemented waste compaction programs for both landfill waste and recyclable materials such as cardboard and paper. TRU should consider implementing a waste compaction system for it's entire waste stream. In one example, Brock University implemented waste compactors, which have a payback period of four years. Waste is brought to a centralized location using hybrid truck. Removing dumpsters would free up areas for parking, which is a revenue-generating stream, as well as improved aesthetics and reduced odours.
13. Several waste streams included in the audit for diverted materials were gross estimates. Improved metrics for gathering waste stream data would improve the reliability and accuracy of waste audits. TRU should implement systems that at minimum track the number of loads of waste outputs for each waste stream, specifically for electronic waste, reusable items, wood waste, compost scraps in the Culinary Arts, meat trimmings in the Retail Meat program. Although it may not be realistic to weigh each load of material diverted from campus, it would be prudent to obtain sample weights from time to time for previously mentioned waste stream, as well as yard waste and Styrofoam. Ideally, waste outputs would be based on actual records, rather than the current combination of actual records, sampling and estimations.

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Appendix A - Waste Outputs and Source Allocation Tables

Table 5 - Waste Output and Source Allocation by Weight

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Dumpster location	Weekly waste output by weight (kg)	Percent weight	Animal Health Technology	Zero Waste Stations	Offices without compost	Offices with compost	Kitchen	Café	Daycare	Washrooms	Trades DLC	Science labs	**Total**
R1	AHT	129.2	2.9%	2.8%	-	0.1%	-	-	-	-	0.1%	-	-	**2.9%**
R2	Arts & Education	224.8	5.0%	-	3.5%	1.0%	-	-	-	-	0.5%	-	-	**5.0%**
R3	CAC	705.4	15.6%	-	3.0%	1.3%	0.3%	10.2%	-	-	0.8%	-	-	**15.6%**
R4	CA	977.7	21.7%	-	12.4%	0.2%	-	8.1%	-	-	1.0%	-	-	**21.7%**
R5	Daycare	426.9	9.5%	-	3.0%	3.0%	1.0%	-	1.1%	0.5%	0.6%	-	-	**9.2%**
R6	Old Main	802.9	17.8%	-	13.0%	0.3%	0.3%	-	3.4%	-	1.1%	-	-	**18.1%**
R7	SC/GYM	287.4	6.4%	-	4.3%	0.4%	-	-	0.9%	-	0.4%	-	0.4%	**6.4%**
R8	Trades 1	222.6	4.9%	-	3.3%	0.3%	-	-	1.0%	-	0.3%	-	-	**4.9%**
R9	Trades 2	526.9	11.7%	-	-	0.0%	-	-	-	-	-	11.7%	-	**11.7%**
R10	Warehouse	203.9	4.5%	-	-	1.4%	-	-	-	-	0.2%	2.9%	-	**4.5%**
R11	**Total**	**4507.7**	**100.0%**	**2.8%**	**42.5%**	**8.0%**	**1.6%**	**18.3%**	**6.4%**	**0.5%**	**5.0%**	**14.6%**	**0.4%**	**100.0 %**
R12	**Weekly Waste Output By Source (kg)**			**126.2**	**1915.8**	**358.4**	**72.1**	**824.9**	**288.5**	**22.5**	**223.1**	**657.6**	**18.0**	**4507.2**

Table 6 - Waste Output and Source Allocation By Volume

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Dumpster location	Weekly waste output by volume (cu.y)	Percent volume	Animal Health Technology	Zero Waste Stations	Offices without compost	Offices with compost	Kitchen	Café	Daycare	Washrooms	Trades DLC	Science labs	**Total**
R1	AHT	1.5	1%	1.3%	-	0.0%	-	-	-	-	0.0%	-	-	**1.4%**
R2	Arts & Education	5.7	5%	-	3.6%	1.0%	-	-	-	-	0.5%	-	-	**5.2%**
R3	CAC	15.3	14%	-	2.7%	1.2%	0.3%	9.0%	-	-	0.7%	-	-	**13.8%**
R4	CA	26.5	24%	-	13.7%	0.2%	-	9.0%	-	-	1.1%	-	-	**24.0%**
R5	Daycare	7.5	7%	-	2.2%	2.2%	0.7%	-	0.8%	0.4%	0.4%	-	-	**6.6%**
R6	Old Main	22.5	20%	-	14.9%	0.3%	0.3%	-	3.9%	-	1.3%	-	-	**20.7%**
R7	SC/GYM	8.5	8%	-	5.2%	0.5%	-	-	1.1%	-	0.5%	-	0.5%	**7.7%**
R8	Trades 1	7.8	7%	-	4.7%	0.4%	-	-	1.4%	-	0.4%	-	-	**7.0%**
R9	Trades 2	8.0	7%	-	-	0.0%	-	-	-	-	-	7.3%	-	**7.3%**
R10	Warehouse	7.0	6%	-	-	2.0%	-	-	-	-	0.3%	4.1%	-	**6.3%**
R11	**Total**	**110.3**	**100%**	**1.3%**	**47.0%**	**7.8%**	**1.3%**	**18.0%**	**7.2%**	**0.4%**	**5.2%**	**11.3%**	**0.5%**	**100.1 %**
R12	**Weekly Waste Output By Source (cu.y)**			**5.8**	**45.3**	**13.6**	**0.9**	**6.6**	**9.2**	**0.3**	**5.9**	**21.8**	**0.7**	**110.1**

Appendix B - Waste Source Samples and Composition Tables

Table 7 - Source Sample Weights and Compositions

	Daycare		Zero Waste Stations		Washrooms		Science labs		AHT		Offices Without		Offices With		Kitchen		Cafes		Trades	
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight	Sample weight (kg)	Percent composition by weight
Paper	1.1	0.3	0.5	5	1.8	0.5	1.9	0.7	1.3	0.1	7.1	0.4	1.7	0.3	0.9	0.0	1.3	0.0	2.6	0.0
Coffee Cups	0.0	0.0	2	50.8	0.3	0.1	0.0	0.0	0.2	0.0	1.5	0.1	0.3	0.1	0.3	0.0	1.0	0.0	0.0	0.0
Plastic	0.2	0.0	3.2	126.2	0.2	0.1	0.0	0.0	0.4	0.0	1.5	0.1	0.2	0.0	2.1	0.0	5.0	0.2	0.0	0.0
Metals	0.0	0.0	0.1	2.5	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.7	0.0	0.1	0.0	60.0	0.3
Glass	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
E-Waste	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazardous Waste	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Refundables	0.0	0.0	0.1	8	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Food Waste	1.6	0.4	5.7	14	0.5	0.1	0.0	0.0	0.9	0.1	4.6	0.3	2.0	0.4	64.1	0.9	14.9	0.5	0.0	0.0
Compostable Packaging	0.0	0.0	4.3	116.2	0.1	0.0	0.0	0.0	0.4	0.0	0.9	0.0	0.9	0.2	3.2	0.0	2.6	0.1	0.0	0.0
Reusable Items	0.0	0.0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Liquids	0.0	0.0	2.6	3.3	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Remainder/ Landfill	1.1	0.3	2.5	35.1	0.6	0.2	0.8	0.3	14.4	0.8	1.9	0.1	0.5	0.1	2.6	0.0	7.2	0.2	146.6	0.6
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.4	0.1
Total weight (kg)	**4.3**	**1.0**	**21.1**	**1.0**	**3.7**	**1.0**	**2.8**	**1.0**	**17.7**	**1.0**	**18.2**	**1.0**	**5.6**	**1.0**	**74.5**	**1.0**	**33.1**	**1.0**	**232.6**	**1.0**

Table 8 - Source Sample Volumes and Compositions

	Daycare		Zero Waste Stations		Washrooms		Science labs		AHT		Offices Without		Offices With		Kitchen		Cafes		Trades	
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume	Sample volume (litres)	Percent composition by volume
Paper	25.3	0.2	5.0	0.0	31.0	0.5	1.9	0.7	27.0	0.2	128.0	0.4	24.0	0.3	17.3	0.1	32.0	0.1	150.0	0.2
Coffee Cups	14.5	0.1	50.8	0.1	15.0	0.3	0.0	0.0	4.5	0.0	45.0	0.1	3.0	0.0	3.3	0.0	35.0	0.1	0.0	0.0
Plastic	11.5	0.1	126.0	0.4	3.2	0.1	0.0	0.0	9.3	0.1	41.0	0.1	7.5	0.1	30.4	0.1	235.0	0.4	0.0	0.0
Metals	26.0	0.3	2.7	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.1	0.0	0.3	0.0	6.5	0.0	1.0	0.0	150.0	0.2
Glass	15.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
E-Waste	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hazardous Waste	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Refundables	1.3	0.0	12.9	0.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
Food Waste	0.0	0.0	14.1	0.0	1.5	0.0	0.0	0.0	3.5	0.0	11.5	0.0	5.1	0.1	117.3	0.5	38.0	0.1	0.0	0.0
Compostable Packaging	0.3	0.0	112.5	0.3	3.0	0.1	0.0	0.0	5.0	0.0	34.0	0.1	35.0	0.4	19.6	0.1	51.0	0.1	0.0	0.0
Reusable Items	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Liquids	1.1	0.0	3.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Remainder/ Landfill	4.0	0.0	32.2	0.1	4.0	0.1	0.8	0.3	127.5	0.7	38.0	0.1	15.3	0.2	24.3	0.1	180.0	0.3	571.0	0.6
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.0	0.0
Total Volume (litres)	**101.4**	**1.0**	**359.6**	**1.0**	**58.8**	**1.0**	**2.8**	**1.0**	**177.4**	**1.0**	**301.0**	**1.0**	**90.1**	**1.0**	**219.5**	**1.0**	**576.1**	**1.0**	**902.0**	**1.0**

Table 9 - Source and Overall Weekly Waste Output By Weight (kg)

	Daycare	Zero Waste Stations	Washrooms	Science labs	AHT	Offices Without	Offices With	Kitchen	Cafes	Trades	Overall
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
	Weekly waste output by weight (kg)										
Paper	5.8	45.4	5.3	12.2	9.3	139.8	21.9	10.0	11.3	7.4	268.3
Coffee Cups	-	181.6	21.1	-	1.4	29.5	3.9	3.3	8.7	-	249.6
Plastic	1.0	290.5	33.8	-	2.9	29.5	2.6	23.3	43.6	-	427.2
Metals	-	9.1	1.1	-	0.7	2.0	-	7.8	0.9	169.6	191.1
Glass	1.6	9.1	1.1	-	-	-	-	4.4	-	-	16.1
E-Waste	-	-	-	-	-	-	-	-	-	-	-
Hazardous Waste	-	-	-	-	-	-	-	-	-	-	-
Refundables	-	9.1	1.1	-	-	9.8	-	2.2	-	-	22.2
Food Waste	8.4	517.5	60.3	-	6.4	90.6	25.8	709.8	129.9	-	1,548.6
Compostable Packaging	-	390.4	45.5	-	2.9	17.7	11.6	35.4	22.7	-	526.1
Reusable Items	-	-	-	-	-	-	-	-	1.7	-	1.7
Liquids	-	236.1	27.5	0.6	-	2.0	-	-	7.0	-	273.1
Remainder/ Landfill	5.8	227.0	26.4	5.2	102.7	37.4	6.4	28.8	62.8	414.5	916.9
Wood	-	-	-	-	-	-	-	-	-	66.2	66.2
Total	**22.5**	**1,915.8**	**223.1**	**18.0**	**126.2**	**358.4**	**72.1**	**824.9**	**288.5**	**657.6**	**4,507.2**

Table 10 - Source and Overall Weekly Waste Output By Volume (litres)

	Daycare	Zero Waste Stations	Washrooms	Science labs	AHT	Offices Without	Offices With	Kitchen	Cafes	Trades	Overall
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
	Weekly waste output by volume (litres)										
Paper	59.4	500.4	2378.6	384.7	671.8	4432.0	191.0	396.1	392.7	2767.8	12174.4
Coffee Cups	34.1	4888.5	1150.9	0.0	112.0	1558.1	23.9	74.4	429.5	0.0	8271.4
Plastic	27.1	12124.9	241.7	0.0	231.4	1419.6	59.7	694.9	2883.7	0.0	17682.9
Metals	61.2	259.8	0.0	0.0	12.4	3.5	2.0	148.8	12.3	2767.8	3267.8
Glass	36.5	9.6	0.0	0.0	0.6	0.0	0.0	9.2	0.0	0.0	55.9
E-Waste	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
Hazardous Waste	2.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	4.2
Refundables	2.9	1241.4	76.7	0.0	0.0	103.9	0.0	11.4	0.0	0.0	1436.4
Food Waste	0.0	1356.8	115.1	0.0	87.1	398.2	40.2	2684.5	466.3	0.0	5148.2
Compostable Packaging	0.6	10825.8	230.2	0.0	124.4	1177.2	278.6	448.8	625.8	0.0	13711.4
Reusable Items	0.7	0.0	0.0	0.0	0.0	5.2	0.0	0.0	36.8	0.0	42.7
Liquids	2.5	298.3	7.7	20.2	1.5	6.9	0.0	0.0	12.3	0.0	349.4
Remainder/ Landfill	9.4	3098.6	306.9	162.0	3172.2	1315.7	121.8	556.4	2208.8	10536.0	21487.7
Wood	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	572.0	572.0
Total	**238.5**	**34604.2**	**4507.8**	**566.9**	**4413.3**	**10420.3**	**717.2**	**5024.4**	**7069.2**	**16643.5**	**84205.4**