

**Waste and Recyclable Materials Audit 2018
Thompson Rivers University
Kamloops, British Columbia**



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Executive Summary

Thompson Rivers University (TRU) engaged the services of Waste Naught BC to perform an audit of the university's solid waste stream in March 2018. The audit is the fourth undertaken by the university, and where applicable, audit results are compared with previous audits. The audit includes a report on types of waste generated on campus; the financial costs for solid waste collection and disposal, including a breakdown of costs by site (dumpster location) and type (institutional and construction/ maintenance type waste); an estimate total annual waste and recyclable material output, as well as per capita waste generation rates; recovery rates of diverted wastes; estimate of TRU's solid waste diversion rate; report on the composition of sources of waste (e.g., zero waste stations, offices, washrooms, etc.); a review of 2017 audit recommendations; and recommendations for further waste reduction and diversion.

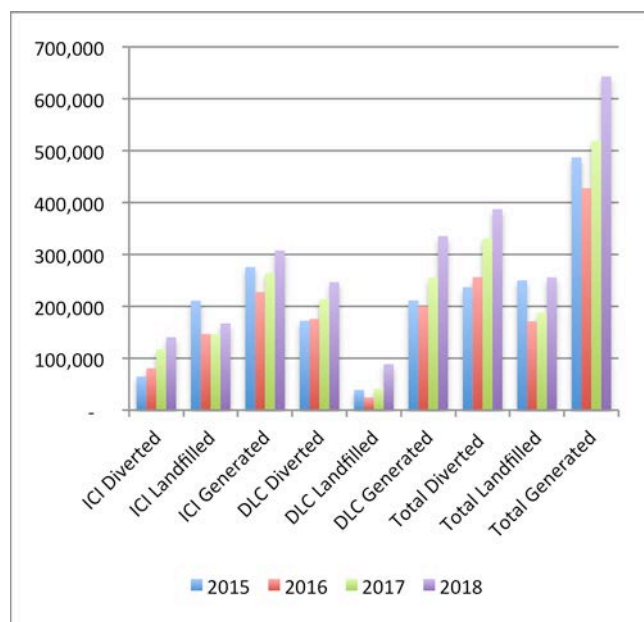
Total cost for garbage, cardboard and mixed recycling collection, including monthly bin rental was \$55,254.78 for the 2017 calendar year. Wood, metal, concrete and mixed demolition, land clearing and construction (DLC) cost for hauling and disposal was \$18,761.50 for the period from April 2017 through March 2018.

Diversion rates were calculated for institutional (ICI) waste, demolition land clearing and construction (DLC) waste, and total waste using annual data. Previous years diversion rates were re-calculated using annual data resulting in diversion rates that differ from waste audit reports for 2015, 2016 and 2017. Prior audit diversion rates were calculated using weekly data.

The ICI diversion rate increased from 24% in 2015, to 35% in 2016, 44% in 2017 and 46% in 2018. DLC diversion rate was 81% in 2015, 88% in 2016, 84% in 2017 and 74% in 2018. The reduction in diversion rates is partially attributed to the inclusion of additional data from construction and demolition projects on campus. The overall diversion rate for 2018 and 2016 was 60%, 64% in 2017 and 49% in 2015.

In 2018, waste outputs increased for both landfilled and diverted material. Total annual diverted waste increased from 331,000 kg in 2017 to 387,000 kg in 2018. Landfilled material increased from 188,000 kg in 2017 to 256,000 kg in 2018.

ICI materials diverted increased from 117,000 kg in 2017 to 141,000 kg in 2018. Diverted ICI waste streams include food waste, mixed recycling, hazardous waste, cardboard, electronics, reuse items, refundables, batteries, and plastic packaging.¹ICI materials landfilled increased from 147,000 kg in 2017 to 167,000 kg in 2018.



¹TRU diverts yard waste, which is considered ICI waste, however due to the large amount of yard waste generated across campus grounds, any variability in the waste stream does not allow to see other trends in the ICI materials.

DLC materials diverted increased from 214,000 kg in 2017 to 247,000 in 2018. DLC materials diverted include wood, scrap metal, yard waste, and concrete. DLC materials landfilled increased from 41,000 kg in 2017 to 89,000 kg in 2018. DLC landfilled material includes garbage collection from the Trades-DLC and the Stores garbage bins, as well as mixed construction (DLC) waste from campus maintenance.

Weekly per capita rates increased for landfilled material from 1.08 kg in 2017 to 1.14 kg in 2018 and reduced for diverted material from 1.74 in 2017 to 1.70 kg in 2018. Average recovery rates for diverted waste increased from 71% in 2017 to 76% in 2018, excluding plastic bag recovery, which was very low (1%).

The five most abundant sources of waste in 2018 were zero waste stations (1700 kg per week), trades DLC waste (1300 kg per week), Culinary Arts kitchen (800 kg per week), Campus Activity Centre kitchen (600 kg per week), and cafes (500 kg per week). Opportunities reduce and divert waste should be targeted for these sources of waste.

Improved diversion rates could be achieved through enhanced communication on proper use of zero waste stations. Providing a wood waste bin for trades would help to divert a significant amount of waste in this area. Engaging with staff and students in the Culinary Arts and Campus Activity Centre kitchens about the compost program would divert the most significant part of these waste sources (food waste).

Reducing campus waste provides a greater benefit, but would also require significant investments and buy-in from stakeholders. Reduction opportunities such as reusable packaging programs, coffee cup share programs, embedding reuse and deconstruction into trades programs, and working with kitchens to reduce food waste would reduce costs associated with waste handling and disposal, as well as the costs for materials that comprise the waste stream.

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1 Scope and Deliverables

Background

Thompson Rivers University (TRU) recognizes the importance of showing leadership and stewardship in environmental sustainability in its Strategic Plan 2007 - 2012. Since adopting the strategic goal of becoming the university of choice for environmental sustainability, TRU has created a department dedicated to improving campus sustainability. Through the Office of Environment and Sustainability, actions are continuously taken to increase campus sustainability.

In 2014, TRU adopted a goal of becoming a zero waste campus. To accomplish this goal, TRU Sustainability Office has implemented several waste reduction and diversion initiatives, diverting waste to composting, recycling, energy conversion. TRU collects and diverts a growing number of materials. Since the previous audit, TRU has further expanded composting through the purchase and installation of an anaerobic digester at the Campus Activity Centre.

A waste audit performed in March 2017 showed that TRU diverted roughly 61% of waste generated on campus through recycling and composting programs, increased from 55% diversion in 2016 and 42% diversion in 2015. In 2017 approximately 522 tonnes of waste generated, an increase from 437 tonnes in 2016 of waste was generated on campus compared to 543 tonnes 2015.

Deliverables

The objectives of the audit are to provide TRU with the following:

- Report on types of waste generated on campus;
- Report on costs for solid waste collection and disposal by location and type of waste;
- Estimate total annual waste and recyclable material output and per capita rates;
- Estimate TRU's solid waste diversion rate;
- Provide composition of sources of waste;
- Provide recovery rates of diverted wastes;
- Review of 2017 audit recommendations;
- Compare audit results with previous audits; and
- Provide recommendations for waste reduction and diversion.

2 Methodology

Sampling

Janitors labeled sources of waste for zero waste station garbage, washrooms, offices and science labs. Aramark staff labeled samples from cafes (Tim Hortons, Starbucks, Deli on the second floor) and from the kitchen in the Campus Activity Centre. Culinary Arts students retained their waste on the loading dock. Samples for stores, trades, and animal health technology were obtained directly from their dumpsters as the user groups use these. Samples from kitchens, cafes, zero waste stations and science labs were obtained over a 24-hour period.

Office waste is collected twice a week, on Tuesdays and Fridays. The sample was obtained from Tuesday's collection.

A sample of event waste was obtained from an event in which waste diversion stations were not setup. The event included food vendors offering cultural

Trades, Animal Health Technology (AHT) and stores waste samples were obtained from the dumpsters used exclusively by the waste source. For the AHT sample, feces was weighed and left in the dumpster and the remaining waste was audited for composition.

Trades and stores waste was audited throughout the week while the material was being weighed, as the material is bulky. Bagged material from waste stations in Trades was included with the zero waste station sample.

Bulky material was weighed and recorded during the entire week, with one sample of bagged material audited for composition.

Calculations

An Ohaus SD series bench scale was used to measure weights in kg during the audit. Volume measurements were estimated in both cubic yards (dumpster measurements) and in litres.

Each sample of waste was sorted into 27 material categories, detailed in Appendix B. The samples were weighed and volumes recorded on data sheets. The data sheets were input into spreadsheets and the following calculations were performed.

Percentage by Waste Source

Percentage by waste source was used to calculate the weekly waste output of each source of waste. The weekly waste output for each source was multiplied by the percent of each material found in the source samples to give the total material output for the week.

Waste source percentages were estimated as follows:

1. The total weight and volume for each dumpster for the week was calculated to give the total material landfilled for each dumpster in kg per week. The total material landfilled for each dumpster was divided by the total material landfilled 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. [Appendix A](#), Tables 6 and 7, Columns 3 - 13 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 12 shows the total percent allocation to each source of waste by weight and volume.
4. The total percent allocation 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 13 shows the total waste landfilled for each source of waste in kg per week.

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 2017 through Winter 2018 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 is variable and will fluctuate depending on the season and activities. The audit is a snapshot of the waste stream at the McGill Campus over a one-week period and therefore data should be applied with discretion. Variations in waste may occur as a result of different events and seasons.

Cross-contamination of wastes was a source of error. Food waste tends to get on everything; high contamination was present in paper, plastic, and garbage bags. Actual quantities for paper, plastic 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.

The weather and topography were also sources of error. It rained during several days of the audit and in some cases material was very wet (specifically cardboard, but also bags of waste). The wind and topography (weighing material on a slope) would have also caused errors in weights.

The scale used for the audit measured to 0.1 kg. In cases where materials weighed less than 0.1 kg (such as batteries), weights were estimated. All volumes were estimated.

4 Financials 2017

Garbage, cardboard and mixed recycling is mainly collected by the City of Kamloops (City), with collection by Waste Connections for the Campus Activity Centre beginning in November 2017. Wood waste and scrap metal are collected from the stores building by Bigstone Industries. The following section is a report on the costs for solid waste collection and disposal for the 2017 calendar year, including a breakdown of costs by dumpster location.

Garbage, Cardboard and Mixed Recycling Services

City service rates for the 2017 period are shown in Table 1. Bin rentals are charged on a monthly basis for garbage. Garbage pickup is charged at the City's multi-family rate, which includes one free pickup per week. Service charges are based on a 13-week period for quarterly billing cycles and a 26 week-period for semi-annual billing cycles. Recycling carts are charged per unit, with a service charge is \$12.50 for quarterly billing and \$25 per unit on semi-annual billing.

Table 1 Garbage, Cardboard and Mixed Recycling Service Rates

Service Charge Name	2017 Rate
BIN RENTAL - MULTI RES 4.0 YD BIN (4 yard garbage bin rental)	\$54.60 per month
BIN RENTAL - MULTI RES 6.0 YD BIN (6 yard garbage bin rental)	\$72.30 per month
GARBAGE: PICKUP - MULTI RES 4.0 YD BIN (4 yard garbage pickup)	\$18.78 per tip
GARBAGE: PICKUP - MULTI RES 6.0 YD BIN (6 yard garbage pickup)	\$30.00 per tip
RECYCLE: COMM CARDBOARD COLLECTION 4 YD (4 yard cardboard pickup)	\$10.88 per tip
RECYCLE: COMM CARDBOARD COLLECTION 6 YD (6 yard cardboard pickup)	\$16.88 per tip
BIN RENTAL REC - MULTI RES 4.0 YD BIN (4 yard mixed recycle bin rental)	\$42.50 per month
RECYCLE: PICKUP MULTIRES 4.0 YD BIN (4 yard mixed recycle pickup)	\$14.25 per tip
RECYCLE: COMM COLLECTION CHARGE (245 L cart mixed recycling pickup)	\$50 per year

Service Charges by Stream, Location, and Billing Period

Table 2 shows the total annual service charges for City and Waste Connections collection and bin rental for 2017. Service charges for garbage collection and bin rental are calculated by multiplying the number of tips charged per week (one less than service levels) by the number of weeks per billing period and the rate, plus the monthly bin rental. For example, the 6 yd garbage bin at the Culinary Arts is charged 4 tips per week x 13 weeks per quarter x \$30 per 6 yd garbage tip equals \$1560.00, plus bin rental of \$216.90 = \$1776.90.

Total cost for garbage, mixed recycling and cardboard bin rental and collection for 2017 was \$55,254.78. Garbage collection and bin rental cost was \$41,184.93, cardboard collection was \$7,624.31 and mixed recycling total cost was \$6,445.54.

Table 2 - 2017 Annual Cost for Garbage, Cardboard and Mixed Recycling Bin Rental and Collection

Utility Account Number	Garbage	Cardboard	Mixed Recycling	Grand Total
Utility Account 1005440	\$12,648.62	\$3,394.56	\$800.00	\$16,843.18
Culinary Arts	\$7,412.82	\$1,131.52	\$150.00	\$8,694.34
Size of bin/ cart	6 yd	4 yd	245 L	N/A
Tips per week	6	2	3	N/A
Jan - Mar 2017	\$1,776.90	\$282.88	\$37.50	\$2,097.28
Apr - Jun 2017	\$1,776.90	\$282.88	\$37.50	\$2,097.28
Jul - Sep 2017	\$1,776.90	\$282.88	\$37.50	\$2,097.28
Oct - Dec 2017	\$2,082.12	\$282.88	\$37.50	\$2,402.50
Daycare/ House of Learning	\$2,808.20	\$2,263.04	\$250.00	\$5,321.24
Size of bin/ cart	4 yd	4 yd	245 L	N/A
Tips per week	4	4	5	N/A
Jan - Mar 2017	\$651.30	\$565.76	\$62.50	\$1,279.56
Apr - Jun 2017	\$651.30	\$565.76	\$62.50	\$1,279.56
Jul - Sep 2017	\$651.30	\$565.76	\$62.50	\$1,279.56
Oct - Dec 2017	\$854.30	\$565.76	\$62.50	\$1,482.56
Science/ Gym	\$2,427.60	N/A	\$400.00	\$2,827.60
Size of bin/ cart	6 yd	N/A	245 L	N/A
Tips per week	2	N/A	8	N/A
Jan - Mar 2017	\$606.90	N/A	\$100.00	\$706.90
Apr - Jun 2017	\$606.90	N/A	\$100.00	\$706.90
Jul - Sep 2017	\$606.90	N/A	\$100.00	\$706.90
Oct - Dec 2017	\$606.90	N/A	\$100.00	\$706.90
Utility Account 1005441	\$8,630.40	N/A	\$400.00	\$9,030.40
Trades	\$8,630.40	N/A	\$350.00	\$8,980.40
Size of bin/ cart	6 yd	N/A	245 L	N/A
Tips per week	6	N/A	8	N/A
Jan - Mar 2017	\$2,157.60	N/A	\$87.50	\$2,245.10
Apr - Jun 2017	\$2,157.60	N/A	\$87.50	\$2,245.10
Jul - Sep 2017	\$2,157.60	N/A	\$87.50	\$2,245.10
Oct - Dec 2017	\$2,157.60	N/A	\$87.50	\$2,245.10
Water Treatment Centre	N/A	N/A	\$50.00	\$50.00
Size of bin/ cart	N/A	N/A	245 L	N/A
Tips per week	N/A	N/A	1	N/A
Jan - Mar 2017	N/A	N/A	\$12.50	\$12.50
Apr - Jun 2017	N/A	N/A	\$12.50	\$12.50
Jul - Sep 2017	N/A	N/A	\$12.50	\$12.50
Oct - Dec 2017	N/A	N/A	\$12.50	\$12.50

<u>Utility Account Number</u>	<u>Garbage</u>	<u>Cardboard</u>	<u>Mixed Recycling</u>	<u>Grand Total</u>
Utility Account 1020792	N/A	N/A	\$483.04	\$483.04
Library	N/A	N/A	\$483.04	\$483.04
Size of bin/ cart	N/A	N/A	4 yd, 245 L	N/A
Tips per week	N/A	N/A	1,1	N/A
Jan - Mar 2017	N/A	N/A	\$325.25	\$325.25
Apr - Jun 2017	N/A	N/A	\$132.79	\$132.79
Jul - Sep 2017	N/A	N/A	\$12.50	\$12.50
Oct - Dec 2017	N/A	N/A	\$12.50	\$12.50
Utility Account 1020688	N/A	N/A	\$500.00	\$500.00
Open Learning	N/A	N/A	\$500.00	\$500.00
Size of bin/ cart	N/A	N/A	245 L	N/A
Tips per week	N/A	N/A	10	N/A
Jan - Mar 2017	N/A	N/A	\$250.00	\$250.00
Apr - Dec 2017	N/A	N/A	\$250.00	\$250.00
Utility Account 1020793	\$10,029.05	\$1,966.71	\$1,062.50	\$13,058.26
Arts & Education	\$2,695.20	N/A	\$262.50	N/A
Size of bin/ cart	4 yd	N/A	245 L	N/A
Tips per week	3	N/A	7	N/A
Jan - Jun 2017	\$1,302.60	N/A	\$87.50	N/A
Jul - Dec 2017	\$1,302.60	N/A	\$175.00 ²	N/A
Campus Activity Centre	\$7,423.85	\$851.76	\$700.00	\$10,090.56
Size of bin/ cart	6 yd	6 yd	245 L	N/A
Tips per week	5	2	14	N/A
Jan - Jun 2017	\$3,553.80	\$851.76	\$350.00	\$4,755.56
Jul - Dec 2017	\$3,870.05 ³	\$1,114.95 ⁴	\$350.00	\$5,335.00
Horticulture (Recycling Only)	N/A	N/A	\$100.00	\$100.00
Size of bin/ cart	N/A	N/A	245 L	N/A
Tips per week	N/A	N/A	2	N/A
Jan - Jun 2017	N/A	N/A	\$50.00	\$50.00
Jan - Jun 2017	N/A	N/A	\$50.00	\$50.00
Utility Account 1020794	\$2,363.66	\$1,131.52	\$750.00	\$4,245.18
Animal Health Technology	\$655.20	N/A	\$150.00	\$805.20
Size of bin/ cart	4 yd	N/A	245 L	N/A
Tips per week	1	N/A	3	N/A
Jan - Jun 2017	\$327.60	N/A	\$75.00	\$402.60
Jul - Dec 2017	\$327.60	N/A	\$75.00	\$402.60

² Service levels increased from three to seven recycling carts on April 12, 2017.

³ Service changed from City to Waste Connections for garbage collection on November 1, 2017.

⁴ Service changed from twice weekly cardboard collection with the City to three times weekly mixed recycling collection with Waste Connections on November 1, 2017. Charges shown include both cardboard and mixed recycling over the period.

<u>Utility Account Number</u>	<u>Garbage</u>	<u>Cardboard</u>	<u>Mixed Recycling</u>	<u>Grand Total</u>
Stores	\$1,708.46	\$1,131.52	\$600.00	\$3,439.98
Size of bin/ cart	4 yd	4 yd	245 L	N/A
Tips per week	3	2	12	N/A
Jan - Jun 2017	\$815.10	\$565.76	\$300.00	\$1,680.86
Jul - Dec 2017	\$893.36	\$565.76	\$300.00	\$1,759.12
Utility Account 1022015	\$7,513.20	\$1,131.52	\$2,450.00	\$11,094.72
Clocktower	N/A	N/A	\$200.00	\$200.00
Size of bin/ cart	N/A	N/A	245 L	N/A
Tips per week	N/A	N/A	4	N/A
Jan - Jun 2017	N/A	N/A	\$100.00	\$100.00
Jul - Dec 2017	N/A	N/A	\$100.00	\$100.00
International Building	N/A	\$1,131.52	\$500.00	\$1,631.52
Size of bin/ cart	N/A	4 yd	245 L	N/A
Tips per week	N/A	2	10	N/A
Jan - Jun 2017	N/A	\$565.76	\$250.00	\$815.76
Jul - Dec 2017	N/A	\$565.76	\$250.00	\$815.76
Old Main	\$7,513.20	N/A	\$1,750.00	\$9,263.20
Size of bin/ cart	6 yd	N/A	245 L	N/A
Tips per week	6	N/A	35	N/A
Jan - Jun 2017	\$3,179.40	N/A	\$875.00	\$4,054.40
Jul - Dec 2017	\$4,333.80	N/A	\$875.00	\$5,208.80
Grand Total	\$41,184.93	\$7,624.31	\$6,445.54	\$55,254.78

Wood, Metal, Concrete and Mixed DLC Services

The service charges for wood, metal, concrete and mixed demolition, land clearing and construction (DLC) waste are shown in Table 3 by location by quarter, for bin rental, hauling and tipping.

Total costs for the period from April 2017 - March 2018 were \$18,761.50. Annual total weights by commodity are also shown. Wood waste was the highest annual cost at \$11,061.50, followed by DLC at \$3,260.00 metal at \$3,180.00, and lastly concrete at \$1,260.00.

Table 3 - Annual Costs for Wood, Metal, Concrete and DLC Waste Bin Rentals, Hauling and Tipping

	Wood	Metal	Concrete	DLC	Grand Total
Arts & Education	N/A	N/A	N/A	\$1,260.00	\$1,260.00
Apr - Jun 2017	N/A	N/A	N/A	\$420.00	\$420.00
Hauling & Tipping	N/A	N/A	N/A	\$420.00	\$420.00
Jul - Sep 2017	N/A	N/A	N/A	\$840.00	\$840.00
Bin Rental	N/A	N/A	N/A	\$50.00	\$50.00
Hauling & Tipping	N/A	N/A	N/A	\$790.00	\$790.00

Campus Activity Centre	N/A	N/A	\$420.00	N/A	\$420.00
Apr - Jun 2017	N/A	N/A	\$420.00	N/A	\$420.00
Hauling & Tipping	N/A	N/A	\$420.00	N/A	\$420.00
Culinary Arts	N/A	N/A	\$420.00	N/A	\$420.00
Apr - Jun 2017	N/A	N/A	\$420.00	N/A	\$420.00
Hauling & Tipping	N/A	N/A	\$420.00	N/A	\$420.00
McGill Housing	N/A	N/A	\$420.00	\$2,000.00	\$2,420.00
Apr - Jun 2017	N/A	N/A	\$420.00	\$420.00	\$840.00
Hauling & Tipping	N/A	N/A	\$420.00	\$420.00	\$840.00
Jul - Sep 2017	N/A	N/A	N/A	\$1,580.00	\$1,580.00
Bin Rental	N/A	N/A	N/A	\$50.00	\$50.00
Hauling & Tipping	N/A	N/A	N/A	\$1,530.00	\$1,530.00
Old Main	\$696.50	N/A	N/A	N/A	\$696.50
Oct - Dec 2017	\$481.00	N/A	N/A	N/A	\$481.00
Bin Rental	\$20.00	N/A	N/A	N/A	\$20.00
Hauling	\$360.00	N/A	N/A	N/A	\$360.00
Tipping	\$101.00	N/A	N/A	N/A	\$101.00
Jan - Mar 2018	\$215.50	N/A	N/A	N/A	\$215.50
Bin Rental	\$10.00	N/A	N/A	N/A	\$10.00
Hauling	\$180.00	N/A	N/A	N/A	\$180.00
Tipping	\$25.50	N/A	N/A	N/A	\$25.50
Stores	\$10,365.00	\$3,180.00	N/A	N/A	\$13,545.00
Apr - Jun 2017	\$2,100.00	\$700.00	N/A	N/A	\$2,800.00
Hauling	N/A	\$700.00	N/A	N/A	\$700.00
Hauling & Tipping	\$2,100.00	N/A	N/A	N/A	\$2,100.00
Jul - Sep 2017	\$3,150.00	\$765.00	N/A	N/A	\$3,915.00
Bin Rental	\$150.00	\$150.00	N/A	N/A	\$300.00
Hauling	N/A	\$615.00	N/A	N/A	\$615.00
Hauling & Tipping	\$3,000.00	N/A	N/A	N/A	\$3,000.00
Oct - Dec 2017	\$1,950.00	\$850.00	N/A	N/A	\$2,800.00
Bin Rental	\$150.00	\$150.00	N/A	N/A	\$300.00
Hauling	N/A	\$700.00	N/A	N/A	\$700.00
Hauling & Tipping	\$1,800.00	N/A	N/A	N/A	\$1,800.00
Jan - Mar 2018	\$3,165.00	\$865.00	N/A	N/A	\$4,030.00
Bin Rental	\$165.00	\$165.00	N/A	N/A	\$330.00
Hauling	N/A	\$700.00	N/A	N/A	\$700.00
Hauling & Tipping	\$3,000.00	N/A	N/A	N/A	\$3,000.00
Grand Total	\$11,061.50	\$3,180.00	\$1,260.00	\$3,260.00	\$18,761.50
Total Weight (kg)	27390	15820	7030	16185	66425

5 Waste Outputs

Garbage Outputs

Weight and volume measurements for each garbage collection location were recorded during the audit. Each garbage bin was measured on collection day.

Table 4 shows the weekly waste outputs for each garbage collection location over the audit weeks for 2016, 2017, and 2018 audits. Total weight output increased by 18 % from in 2018 from 4893 kg per week in 2017 to 5934 kg per week in 2018, while 2017 levels increased by eight % over 2016 levels from 4508 to 4893 kg per week.

Table 4 - Weekly Waste Outputs by Weight by Garbage Collection Location

Garbage collection location	Total weight (kg/week) 2016	Total weight (kg/week) 2017	Total weight (kg/week) 2018
Animal Health Technology	129	141	177
Arts & Education	225	81	161
Campus Activity Centre	705	580	947
Culinary Arts	978	1123	1410
Daycare	427	332	245
Old Main	803	560	750
Science / Gym	287	588	548
Stores	204	325	155
Trades Bags	223	221	213
Trades DLC	527	580	967
Trades Sawdust ⁵	not measured	361	361
Total	4508	4893	5934

Table 5 shows the weekly volume measurements by garbage collection location in cubic yards per week over the audits weeks for 2016, 2017 and 2018. Total volume output increased by 8% in 2018 from 111 cu.yd. per week in 2017 to 121 cu.yd. per week in 2018, while 2017 levels increased by 1 % over 2016 levels from 110 to 111 cu.yd. per week in 2017.

Table 5 also shows the weekly capacity in volume of each garbage collection location for 2017 and 2018 and the utilization rate for each location. Capacity is calculated by multiplying the size of the bin by the frequency of collection. Utilization rates are calculated by dividing the outputs by the capacity for each location.

The average utilization rate decreased from 58% in 2017 to 57% in 2018. Locations with the highest utilization rates were Science/ Gym (113%), Trades - DLC (97%) and Culinary Arts (91%). Locations with the lowest utilization rates during the audit were Trades - bags (25%), Daycare (29%), Stores (35%), Campus Activity Centre (37%), and Arts & Education (40%).

⁵ Trades sawdust bin weight was estimated based on volume using a density of 0.21 kg per litre.

Table 5 - Weekly Waste Outputs by Volume by Garbage Collection Location and Garbage Bin Utilization Rates

Garbage collection location	Volume outputs (cu.yd. per week)			Volume capacity (cu.yd. per week)		Utilization rate (volume output/volume capacity)	
	2016	2017	2018	2017	2018	2017	2018
Animal Health Technology	2	1	2	4	4	13%	44%
Arts & Education	6	2	5	12	12	18%	40%
Campus Activity Centre	15	15	11	24	30	64%	37%
Culinary Arts	27	25	33	30	36	84%	91%
Daycare	8	8	6	12	20	63%	29%
Old Main	23	20	23	30	36	65%	63%
Science / Gym	9	11	14	12	12	94%	113% ⁶
Stores	7	4	4	8	12	50%	35%
Trades Bags	8	12	5	18	18	68%	25%
Trades DLC	8	11	18	18	18	61%	97% ⁷
Trades Sawdust	not measured	2	2	4	4	56%	56%
Total	110	111	121	172	202	58%	57%

Diverted Wastes

TRU diverts many types of waste through reuse, recycling, composting and conversion to energy. The following section reports the weekly diversion weights for the 2015 - 2018 audit periods and discusses the methods of diverting the many waste streams generated on campus.

Reuse

TRU has three reuse streams: textbooks, textiles and reusable items, and office items sold through BC Bid.

Textbooks

Textbooks are collected from the on-campus community, and the general public. A textbook collection bin is located outside the campus bookstore, as shown in Figure 1. Ancillary services collect the books from the bins on an as-needed basis and donates them to a program called Textbooks For Change. Approximately four to five pallets of books are donated through the program on an annual basis. For more information about the program, visit Textbooks For Change website [here](#).

Figure 1 - Textbook collection bin



⁶ Two events took place over the weekend during the 2018 audit. Both events placed waste in the Science/ Gym garbage bin resulting in a higher than normal volume output during the week.

⁷ Waste in the two bins at Trades for bags and DLC was mixed. For the purposes of the audit, waste was reported separately for bags and DLC-type materials.

Textiles and Reusable Items

In 2018, TRU brought in bins to help divert the usable items that make their way into the campus waste stream, such as clothing, shoes, books, office supplies, and other durable goods. Diabetes Canada placed two bins on campus - one outside the Daycare and the other outside Old Main. In the first two months of the program, 148 kg of items were collected from donation bins, as reported from Diabetes Canada.

BC Bid

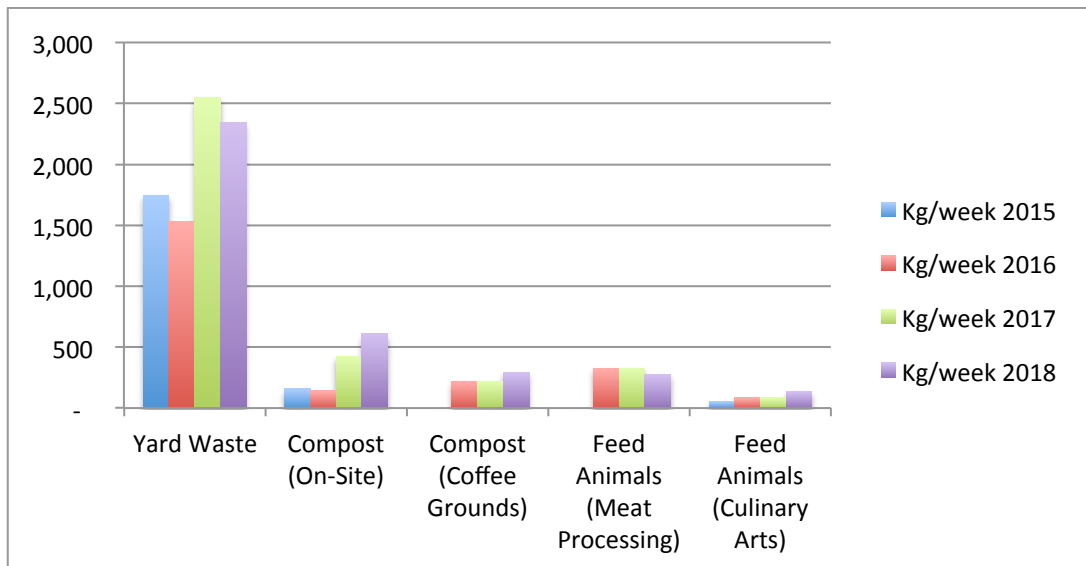
When TRU replaces office furniture, the old items that are in good condition are sold through BC Bid. Data for 2018 was not provided. Weights reported for 2018 were assumed at the 2017 weights.

Organic Diversion

TRU diverts organic waste into several channels for composting or animal feed. The Culinary Arts and Meat Processing Departments send their scraps to local farmers, yard waste from TRU Grounds is sent to Cinnamon Ridge Composting Facility, coffee grounds are collected by a faculty member and brought home to his hobby farm for composting. Lastly, TRU has onsite composting for food scraps collected through zero waste stations and kitchens.

Figure 2 shows the amount of material diverted through composting over the last four audits in kg per week.

Figure 2 - Diversion - Organic Waste Streams 2015 - 2018



Feed Animals - Culinary Arts

The Culinary Arts program diverts kitchen scraps to a local farmer on a weekly basis. The farmer uses the scraps to feed pigs and chickens. Data is estimated for this waste stream by measuring one-week's worth of scraps sent to the farmer. The Culinary Arts program does not track pickups and so data is assumed to be an estimate. As shown in the chart above, the samples measured have been steadily increasing, from 54 kg in 2015, 85 kg in 2016, 86 kg in

2017 and 137 kg in 2018. A new farmer started collecting material in 2017, and according to the head of the Culinary Arts Department, is more consistent with their pickups so there are less constraints with storage of waste material (which is stored in the fridge to keep fresh). Annual outputs were estimated by multiplying the weekly output by 34 weeks (the duration of the program).

Feed Animals - Meat Trimmings

The Meat Processing Department began sending their meat trimmings to a local dog breeder in 2016. The trimmings are stored in their fridge and collected on a weekly basis on Fridays. Data for 2016 was measured over a one-week period with a weekly output of 327 kg. In 2017, meat trimmings were assumed to be the same as the previous year. In 2018, meat trimmings were again measured over a one-week period, which measured 276 kg. Data is not tracked by the Meat Processing Department. Annual outputs were estimated by multiplying the weekly output by 34 weeks (the duration of the program).

Compost - Zero Waste Stations and Kitchens

TRU implemented onsite composting in 2014 with the purchase of a Jora 2100. In 2016, TRU purchased a second composter but due to some technical issues, the second unit was not fully operational until 2017. In 2017 the university was given an anaerobic digester, which has been installed outside the Campus Activity Centre. The digester was not being used at the time of this audit.

Data tracking has improved for this waste stream. In 2015, data was estimated by multiplying measured samples over a period of time. In 2016, data was measured for most of the year, but gaps in tracking resulted in using averages to calculate total annual weights for missing data. Since January 2017, data has been consistently measured, providing actual reporting for the 2017-2018-audit period. On-site composting increased from 16,758 kg in 2017 audit period to 33,009 kg in the 2018 audit period.

Compost - Coffee Grounds

In 2016, faculty member Charles Hays began collecting coffee grounds from the cafes around campus, and taking them home to create compost to improve soil quality in the rocky area of Black Pines. Figure 3 shows Charles and his coffee-ground collection setup.

Data was measured over a one-week period in 2016 and again in 2018. In 2016, 221 kg were measured over the week during the audit, which grew to 294 kg over the same week in 2018. The methodology in the section 2 above describes how annual outputs were calculated for this waste stream.



Figure 3 - Professor Charles Hays collecting coffee grounds from cafes around campus

Compost - Yard Waste

The largest source of organic waste and third largest source of waste comes from maintaining the campus grounds. The head of ground maintenance began tracking the number of loads of

yard waste brought to the McGill Yard Waste Site each year starting in 2016. Each load is estimated at 227 kg, based on an average estimated by the head of the grounds based on a series of loads weighed on a nearby scale.

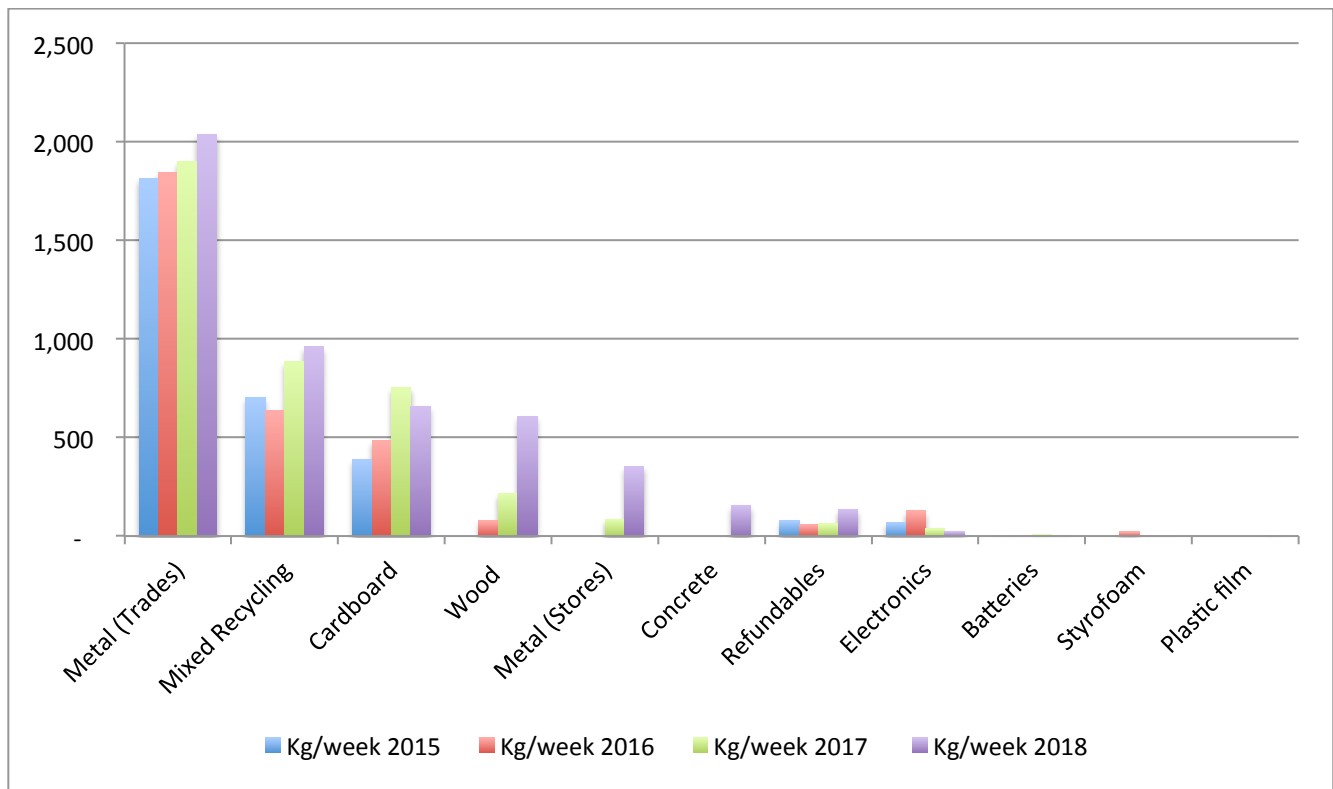
Yard waste reduced from 114,091 kg in the 2017 audit to 104,774 kg in 2018. Weekly output for yard waste was calculated by dividing the annual output by 45 weeks.

Recycling

TRU diverts a number of waste materials through recycling. Scrap Metal is the largest source of recycled waste on campus, largely a result of the Trades and Technology Department, but also Facilities Services. Mixed recycling and refundable beverage containers are collected across campus in zero waste stations. Cardboard is mostly generated by staff and recycled in bins outside, and also collected in carts. There are also bins to collect batteries, Styrofoam, and plastic bags in all buildings, as well as electronics recycling bins in two buildings (Old Main and International Building).

Figure 4 shows the amount of material diverted through recycling over the last four audits in kg per week.

Figure 4 - Recycling Waste Streams 2015 - 2018



Recycling - Scrap Metal Trades & Facilities Services

Scrap metal is the second largest source of waste, and the largest source of recycled waste on campus. The Trades and Technology Department recycles scrap metal through Richmond Steel and uses several bins to sort different types of metals, for which they are compensated. In 2017, the Sustainability Office sourced a scrap metal bin for Facilities Services. The bin is hauled to

Mission Flats Landfill and put in the scrap metal pile. TRU is not compensated for this metal. As shown in the chart above, scrap metal is a significant source of recycled waste.

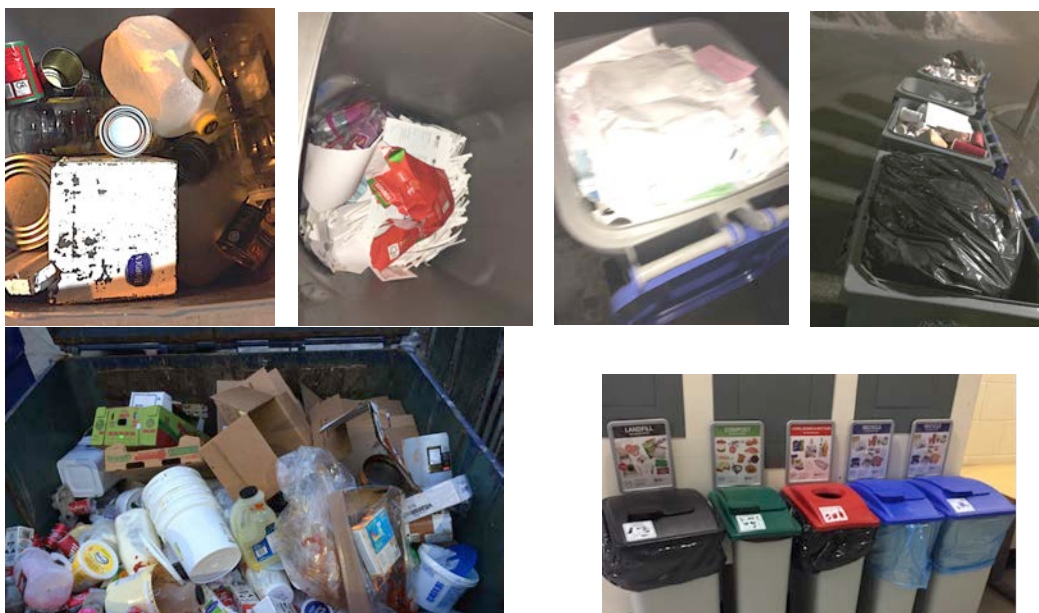
Recycling - Wood

The wood recycling program began in the trades department in early 2016, where the Sustainability Office set up a firewood bin for students to fill and use for home and campfires. An estimated 79 kg per week was diverted through this system in 2016, and continues to be in place and used by students and staff. In September 2016, the Sustainability Office placed a wood recycling bin outside Facilities Services building, increasing the weekly recycling rate for wood to 245 kg in 2017. In 2018, TRU further expanded the wood recycling program, sourcing wood bins for the Theatre and Fines Arts programs to fill at three times throughout the year (after each production performance). In 2018 TRU recycled 609 kg of wood per week, with a total of 27,390 kg during the 2018 audit year, up from 10,880 kg in 2017 audit year. Weekly outputs were calculated by dividing the annual output by 45 weeks.

Recycling - Mixed Recycling

Mixed recycling includes paper and packaging materials (plastic, paper, metal). Mixed recycling is collected across campus from zero waste stations and directly placed into recycling carts from offices, cafes, kitchens, and occasionally from events. Janitors are responsible for placing mixed recycling from the zero waste stations into 245-litre recycling carts distributed across campus. Carts are placed at the curb on a weekly basis by staff and contractors. Mixed recycling is also collected in a 6-yard bin outside the Campus Activity Centre (prior to November 2017 this was a cardboard-only bin).

Figure 5 - Mixed recycling collected across campus. Top right to left: Culinary Arts, Old Main Print Shop, Open Learning, Science building. Bottom: Comingled 6-yard bin outside the Campus Activity Centre, zero waste station inside Old Main



Mixed recycling is estimated by measuring one-week's worth of recycling placed at the curb. Mixed recycling was measured at 705 kg per week in 2015, 636 kg per week in 2016, 883 kg per week in 2017 and 960 kg per week in 2018. The methodology in the section 2 above describes how annual outputs were calculated for this waste stream.

Contamination was found in most of the recycling carts - mainly from bags. There was also scrap metal, organics, textiles, and engine oil (full). Recycling was also found in the garbage dumpsters.

Recycling - Cardboard

Cardboard is collected in four and six yard bins outside five buildings on campus. Cardboard is placed in bins by staff and contractors. In 2017, TRU placed signs on cardboard bins to remind everyone to flatten boxes, shown in Figure 6. There was a noticeable improvement in flattened boxes during the audit.

Cardboard was measured over a one-week period during the audit. In 2018, cardboard rates decreased slightly over 2017. 658 kg of cardboard were measured over the week in 2018, down from 753 kg per week in 2017. In 2016 there was 484 kg per week and in 2015 there was 389 kg per week. The methodology in the section 2 above describes how annual outputs were calculated for this waste stream.

Figure 6 Signage on cardboard bins reminding staff to flatten boxes



Recycling - Refund Beverage Containers

A class from Kamloops School of the Arts are is responsible for recycling refund beverage containers as part of their class curriculum. The students and staff collect beverage containers from zero waste stations, twice per week. In 2017 the group began collecting from Ancillary Services for event waste as well, which accounts for some of the increase to this waste stream for 2018.

Beverage containers were measured over the week. In 2018, 137 kg were measured, an increase from 62 kg in 2017, 59 kg in 2016 and 78 kg in 2015. The methodology in the section 2 above describes how annual outputs were calculated for this waste stream.

The school staff person responsible for the refund beverage container recycling program mentioned that contamination seemed higher in 2018 than in previous years. Contamination for this waste stream is discussed at the end of section 7 below. Bags of refundable beverage containers were observed in the garbage during the audit, as shown in Figure 7.

Figure 7 - Refundable beverage containers found in the garbage



Recycling - Plastic Bags & Overwrap

In September 2017, TRU separated out the plastic bags stream from being collected as part of zero waste stations to collected in stand-alone bins in each building as shown in Figure 8. As such, the contamination of these bins has improved to almost nothing, according to TRU staff. Prior to 2017, the material

Figure 8 - Plastic film recycling bins removed from zero waste stations



collected in plastic bag bins was placed in mixed recycling carts, as this material was previously accepted through the recycling program. The contamination rate for this stream was 84% in 2017.

TRU staff tracked the number of bags of plastic bags brought to the recycling depot. Diversion began in September 2017 resulting in 31 kg of bags recycled over 6 month period.

Recycling - Styrofoam

TRU began recycling Styrofoam in 2016, collected in bright yellow totes in all buildings around campus, as shown in Figure 9. TRU counts the number of bags brought to General Grants Recycling Centre and multiplies each bag by a rate of 1.13 kg per bag to estimate the amount of foam packaging diverted. In 2018 TRU recycled 130 kg of Styrofoam over the 2018 audit period, or 3 kg per week. In 2017 of 102 kg was recycled (2 kg per week).

Figure 9 - Styrofoam collection bins located across campus



Recycling - Batteries

Batteries are collected in 13 bins across all major buildings on campus. Batteries are emptied on a monthly (or so) basis by Facilities Services. The batteries are stored and sent to a recycler on a quarterly basis. Battery recycling in 2018 reduced from six kg per week in 2017 to five kg per week in 2018.

Recycling - Electronics

In 2017, TRU partnered with the Electronics Recycling Association (ERA) to recycle the e-waste from campus. ERA set up two collection bins, one in the Campus Activity Centre and the other in the Old Main building. ERA also picks up TRU's e-waste that is collected by Facilities Services. ERA provides certificates with descriptions and weights for material recycled through the program.

Figure 10 - Electronics Recycling Association certificates provided for collection of e-waste on campus



Electronic waste weights reported for 2018 represent the 2017 calendar year. TRU recycled 1066 kg of e-waste in 2017, down from 1659 kg in 2016. Prior to 2016, e-waste was grossly estimated.

Converted to Energy

Several waste streams are incinerated and or converted to energy, which include cooking oil from the Culinary Arts Program and the Campus Activity Centre kitchens and hazardous waste.

Cooking Oil

The Culinary Arts building and the Campus Activity Centre kitchens collect used cooking oil. The oil is collected by McLeod's Byproducts in Armstrong and converted to biofuel. Data was not provided for 2018. Data for this audit used the 2017 figures.

Hazardous Waste

The TRU Safety Office manages the hazardous waste generated through various departments (trades, and labs). In 2017 approximately 213 kg of hazardous waste was sent to be incineration, up to 410 kg in 2018. In 2017 the Safety Office began sent 100 kg of oil soaked absorbent to the hazardous waste facility rather than putting it in the garbage dumpsters like in previous years.

6 Diversion, Recovery and Waste Generation Rates

Diversion Rates

Diversion rates compare the amount of material diverted to the total amount of material generated (landfilled plus diverted). The following section discusses the overall diversion rate, as well as diversion rates for the institutional type waste (ICI) and maintenance type waste (DLC).

Diversion rates are calculated based on annual weights. As discussed in the diverted wastes section above, measurements for wastes vary, some are actuals (wood, metal, on-site compost, DLC) and others are estimations (all other waste streams).

Table 6 shows the total annual waste streams diverted and landfilled from 2015 - 2018 in kg per year, as well as the diversion rates for ICI-type waste, DLC-type waste and overall (ICI plus DLC). Yard waste would technically be considered ICI waste, however due to the high output of this type of waste, it has been classified as DLC. The weights for the Trades DLC and Stores waste were included in the DLC landfilled totals.

ICI Diversion Rates

The ICI diversion rate has been steadily increasing from 24 % in 2015, 35 % in 2016, 44 % in 2017 and 46 % in 2018, in part due to improved data collection during the audits, but also from increased diversion of various waste streams.

New diversion programs for plastic bags and textiles were implemented during the 2018 audit cycle. On-site composting saw the greatest increase in diverted waste from 16,375 kg in 2017 to 33,009 kg in 2018, an increase of 50 %. Hazardous waste also increased significantly over the year from 213 kg in 2017 to 410 kg in 2018, as the program began diverting oil-soaked absorbent from Trades in 2018.

Refundable beverage containers diverted increased by 60 % in 2018 from 2356 kg in 2017 to 5943 kg in 2018 as the program began collecting beverage containers from events, which were previously managed by the contractor and not captured in the audits. Diversion for coffee grounds, compost to farmers from the Culinary Arts, mixed recycling and Styrofoam also increased in 2018.

Electronics saw the greatest reduction in diverted material, from 1659 kg in 2017 to 1066 kg in 2018. The reduction in electronics could be attributed to improved data collection through a new electronics recycler. Battery recycling also reduced in 2018. The battery waste stream is variable. Meat processing scraps and cardboard recycling also decreased in 2018.

DLC Diversion Rates

DLC diversion rates have varied since 2015, and are largely impacted by the amount of waste generated in the Trades DLC and Stores bins, which increased by approximately 500 kg per week in 2018 over 2017 levels. The DLC diversion rates were 81 % in 2015, 88 % in 2016, 84 % in 2017 and 74 % in 2018.

DLC type waste included additional data from construction projects on campus in 2018 that was not captured in previous audits (16,185 kg in 2018). The amount of DLC waste diverted has increased since 2015, with 172,303 kg in 2015, 175,828 kg in 2016, 213,862 kg in 2017, and 246,784 kg in 2018.

Table 6 Total Annual Waste Streams Diverted and Landfilled (kg/year) 2015 - 2018

Class	Destination	Stream	Kg/ year 2015	kg/year 2016	Kg/year 2017	Kg/year 2018
ICI	Composted	Feed Animals (Culinary Arts)	1,836	2,890	2,924	4,658
ICI	Composted	Feed Animals (Meat Processing)	-	11,118	11,152	9,384
ICI	Composted	Compost (On-Site)	6,986	4,997	16,375	33,009
ICI	Composted	Compost (Coffee Grounds)	-	8,328	8,507	13,230
ICI	Converted	Hazardous waste	Not included	Not included	213	410
ICI	Converted	Cooking Oil - CAC	Not included	Not included	3,000	3,000
ICI	Converted	Cooking Oil - CA	Not included	Not included	1,080	1,080
ICI	Recycled	Mixed Recycling	27,943	24,984	34,002	35,661
ICI	Recycled	Cardboard	15,718	18,322	28,997	25,755
ICI	Recycled	Refundables	3,493	1,666	2,373	5,943
ICI	Recycled	Electronics	3,493	4,997	1,659	1,066
ICI	Recycled	Styrofoam	-	1,666	102	130
ICI	Recycled	Batteries	117	76	220	190
ICI	Recycled	Plastic bags	-	-	-	31
ICI	Reused	Resold/ Reuse	5,239	1,666	1,376	1,408
ICI	Reused	Text books	-	-	5,460	5,460
ICI	Reused	Textiles and Household	-	-	-	148
ICI	Landfilled	Garbage	210,999	146,909	146,532	167,176
DLC	Landfilled	DLC	39,144	24,333	41,281	88,746
DLC	Composted	Yard Waste	90,718	78,182	114,091	104,773
DLC	Recycled	Wood	-	3,555	10,880	27,390
DLC	Recycled	Metal (Trades)	81,585	94,091	85,001	91,771
DLC	Recycled	Metal (Stores)	0	0	3890	15,820

DLC	Recycled	Concrete	-	-	-	7,030
	Total ICI Diversion	64,825	80,709	117,440	140,564	
	Total ICI Landfill	210,999	146,909	146,532	167,176	
	Total ICI Generated	275,824	227,618	263,972	307,740	
	ICI Diversion Rate	24%	35%	44%	46%	
	Total DLC Diversion	172,303	175,828	213,862	246,784	
	Total DLC Landfilled	39,144	24,333	41,281	88,746 ⁸	
	Total DLC Generated	211,447	200,161	255,143	335,530	
	DLC Diversion Rate	81%	88%	84%	74%	
	Total Diversion	237,128	256,537	331,302	387,348	
	Total Landfill	250,143	171,243	187,813	255,922	
	Total Generated	487,271	427,779	519,115	643,269	
	Diversion Rate	49%	60%	64%	60%	

Recovery Rates

Recovery rates compare the amount of each material diverted as a % of the total amount of each material generated (diverted plus landfilled) in kg per week. The amount of material landfilled per week is estimated based on the overall composition data (discussed in the landfill waste stream section below). Table 7 shows the amount of each material group diverted and landfilled as well as the recovery rates from 2015 - 2018.

TRU began diverting plastic bags in 2017 as a result of changes to the mixed recycling collection regulations. The recovery rate for this type of material was very low in 2018 (1%), which caused the average recovery rate across all waste streams to reduce from 71% in 2017 to 68% in 2018, despite improved recovery rates for most materials. Discounting the rate for plastic bag recovery, the average recovery rate improved in 2018 to 76%.

Recovery rates improved for most materials in 2018, including mixed recycling, refundable beverage containers, wood and electronic waste. Refundable beverage containers saw the greatest recovery rate due to an increased amount diverted through collection, as result of the collectors taking on the collection of beverage containers from events, previously managed by the contractor.

Wood saw an increased recovery from 31% in 2017 to 42% in 2018, a result of implementing wood waste diversion for the Stores and Old Main buildings. Mixed recycling recovery rates increased from 47% in 2017 to 52% in 2018, which could be attributed to improved signage at zero waste stations. Electronic waste recovery also significantly improved, however this material type is highly variable.

Recovery rates for compost and reusable items reduced in 2018. Recovery of compost reduced from 76% to 67%, largely a result of significantly more food scraps found in the garbage in the Culinary Arts samples, which had been very low in 2016 and 2017. Reusable item recovery reduced from 77% in 2017 to 54% in 2018.

⁸ Includes 16,185 kg of mixed DLC from construction projects on campus. This waste stream was not previously included in audits.

Table 7 - Recovery Rates for Materials Diverted and Landfilled 2015 - 2018 (kg/week)

Materials	2015	2016	2017	2018	Recovery rate 2015	Recovery rate 2016	Recovery rate 2017	Recovery rate 2018
Batteries	3.1	2.0	5.9	5.0	100%	100%	100%	100%
Diverted	3.1	2.0	5.9	5.0				
Landfilled	0.0	0.0	0.0	0.0				
Cardboard	487.3	498.3	778.6	678.3	80%	97%	97%	97%
Diverted	389.3	484.4	752.6	658.0				
Landfilled	98.0	13.9	26.0	20.3				
Compost	3922.0	3859.1	4771.2	5390.1	48%	60%	76%	67%
Diverted	1866.0	2310.5	3611.8	3659.0				
Landfilled	2056.0	1548.6	1159.4	1731.1				
Electronic Waste	117.2	128.3	64.0	24.0	58%	100%	58%	100%
Diverted	67.5	128.3	37.1	24.0				
Landfilled	49.7	0.0	26.9	0.0				
Mixed Recycling	1838.0	1583.2	1890.1	1800.2	38%	40%	47%	52%
Diverted	705.3	635.8	882.5	960.0				
Landfilled	1132.7	947.4	1007.6	840.2				
Refundable beverage containers	158.0	81.5	104.6	194.4	49%	73%	59%	70%
Diverted	78.0	59.3	61.6	137.0				
Landfilled	80.0	22.2	43.0	57.4				
Reusable (donated/sold)	304.6	38.9	203.7	290.7	40%	92%	77%	55%
Diverted	121.8	35.7	157.8	161.0				
Landfilled	182.8	3.2	45.9	129.7				
Scrap metal	1971.8	2036.0	1927.6	2077.3	92%	91%	99%	99%
Diverted	1812.7	1844.9	1901.0	2052.0				
Landfilled	159.1	191.1	26.6	25.3				
Wood	0.0	91.4	783.1	1510.1	Not measured	87%	31%	42%
Diverted	0.0	79.2	243.3	639.0				
Landfilled	0.0	12.2	539.8	871.1				
Plastic bags	0.0	0.0	0.0	63.8	Not measured	Not measured	Not measured	1%
Diverted	0.0	0.0	0.0	0.7				
Landfilled	0.0	0.0	0.0	63.1				
Grand Total⁹	8802.0	8318.7	10528.7	12033.9	63%	82%	71%	69%¹⁰

Population and Per-Capita Waste Output

Table 8 below shows student, staff and total population for each semester from 2015 - 2018, as well as the number of weeks in each semester. The remainder period accounts for the time when school is not in session but staff are still on campus generating waste. The remainder population is assumed to be 75 % of staff population.

Table 8 Student and Staff Population 2015 - 2018

Year	Summer	Fall	Winter	Remainder
Number of weeks	14	15	16	6
2015 Total	1859	4730	4489	974

⁹ Grand totals do not reflect the entire waste stream as not all materials are shown and do not event waste.

¹⁰ The average recovery rate discounting plastic bag recovery was 76%.

	Students	578	3449	3208	0
	Staff	1281	1281	1281	974
	Total	1763	4473	4365	824
2016	Students	664	3374	3266	0
	Staff	1099	1099	1099	824
	Total	1885	4654	4504	876
2017	Students	717	3486	3336	0
	Staff	1168	1168	1168	876
	Total	2365	4995	5201	1144
2018	Students	840	3470	3676	0
	Staff	1525	1525	1525	1144

Table 9 shows the landfill, diversion and total weekly per capita waste generation rates from 2015 - 2018. Per capita rates are calculated by dividing the estimated weekly output for landfill and diversion during the winter semester by the population in the winter semester.

Weekly per capita rates for landfilled material increased in 2018 from 1.08 kg per person per week in 2017 to 1.14 kg per person per week in 2018. Per capita rates for diverted waste decreased from 1.74 kg per person per week in 2017 to 1.70 kg per person per week in 2018. Total per capita rates increased from 2.82 kg per person per week in 2017 to 2.84 kg per person per week in 2018.

Table 9 Weekly Per Capita Landfill and Diversion Generation Rates 2015 - 2018

	2015	2016	2017	2018
Landfilled (kg/person/week)	1.73	1.03	1.08	1.14
Diverted (kg/person/week)	1.18	1.28	1.74	1.70
Total (kg/person/week)	2.91	2.31	2.82	2.84

7 Landfill Waste Stream Composition and Outputs

The section below discussed the amount of waste landfilled by material group based on the total output of materials audited for composition for each source of waste for the 2015 to 2018 audits.

Materials were sorted into 29 categories. Figures below show various groupings of materials based on the manner in which they can be diverted for the overall (combined) and each source of waste, shown in Table 10.

Table 10 - Garbage Composition Material Classification

Material	Expanded Material Group	Material Group	Material Details
1.2 Cardboard	Paper	Cardboard	Corrugated cardboard boxes (including pizza boxes)
8.2. Food waste - scraps	Food Waste	Compost	Food scraps not considered edible such as peels, cores, bones, tea bags and coffee grinds
8.3. Food waste - preventable	Food Waste	Compost	Food waste considered to be edible prior to disposal such as uneaten food and wasted food (unsold food from vendors)
8.6. Yard waste	Yard Waste	Compost	Plants, leaves, branches, soil, dirt from sweepings, rocks, etc.
8.4. Compostable paper	Compostable Paper	Landfill	Paper towel, napkins and paper containers soiled from food but not including paper food containers used by vendors on campus to serve food. Examples include McDonalds food containers
8.5. On-campus paper food containers	Compostable Paper	Landfill	Disposable paper containers used to serve food from on campus vendors and not fit for recycling. Examples include soup bowls, Tim Hortons containers and paper bags, paper clamshell containers and paper plates
8.7. Fats and oils	Fats and Oils	Landfill	Fats and oils
8.8. Dog and cat feces	Animal feces	Landfill	Dog and cat feces, including kitty litter and bags
10.1. Garbage bags	Residuals	Landfill	Clear or black garbage bags
10.2. Diapers	Residuals	Landfill	Diapers
10.4 k-cups	Residuals	Landfill	Single-use coffee and tea pods not including pods that were properly emptied and recycled
10.6. Disposable utensils	Residuals	Landfill	Disposable plastic utensils (only for the event waste sample due to the high amount of this material found in the sample)
10.5. Remainder / miscellaneous	Residuals	Landfill	Material that does not fit into any of the above categories including plastic laminates (chip bags, candy wrappers), pallet wrap, chopsticks, rubber bands, textiles, disposable cloths, disposable gloves, plastic bags contaminated with food, plastic products (including straws and stir sticks), welding rods (trades).

10.3. Liquids	Liquids	Liquids	Residual liquids, mainly from beverages
1.1. Paper	Paper	Mixed Recycling	Copy paper, envelopes, post-its, box board, newspaper, magazines, flyers, books, kraft paper
1.3. Coffee cups	Coffee Cups	Mixed Recycling	Disposable coffee and drink cups (not including lids)
1.5. Other paper containers	Paper	Mixed Recycling	Disposable paper containers fit for recycling but not including paper containers generated on-campus. Examples include milk cartons, paper coffee containers, boxes for chocolates, and paper containers from off-campus sources.
2.1. Plastic packaging	Plastic	Mixed Recycling	Disposable plastic containers and lids <u>not</u> including those generated on campus food vendors for serving food. Examples include milk jugs, soap dispensers, yogurt cups, muffin trays, and moulded plastic packaging for batteries, etc.
2.2. On-campus plastic food containers	Plastic	Mixed Recycling	Disposable plastic containers used to serve food from on campus vendors
3.1. Metal food packaging	Metals	Mixed Recycling	Metal packaging material including cans, aluminum foil, aluminum trays
2.3. Plastic film	Plastic	Other recycling	Grocery bags, overwrap, and other polyethylene plastic film
2.4. Styrofoam	Plastic	Other recycling	Foam packaging (trays, packing material)
3.2. Metal products	Metals	Other Recycling	Metal from non-packaging sources including screws, nails, paper clips, brackets but does not include electronic waste
4.1. Glass food containers	Glass	Other Recycling	Glass packaging material such including jars and bottles but does not include refundable beverage containers (juice bottles, alcoholic beverage bottles, etc.)
5.1 Electronic Waste	E-Waste	Other Recycling	Electronic waste including cell phones, headphones, electronic storage devices (e.g. DVDs, thumb drives), and items accepted in the provincial electronics recycling program
6.1. Hazardous Waste	Hazardous Waste	Other Recycling	Items containing hazardous material including CFL tubes, paints, solvents, pesticides, flammables, and other hazardous waste
7.1. Refundable beverage containers	Refundables	Other Recycling	Material accepted in the provincial recycling program for beverage containers for which there is a deposit and refund including plastic and glass bottles, cans, and juice boxes.
11.1. Wood	Wood	Other Recycling	Wood and sawdust
9.1. Reusable	Reusable	Thrift	Items deemed in usable condition such as clothing, office supplies, unused toilet paper rolls, and other usable products but not including edible food

Overall Landfill Waste Stream By Material Group And Source

Figure 11 shows the estimated waste output for the overall garbage stream by material group in kg per week for the 2015 - 2018 audits. A further breakdown of the source of the waste materials is shown in Table 11.

Figure 11 - Overall landfill waste stream by material group 2015 - 2017 (kg/week) - weights

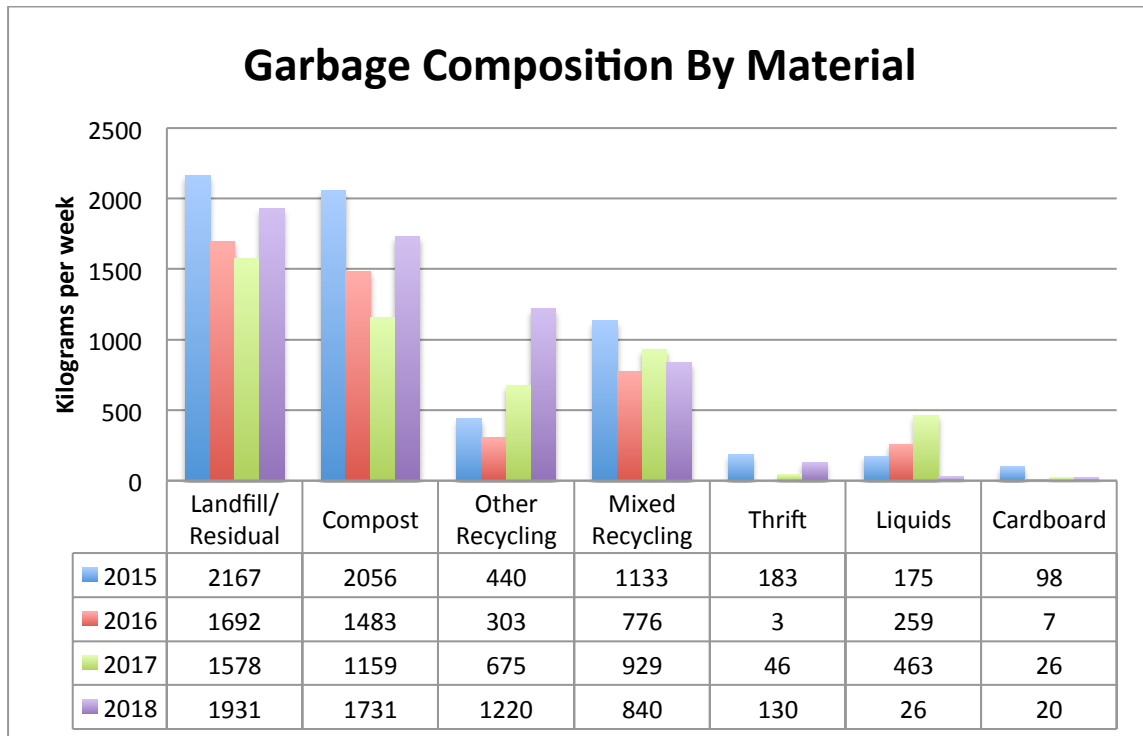


Table 11 - Garbage Materials By Source 2015 - 2018

Material Group Source	2015	2016	2017	2018
Residual	2167	1692	1578	1931
ZWS Garbage	860	626	551	567
Trades	578	434	340	367
Café	54	87	138	237
Washrooms	284	146	115	191
Kitchen (CAC)	70	68	58	171
AHT	48	114	108	157
Offices	156	129	74	99
Kitchen (Culinary Arts)	Mixed CAC	20	129	77
Stores	68	44	26	36
Science Labs	19	16	0	27
Stand Alone	Not audited	0	1	3
Daycare	31	8	36	Not audited
Compost	2056	1483	1159	1731
Kitchen (Culinary Arts)	Mixed CAC	272	74	633

ZWS Garbage	959	517	486	488
Kitchen (CAC)	543	397	278	338
Café	241	130	109	153
Offices	218	121	101	80
Washrooms	11	30	26	17
AHT	24	6	19	14
Stores	54	0	9	6
Science Labs	3	0	0	2
Stand Alone	Not audited	Not audited	1	1
Daycare	3	8	58	Not audited
Other Recycling	440	303	675	1220
Trades	151	93	564	944
Stores	8	87	33	157
Café	42	10	13	38
ZWS Garbage	135	64	52	33
Kitchen (CAC)	11	8	3	22
Offices	82	18	5	11
Washrooms	7	6	0	11
Kitchen (Culinary Arts)	Mixed CAC	13	0	2
AHT	3	1	2	1
Science Labs	1	0	0	1
Stand Alone	Not audited	Not audited	0	1
Daycare	0	2	1	Not audited
Mixed Recycling	1133	776	929	840
ZWS Garbage	696	472	591	514
Café	76	51	48	91
Offices	172	162	130	85
Kitchen (Culinary Arts)	Mixed CAC	3	17	66
Kitchen (CAC)	61	41	41	32
Washrooms	28	37	29	27
Stores	38	0	46	12
Trades	51	0	4	5
Science Labs	3	2	0	3
Stand Alone	Not audited	Not audited	1	3
AHT	8	4	7	0
Daycare	0	4	14	Not audited
Thrift	183	3	46	130
ZWS Garbage	47	0	0	56
Kitchen (CAC)	5	1	0	34
Offices	8	1	21	25
Washrooms	1	0	0	11

Stores	20	0	24	5
AHT	100	0	1	0
Café	2	2	0	0
Science Labs	0	0	0	0
Liquids	175	259	463	26
ZWS Garbage	139	236	446	23
Washrooms	4	12	10	2
Stand Alone	Not audited	Not audited	0	1
Stores	8	0	0	1
AHT	3	0	0	0
Café	4	7	0	0
Kitchen (CAC)	10	1	1	0
Offices	8	2	5	0
Science Labs	0	1	0	0
Cardboard	98	7	26	20
Trades	3	0	21	12
ZWS Garbage	12	0	0	7
AHT	0	0	0	1
Washrooms	0	0	0	1
Café	11	2	0	0
Kitchen (CAC)	71	3	0	0
Offices	0	2	0	0
Stores	0	0	5	0
Grand Total	6252	4523	4875	5898

Landfill/ Residual Materials By Source

Landfill/ residual remained as the most abundant material found in the garbage in the 2018 audit, with an estimated 1931 kg per week, up from 1578 kg per week in 2017. Examples of landfill/ residual materials include paper not fit for recycling due to food contamination, paper towels and napkins, dog and cat feces, garbage bags, plastic laminate packaging (e.g. chip bags), drywall, welding rods and disposable utensils.

Nearly 30 % of landfill/ residual materials were found in the zero waste station garbage bins, accounting for 567 kg per week. Trades - DLC accounted for 19 % of the landfill/ residual materials, with 367 kg per week. Cafés accounted for 12 % of the landfill/ residual materials with 237 kg per week, increase from 138 kg per week in 2017. Washrooms accounted for ten % of the landfill/ residual material group in 2018, sending approximately 191 kg per week to landfill, most of which was paper towel (152 kg per week).

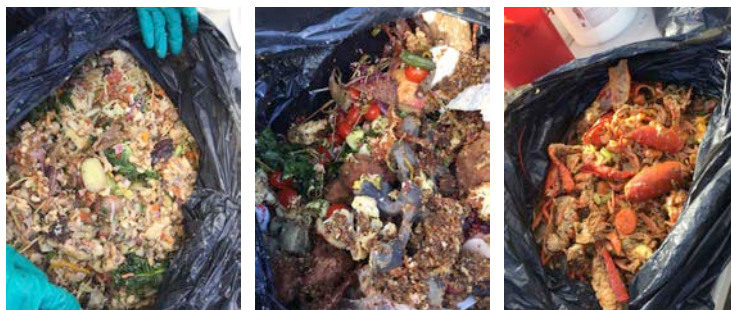
Compost Materials By Source

Compost materials were the second most abundant materials found in the garbage in the 2018 audit, with an estimated 1731 kg per week in 2018, up from 1159 kg per week in 2017.

Compost consists primarily of food scraps and uneaten food with minimal yard waste (plants), dirt, rocks, and other non-edible organic matter.

Figure 12 Food waste found in Culinary Arts samples

A significant increase in compost materials found in the landfill waste stream in 2018 is a result of an increased amount of compost materials found in the Culinary Arts kitchen, as shown in Figure 12, which accounted for 37 % of this material group and an estimated 633 kg per week in 2018, up from 74 kg per week in 2017.



Zero waste stations accounted for 28 % of the compost found in the garbage, with a small increase from 486 kg per week in 2017 to 488 kg per week in 2018. The Campus Activity Centre kitchen accounted for 20 % of the compost found in the garbage from 278 kg per week in 2017 to 338 kg per week in 2018. Cafes accounted for nine % of the compost material landfilled, generating approximately 153 kg of landfill-destined food scraps per week in 2018, and an increase over 2017 weekly output of 153 kg per week.

Other Recycling Materials By Source

Other recycling materials were the third most abundant material group found in the garbage in 2018, which included wood, crushable material (bricks), plastic film, scrap metal, and refundable beverage containers.

Trades - DLC accounted for 77 % of the other recycling materials found in the garbage in 2018, with an estimated 944 kg per week during the 2018 audit, which consisted of wood (721 kg) and bricks (201 kg). Stores accounted for 13 % of other recycling materials found during the audit, which included 151 kg of wood during the week¹¹.

Figure 13 Other recycling found in Trades and Stores samples. From left: wood found in Stores bin; bricks found in Trades bin, wood found in Trades bin



¹¹ Wood found in the Stores bin was laminated wood and plywood. Signage on the wood bin at Stores implied that “contaminated” wood is not accepted, however contaminated wood is accepted for recycling.

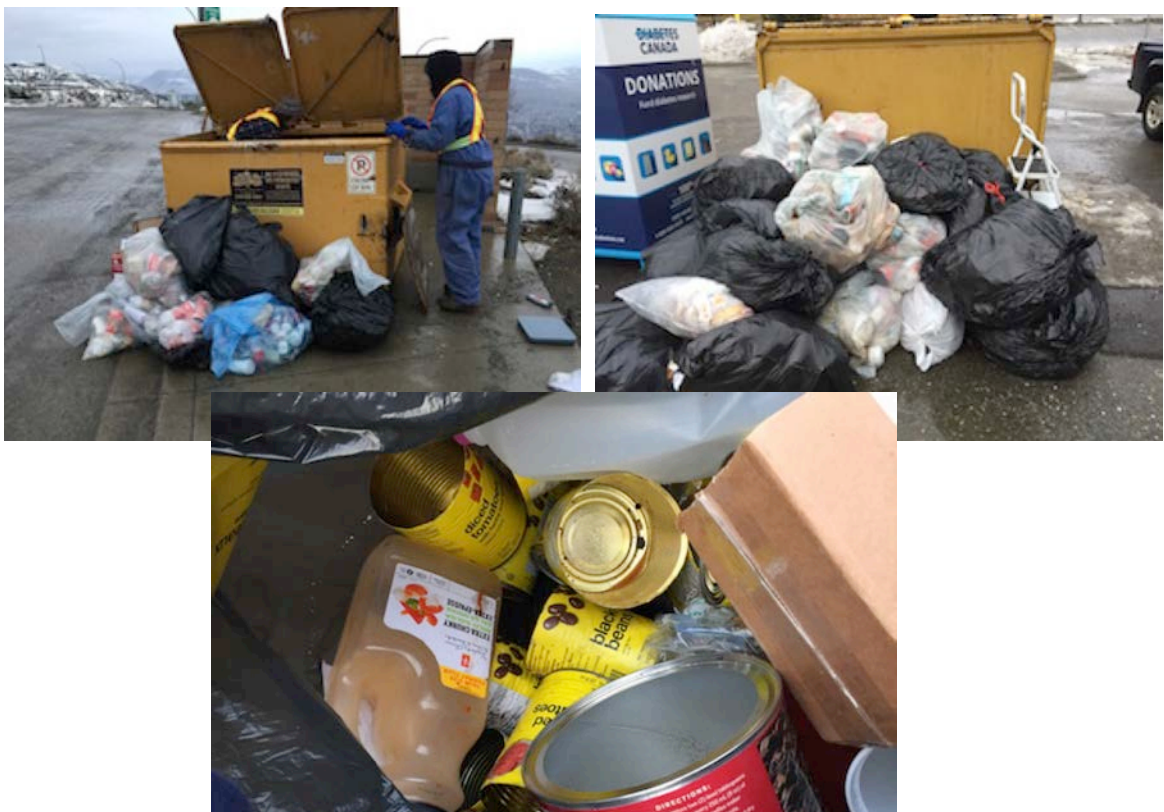
Mixed Recycling Materials By Source

Mixed recycling materials material group found in the garbage reduced from 929 kg per week in 2017 to 840 kg per week in 2018. Mixed recycling materials found in the garbage consisted on paper and recyclables containers (paper, plastic and metal packaging from on and off campus sources).

The majority of mixed recycling found in the garbage came from zero waste station garbage bins, accounting for 61 % of the mixed recycling in the garbage, or 514 kg per week in 2018, down from 591 kg per week in 2017. There was an increased amount of mixed recycling from Cafes in 2018, which account for 11 % of the mixed recycling in the garbage and 91 kg per week in 2018, up from 48 kg per week in 2017. Mixed recycling in offices reduced from 130 kg per week in 2017 to 85 kg per week in 2018.

Bags of mixed recycling were found in dumpsters throughout the audit, which were not accurately reflected in the compositions presented, as the source was likely from recycling bins, as shown in Figure 14.

Figure 14 Mixed recycling found in garbage bins likely from recycling bins in zero waste stations. Top: Arts & Education bin (left), Old Main bin (right). Bottom: Culinary Arts bin



Thrift, Liquids and Cardboard Materials By Source

The remaining three material groups found in the samples of garbage were thrift (reusable items), liquids, and corrugated cardboard, which accounted for three % of the waste stream.

Thrift materials increased from 46 kg per week in 2017 to 130 kg per week in 2018. The amount of liquids found in the audit in 2018 reduced significantly from 446 kg per week in 2017 to 26 kg per week in 2018.

The audit does not accurately capture the amount of cardboard found in the garbage, as this material tends to be found loose in the bins and not associated with any particular source. While levels of cardboard were low in the samples, amounts of cardboard were found throughout the audit, particularly in the Old Main, Science, and Arts & Education garbage bins, as shown in Figure 15.

Figure 15 Cardboard found in garbage bins from unknown sources. From Left to right: Arts & Education bin, Science bin, Old Main bin

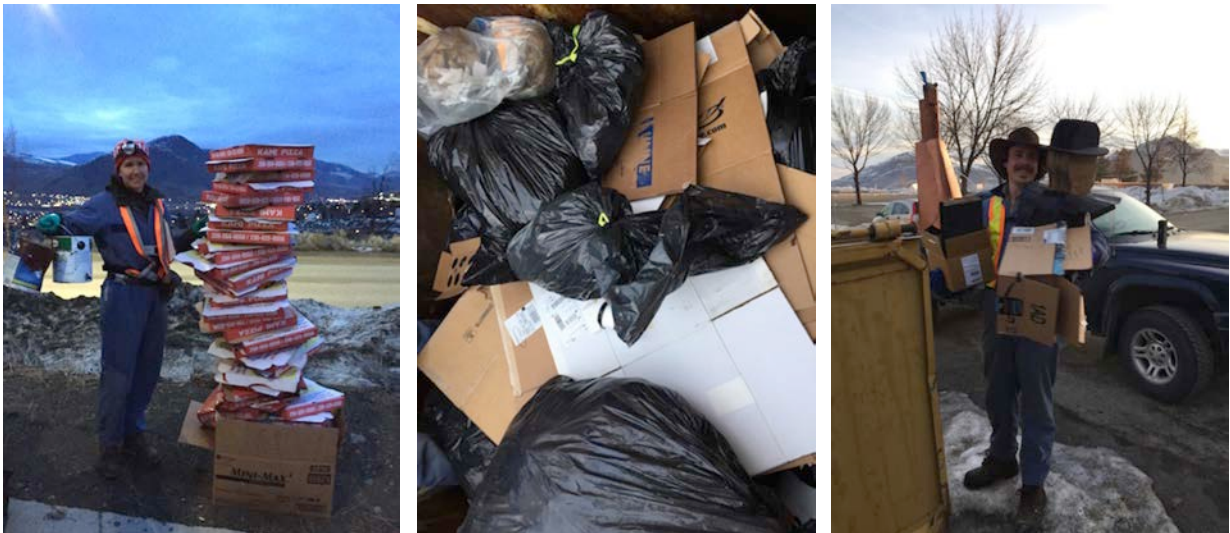
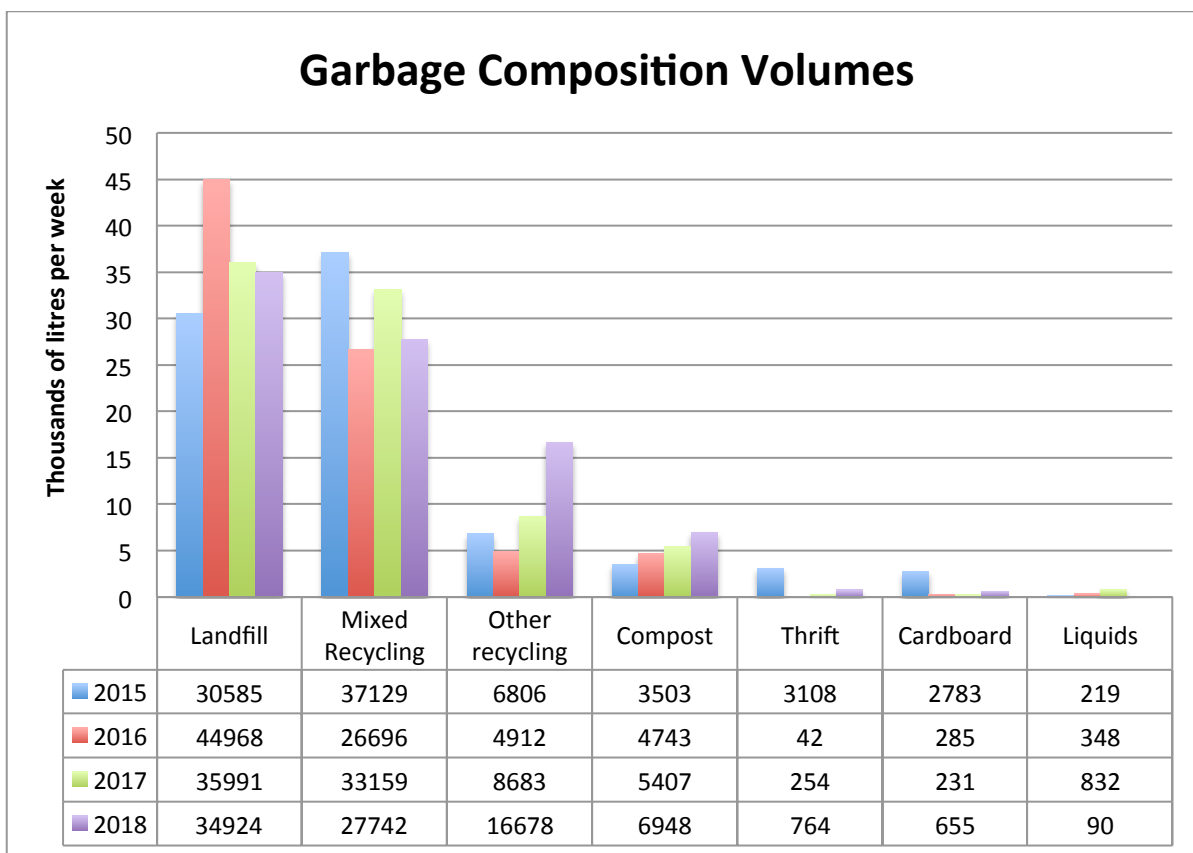


Figure 16 below shows the material outputs in litres per week of the material groups found in the garbage. Residual materials accounted for 40 % of the samples in the garbage, with approximately 34924 L per week in 2018, down from 35991 L per week in 2017. Mixed recycling was the second most abundant material by volume, accounting for 32 % of the materials in the garbage in 2018 with 27742 L per week, down from 33159 L per week in 2017.

Other recycling accounted for 19 % of the volume of garbage in 2018 with 16678 L per week, up from 8683 L per week in 2017. Compost materials accounted for only 8 % of the volume landfilled in 2018, with 6948 L per week, up from 5407 L per week in 2017.

Thrift, cardboard and liquids accounted for the remaining 1 % of the volume of landfilled material in the samples audited in 2018, with a combined volume of 1509 L per week in 2018.

Figure 16 - Overall Garbage waste stream by material group 2015 - 2017 (L/week) - volumes



Garbage Composition By Source And Material

The following sections discuss the compositions of the Garbage waste stream from 2015 to 2018 for the 12 sources of waste audited in 2018. Figure 17 shows the garbage composition by source in kg per week. Zero waste station garbage bins account for nearly 30% of the garbage landfilled in 2018, followed by Trades - DLC garbage (23 %), the kitchens in the Culinary Arts building (13%) and Campus Activity Centre (10%), cafes (9%), offices (5%), washrooms (4%), Stores (4%), Animal Health Technology (3%) and science labs (1%).

Event waste was audited for composition in 2018 but it is unknown how much events contribute to the waste stream to the variability of this source of waste. As a result, the amount

of event waste landfilled is not reflected in the audit. Event waste is accounted for in the other sources of waste included in the audit and is a source of error.

Daycare waste was not audited in 2018. Previous audits had found daycare samples from their use of unique garbage bags but 2018 their bags were not identifiable and the user group was not engaged to participate.

Figure 17 Garbage composition by source (kg/week) 2015 - 2018

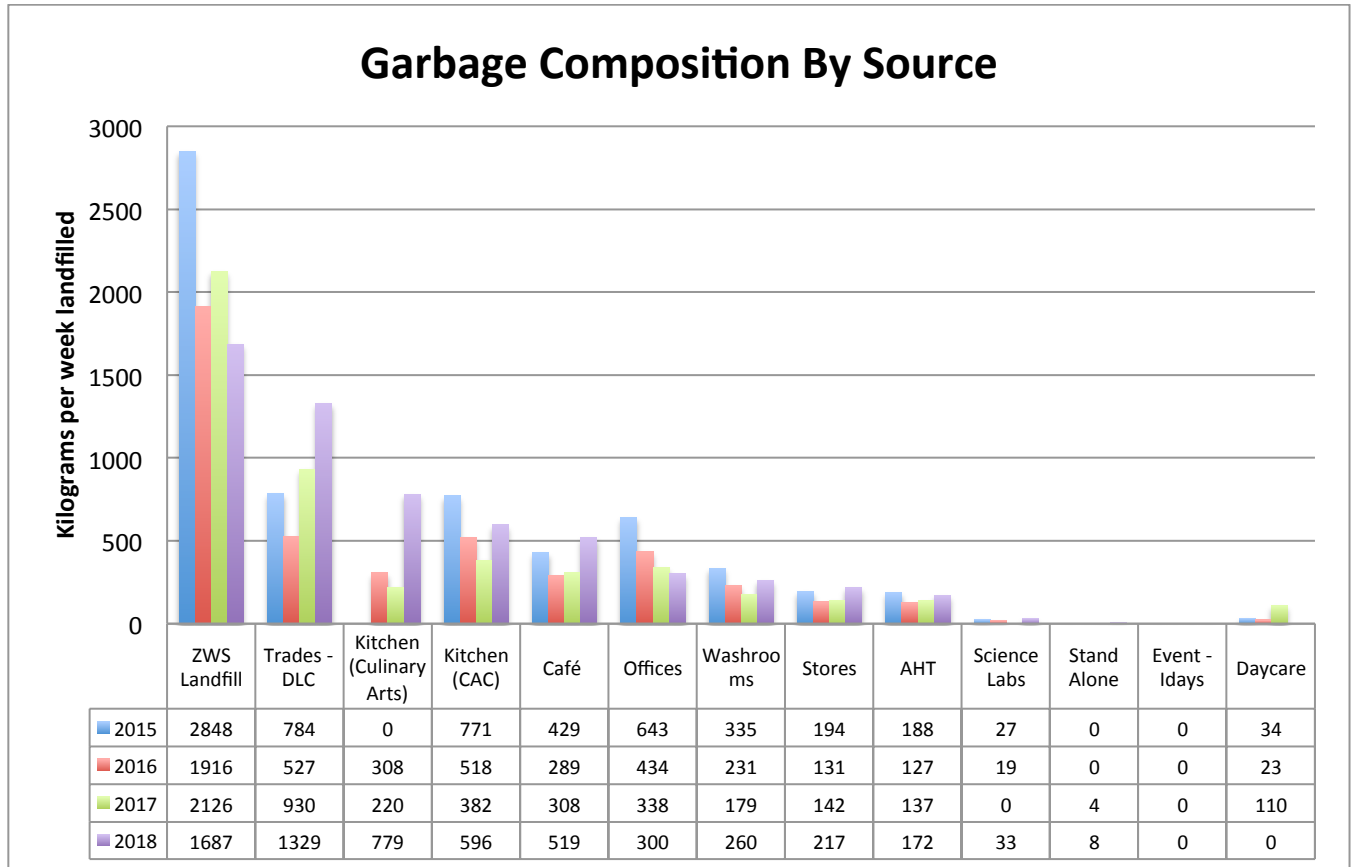
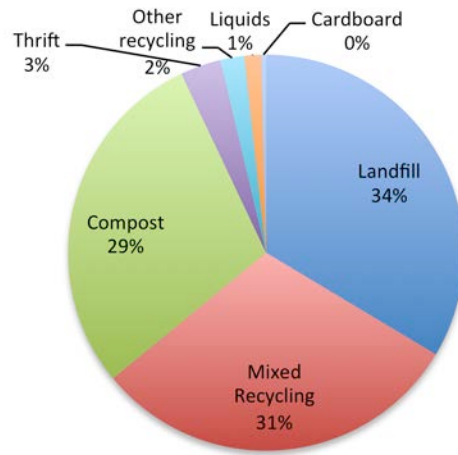


Figure 18 Zero Waste Station Garbage Composition by Material Group 2018

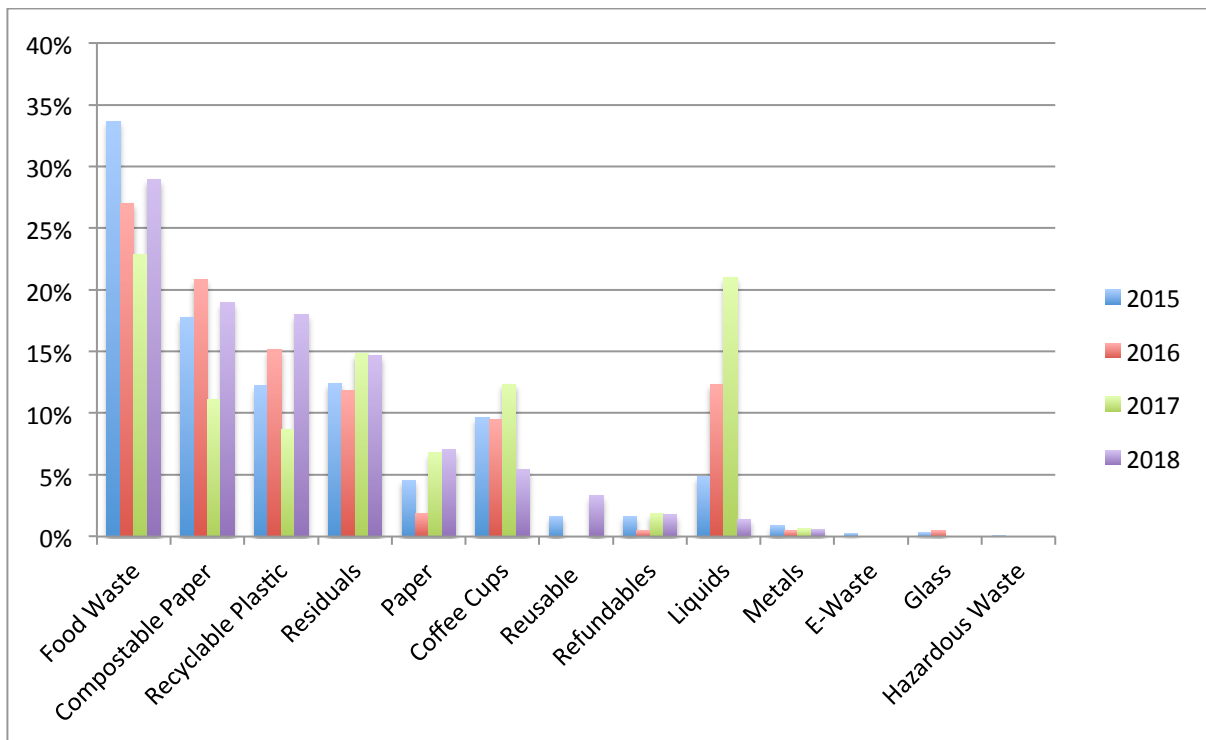
Zero Waste Station Garbage

Zero waste station garbage bins contributed an estimated 1687 kg per week to landfill in 2018. Figures 18 and 19 shows the percentage of each material group found in the garbage samples from zero waste station garbage bins from 2015 - 2018. Table 12 shows the estimated weekly amount of each material generated based on the composition of the sample and the estimated total output for the zero waste station garbage source in kg per week for 2015 - 2018.



Food waste was the most abundant material by weight in zero waste station garbage in 2018. An estimated 277 kg per week of uneaten food and 211 kg per week of food scraps went to the landfill in 2018; nearly unchanged over 2017 levels of 276 and 210 kg per week, respectively.

Figure 19 - Sample Composition From Zero Waste Station Garbage 2015 - 2018



Compostable paper accounted for 19 % of the zero waste station garbage sample in 2018, with 165 kg per week of food-contaminated paper containers generated on-campus and 155 kg per week of napkins and paper towel destined for the landfill. Compostable material is accounted for in the landfill material group shown in Figure 12 above, as there are currently no readily available options to divert compostable paper.

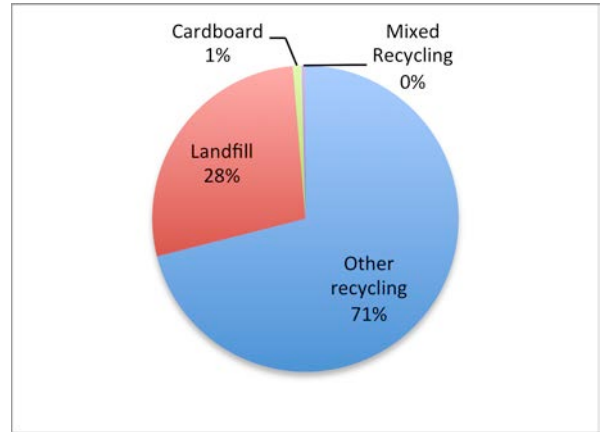
Recyclable plastics were the third most prevalent material group shown in Figure 13 above, accounting for 18 % of the total sample and an estimated 303 kg per week to landfill from. The majority of the recyclable plastics are from on-campus packaging with an estimated 273 kg per week in 2018.

Residuals accounted for nine % of the zero waste station garbage samples in 2018, with an estimated 155 kg per week of plastic laminates (bags) and food-contaminated plastic bags, plastic products not accepted in the recycling program such as straws and utensils, garbage bags, textiles not fit for reuse and chopsticks going to landfill.

Table 12 - Zero Waste Station Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
ZWS Garbage	2848	1916	2126	1687
8.3. Food waste - preventable	539	363	276	277
2.2. On-campus plastic food containers	0	64	26	273
8.2. Food waste - scraps	419	154	210	211
8.5. On-campus paper food containers	0	73	66	165
10.5. Remainder / miscellaneous	174	163	171	155
8.4. Compostable paper	507	327	171	155
1.1. Paper	117	36	144	112
10.1. Garbage bags	166	54	144	92
1.3. Coffee cups	275	182	262	92
9.1. Reusable	47	0	0	56
7.1. Refundable beverage containers	46	9	39	30
2.1. Plastic packaging	288	182	144	26
10.3. Liquids	139	236	446	23
3.1. Metal food packaging	16	9	13	10
1.2 Cardboard	12	0	0	7
2.3. Plastic film	60	45	13	3
10.2. Diapers	14	9	0	0
3.2. Metal products	10	0	0	0
4.1. Glass food containers	9	9	0	0
5.1 Electronic Waste	8	0	0	0
6.1. Hazardous Waste	2	0	0	0

Figure 20 Trades DLC Composition by Material Group 2018

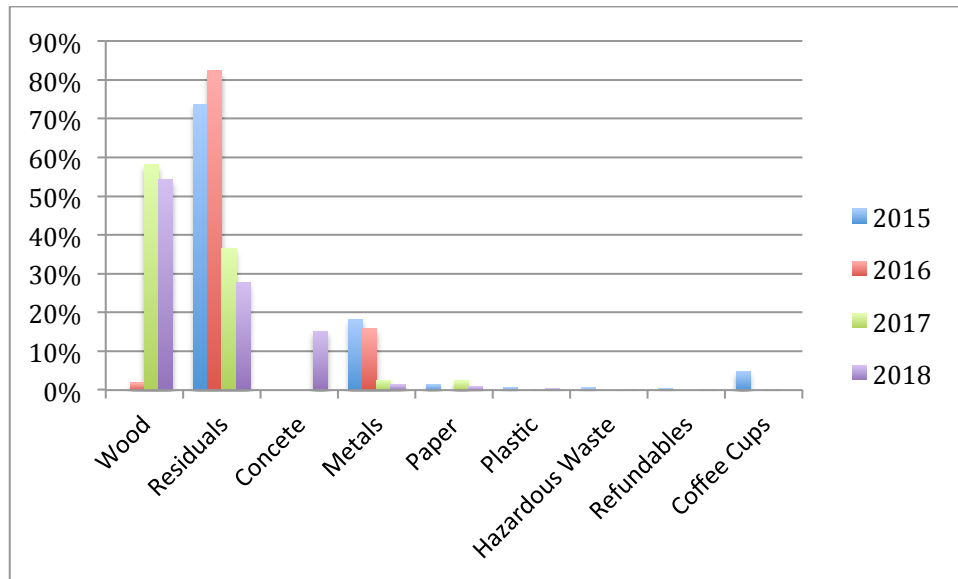


Trades DLC

Trades - DLC bin contributed an estimated 1687 kg per week to landfill in 2018. Figures 20 and 21 show the percentage of each material group found in the garbage samples from trades - DLC bins from 2015 - 2018. Table 13 shows the estimated weekly amount of each material generated based on the composition of the sample and the estimated total output for the trades - DLC source in kg per week for 2015 - 2018.

Other recycling includes wood, concrete, metal and refundable beverage containers. Wood waste was the most abundant material by weight in the trades - DLC bin in 2018. An estimated 721 kg per week of wood waste went to the landfill in 2018, up from 540 kg per week in 2017. A large amount of bricks (concrete) were found during the audit in the trades bin, accounting for 201 kg per week from this source.

Figure 21 - Sample Composition For Expanded Material Group For Trades DLC Bin 2015 - 2018



Residual materials in the trades DLC sample was mainly from welding rods and soldering residue, plastic casing from wires, sawdust, greasy paper towel, air filters, pieces of hard plastics, plastic lumber wrap, and various parts and supplies not readily recyclable.

While the percentage of residuals found in the sample in 2018 reduced over 2017 levels from 37% to 28% (shown in Figure 15 above), the total output increased from 340 kg per week in 2017 to 367 kg per week in 2018, as shown in Table 10 below.

A small amount of hazardous waste was found in the trades - DLC sample, which included empty engine oil, paint aerosol, and antifreeze containers, estimated to account for two kg per week based on the audit methodology.

Table 13 - Trades DLC Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Trades - DLC	784	527	930	1329
11.1. Wood	0	10	540	721
10.5. Remainder / miscellaneous	578	434	340	367
11.2. Crushables	0	0	0	201
3.2. Metal products	143	83	24	19
1.2 Cardboard	3	0	21	12
2.1. Plastic packaging	5	0	1	5
6.1. Hazardous Waste	4	0	0	2
7.1. Refundable beverage containers	4	0	0	1
1.1. Paper	8	0	1	0
1.3. Coffee cups	38	0	2	0

Kitchen - Culinary Arts Garbage

Culinary Arts kitchen contributed an estimated 779 kg per week to landfill in 2018. Figures 22 and 23 shows the % of each material group found in the garbage samples from 2015 - 2018. Table 14 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The majority of waste found in the Culinary Arts samples was compost (81%), which consisted of an estimated 490 kg per week of uneaten food and 143 kg per week of food scraps. Uneaten food was not observed in the Culinary Arts kitchen sample in 2017, and 74 kg per week of food scraps were found in the 2017 sample.

Residuals accounted for nine % of the sample of Culinary Arts kitchen waste in 2018, with approximately 58 kg per week, up from 26 kg per week in 2017. Residuals in the Culinary Arts samples consisted mainly of food contaminated plastic laminates and plastic bags, and parchment paper.

Figure 22 Culinary Arts Composition by Material Group 2018

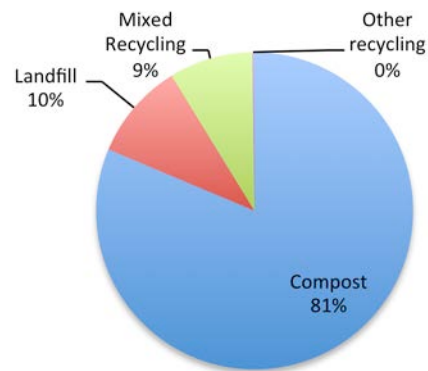


Figure 23 - Sample Composition For Expanded Material Group For Culinary Arts Kitchen 2015 - 2018

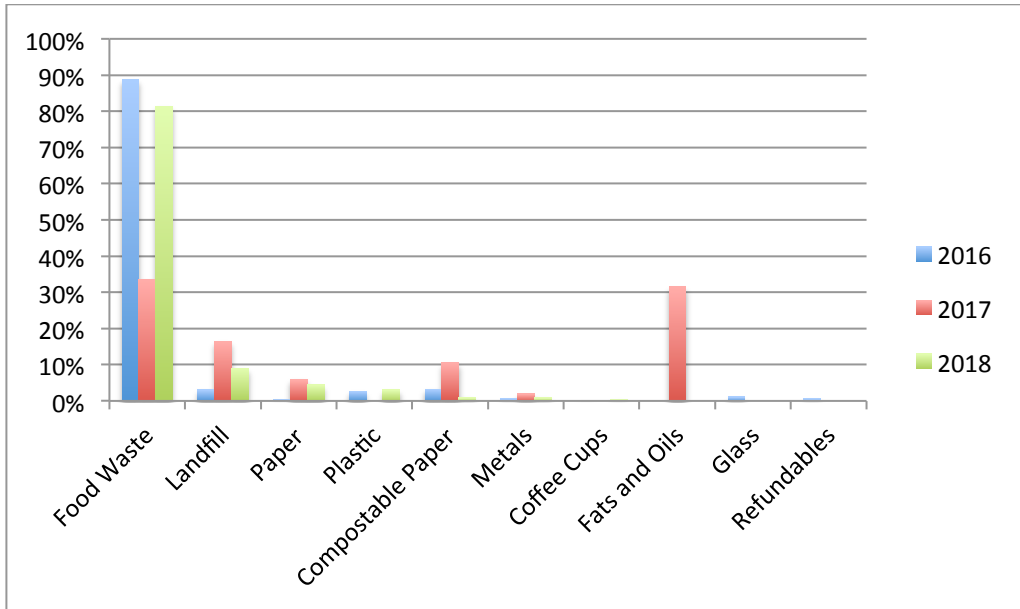


Table 14 - Culinary Arts Kitchen Estimated Weekly Output By Material (kg/week) 2015-2018

	2016	2017	2018
Kitchen (Culinary Arts)	308	220	779
8.3. Food waste - preventable	217	0	490
8.2. Food waste - scraps	55	74	143
10.5. Remainder / miscellaneous	7	26	58
2.1. Plastic packaging	0	0	20
1.5. Other paper containers	0	10	19
1.1. Paper	1	3	15
10.1. Garbage bags	3	10	13
3.1. Metal food packaging	2	4	7
8.4. Compostable paper	10	22	7
1.3. Coffee cups	0	0	3
2.2. On-campus plastic food containers	0	0	2
2.3. Plastic film	8	0	2
4.1. Glass food containers	3	0	0
7.1. Refundable beverage containers	2	0	0
8.5. On-campus paper food containers	0	1	0
8.7. Fats and oils	0	70	0

Kitchen - Campus Activity Centre Garbage

The Campus Activity Centre kitchen contributed an estimated 596 kg per week of waste to the landfill in 2018. Figures 24 and 25 show the % of each material group found in the garbage samples from 2015 - 2018. Table 15 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The majority of waste found in the Campus Activity Centre kitchen samples was compost (56%), which consisted of an estimated 285 kg per week of uneaten food in 2018, up from 276 kg per week in 2017, and 53 kg per week of food scraps, up from 2 kg per week in 2017.

Residuals accounted for 22 % of the sample of Campus Activity Centre kitchen waste in 2018, with approximately 108 kg per week, up from 40 kg per week in 2017. Residuals in the Campus Activity Centre kitchen samples consisted mainly of food contaminated plastic laminates (e.g. saran wrap), plastic bags, disposable gloves, and disposable cloths.

Figure 24 Campus Activity Centre Kitchen Composition by Material Group 2018

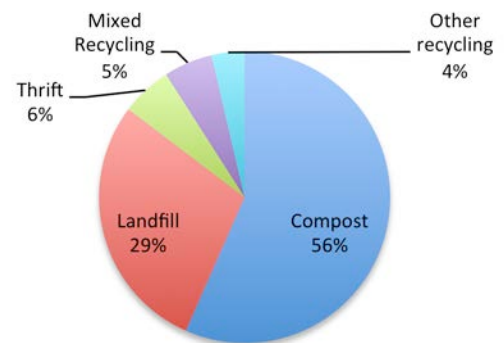


Figure 25 Sample Composition For Expanded Material Group For Campus Activity Centre Kitchen 2015 - 2018

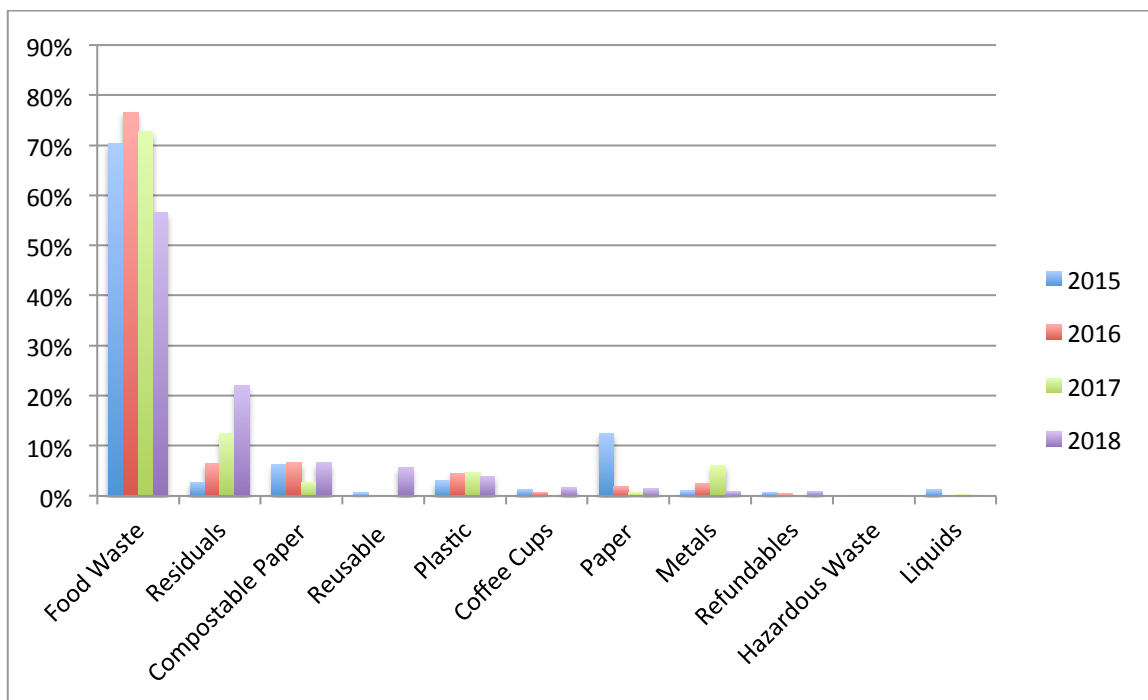


Table 15 Campus Activity Centre Kitchen Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
--	------	------	------	------

Kitchen (CAC)	771	518	382	596
8.3. Food waste - preventable	468	219	276	285
10.5. Remainder / miscellaneous	10	24	40	108
8.2. Food waste - scraps	75	178	2	53
9.1. Reusable	5	1	0	34
8.4. Compostable paper	48	32	10	25
10.1. Garbage bags	11	9	8	23
2.3. Plastic film	5	6	3	16
8.5. On-campus paper food containers		2	0	15
1.3. Coffee cups	10	4	0	10
1.1. Paper	25	6	3	9
2.2. On-campus plastic food containers		1	3	7
3.1. Metal food packaging	8	13	23	6
7.1. Refundable beverage containers	6	2	1	6
1.2 Cardboard	71	3	0	0
10.3. Liquids	10	1	1	0
2.1. Plastic packaging	18	17	12	0

Café Garbage

Cafés contributed an estimated 519 kg per week of waste to the landfill in 2018. Figures 26 and 27 show the % of each material group found in the garbage samples from 2015 - 2018. Table 16 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The majority of waste found in the Cafés samples was landfill (46%), which consisted of an estimated 158 kg per week of residuals in 2018, up from 94 kg per week in 2017, and 44 kg per week of compostable paper, up from 36 kg per week in 2017.

Compost accounted for 30 % of the Cafés waste in 2018. Approximately 83 kg per week of food scraps (mainly coffee grounds) were landfilled, up from just 8 kg per week in 2017. An estimated 70 kg per week uneaten food, down from 2017 levels of 96 kg per week.

Figure 26 Café Composition by Material Group 2018

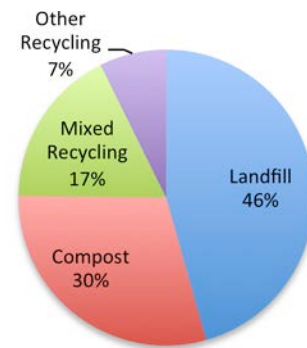


Figure 27 Sample Composition For Expanded Material Group For Cafés 2015 - 2018

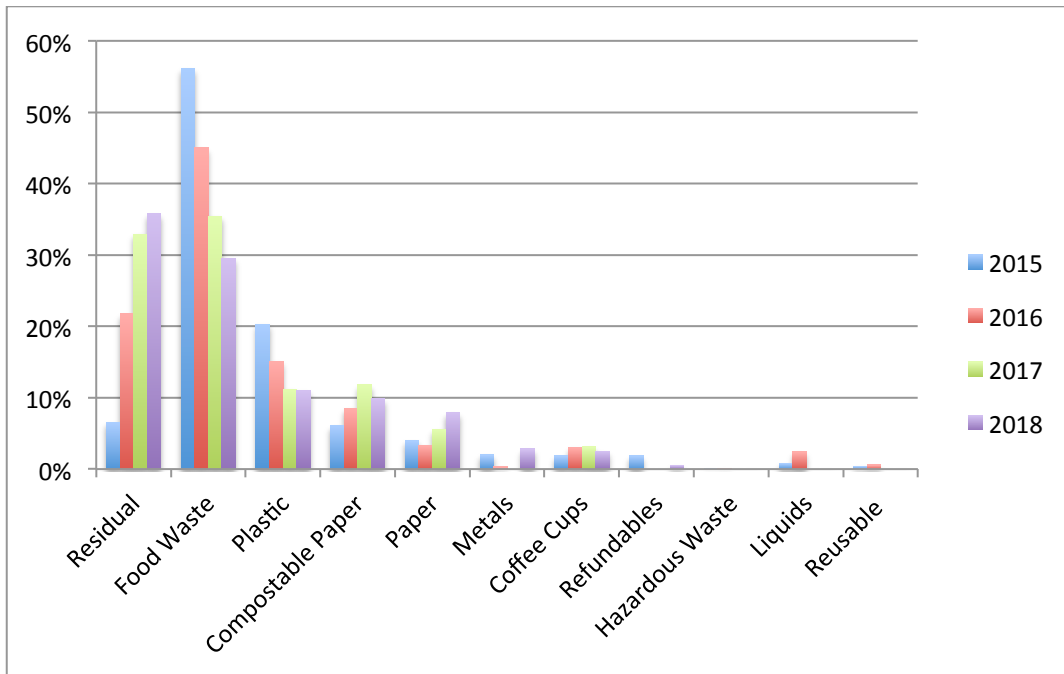


Table 16 Cafés Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Cafés	429	289	308	519
10.5. Remainder / miscellaneous	17	56	94	158
8.2. Food waste - scraps	105	81	13	83
8.3. Food waste - preventable	136	49	96	70
8.4. Compostable paper	26	22	36	44
1.5. Other paper containers	0	0	6	41
2.3. Plastic film	32	10	13	35
10.1. Garbage bags	11	7	8	28
3.1. Metal food packaging	7	1	0	15
1.3. Coffee cups	8	9	10	13
2.1. Plastic packaging	55	34	21	13
2.2. On-campus plastic food containers	0	0	0	9
8.5. On-campus paper food containers	0	3	0	7
7.1. Refundable beverage containers	8	0	0	3
1.1. Paper	6	8	11	0
1.2 Cardboard	11	2	0	0
10.3. Liquids	4	7	0	0
3.2. Metal products	1	0	0	0
6.1. Hazardous Waste	0	0	0	0
9.1. Reusable	2	2	0	0

Office Garbage

Offices contributed an estimated 519 kg per week of waste to the landfill in 2018. Figures 28 and 29 show the % of each material group found in the garbage samples from 2015 - 2018. Table 17 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

Office waste was fairly evenly distributed across material groups for landfill (33%), mixed recycling (28%) and compost (17%). Landfill materials included compostable paper (43 kg per week in 2018) and residuals (35 kg per week in 2018).

Food scraps were the most abundant materials in the office samples in 2018, accounting for 22 % of the sample from offices in 2018 and an estimated 65 kg per week output, up from 51 kg per week in 2017. Uneaten food accounted for five % of the office waste, contributing 15 kg per week to the landfill in 2018, down from 51 kg per week in 2017.

Figure 28 Offices Composition By Material Group 2018

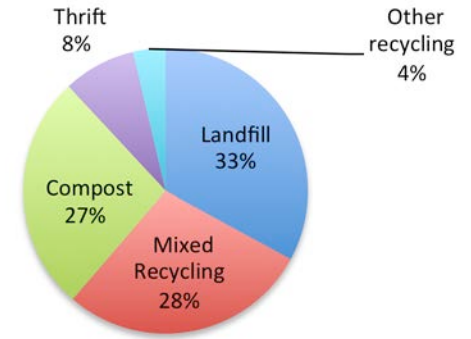


Figure 29 Sample Composition For Expanded Material Group For Offices 2015 - 2018

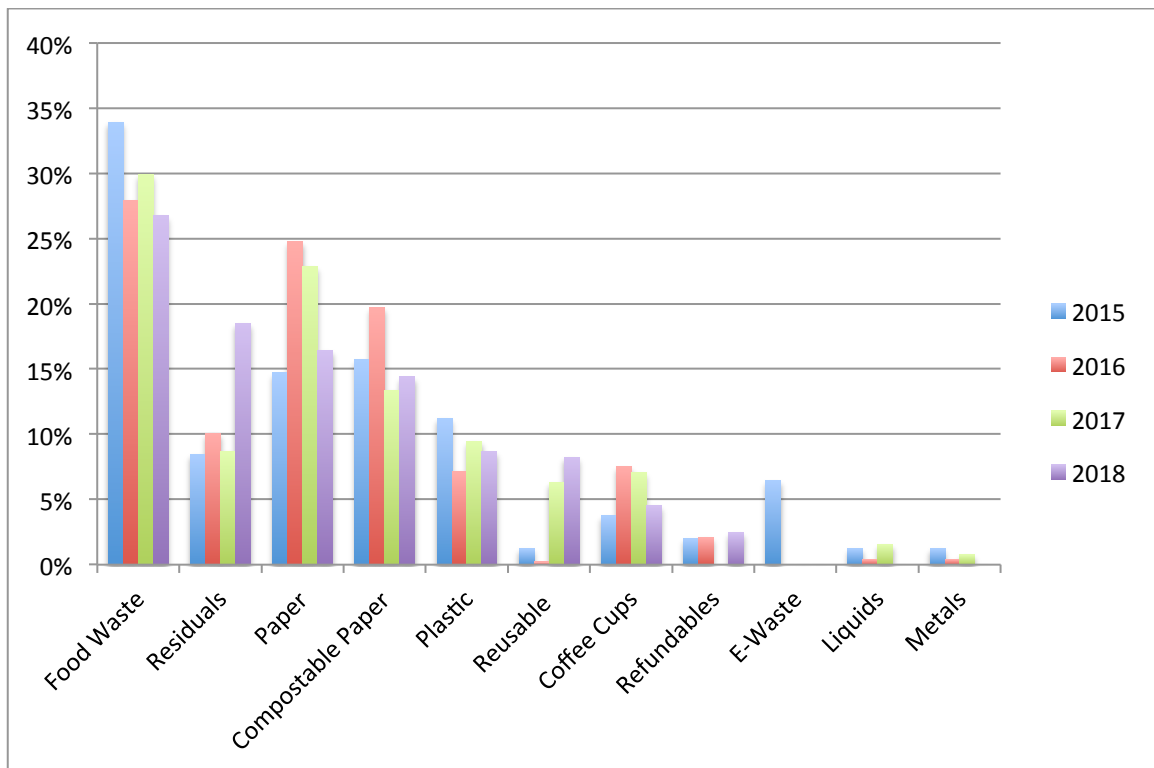


Table 17 Offices Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Offices	643	434	338	300

8.2. Food waste - scraps	159	75	51	65
1.1. Paper	95	105	77	49
8.4. Compostable paper	101	84	35	43
10.5. Remainder / miscellaneous	45	31	24	35
9.1. Reusable	8	1	21	25
10.1. Garbage bags	10	13	5	17
2.2. On-campus plastic food containers	0	4	5	15
8.3. Food waste - preventable	59	45	51	15
1.3. Coffee cups	24	33	24	14
2.1. Plastic packaging	50	18	21	7
7.1. Refundable beverage containers	13	9	0	7
10.4 k-cups	0	0	0	4
2.3. Plastic film	22	9	5	4
1.2 Cardboard	0	2	0	0
10.3. Liquids	8	2	5	0
3.1. Metal food packaging	3	2	3	0
3.2. Metal products	5	0	0	0
5.1 Electronic Waste	42	0	0	0
8.5. On-campus paper food containers	0	2	11	0

Washroom Garbage

Washrooms contributed an estimated 260 kg per week of waste to the landfill in 2018. Figure 24 shows the % of each material group in 2018 and each expanded material group from 2015-2018 found in the washroom samples. Table 18 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

Washroom waste consisted mainly of the landfill material group (74%), most of which was compostable paper (60%) sending an estimated 152 kg per week to landfill in 2018.

Figure 30 - Washroom Sample Composition by Material Group 2018 and Expanded Material Group 2015-2018

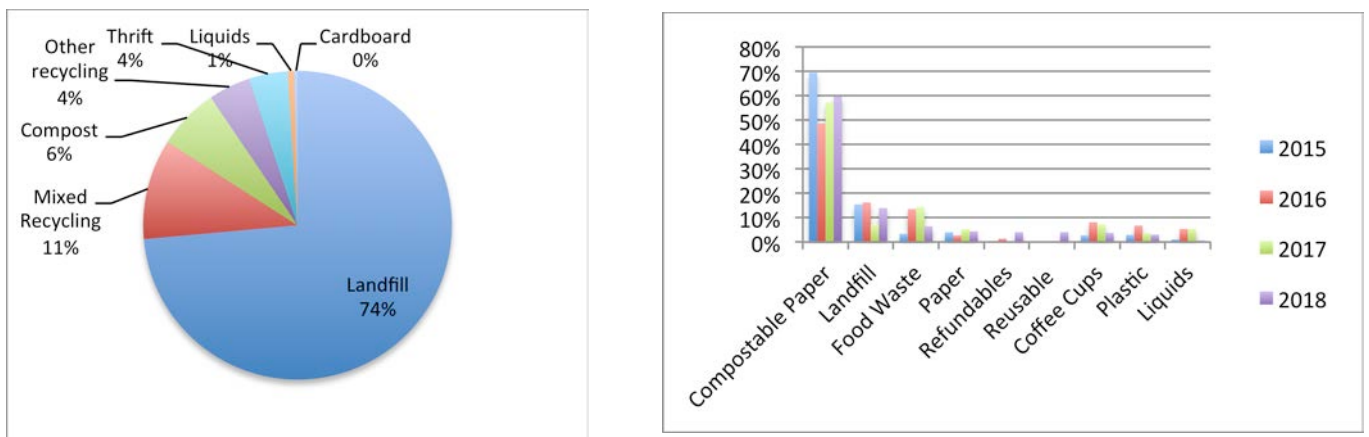


Table 18 Washrooms Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Washrooms	335	231	179	260
8.4. Compostable paper	233	110	102	152
10.5. Remainder / miscellaneous	20	24	3	26
1.1. Paper	13	6	0	11
10.1. Garbage bags	30	12	10	11
7.1. Refundable beverage containers	0	3	0	11
8.2. Food waste - scraps	9	18	19	11
9.1. Reusable	1	0	0	11
1.3. Coffee cups	9	18	13	10
8.3. Food waste - preventable	2	12	6	6
2.2. On-campus plastic food containers	0	0	0	4
2.1. Plastic packaging	5	12	6	3
8.5. On-campus paper food containers	0	0	0	3
10.3. Liquids	4	12	10	2
1.2 Cardboard	0	0	0	1
2.3. Plastic film	5	3	0	1
1.5. Other paper containers	0	0	10	0
10.2. Diapers	2	0	0	0
3.2. Metal products	0	0	0	0
6.1. Hazardous Waste	2	0	0	0

Stores Garbage

Stores contributed an estimated 217 kg per week of waste to the landfill in 2018. Figure 25 shows the % of each material group in 2018 and each expanded material group from 2015-2018 found in the stores samples. Table 19 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

Stores waste consisted mainly of the other recycling material group (72%), most of which was wood (69%) sending an estimated 150 kg per week to landfill in 2018. Approximately 32 kg per week of residual materials were sent to landfill from Stores (16 % of the Stores sample in 2018), which consisted mainly of pallet wrap, sawdust, and air filters.

Figure 31 Stores Sample Composition by Material Group 2018 and Expanded Material Group 2015-2018

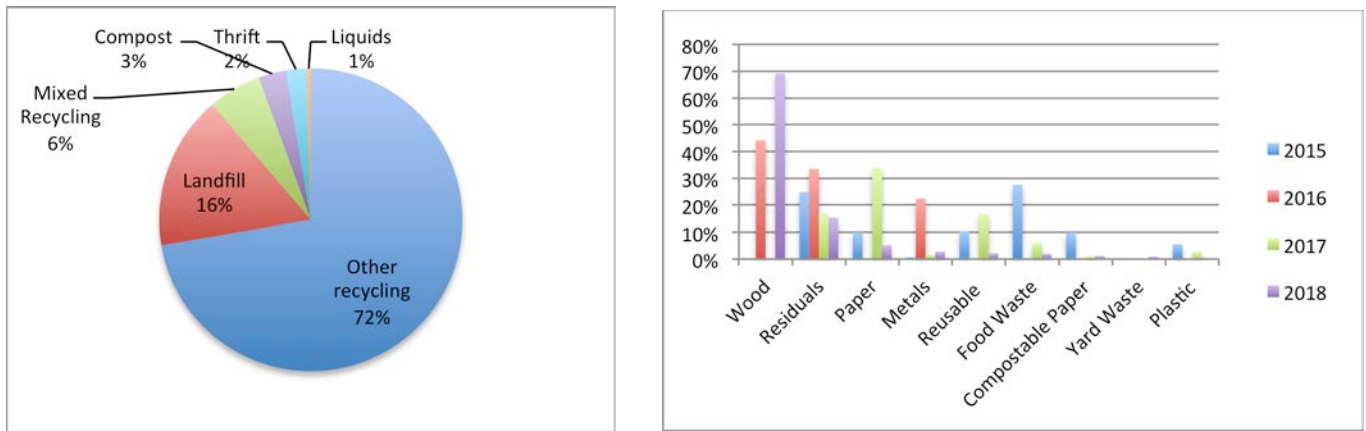


Table 19 Stores Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Stores	194	131	142	217
11.1. Wood	0	58	0	150
10.5. Remainder / miscellaneous	45	44	22	32
1.1. Paper	19	0	43	11
3.2. Metal products	0	29	2	6
9.1. Reusable	20	0	24	5
8.4. Compostable paper	19	0	1	3
8.2. Food waste - scraps	40	0	0	2
8.3. Food waste - preventable	14	0	8	2
8.6. Yard waste	0	0	0	2
10.3. Liquids	8	0	0	1
10.1. Garbage bags	3	0	1	1
2.1. Plastic packaging	8	0	3	1
2.3. Plastic film	3	0	1	0
1.3. Coffee cups	10	0	0	0

6.1. Hazardous Waste	2	0	0	0
3.1. Metal food packaging	1	0	0	0
1.2 Cardboard	0	0	5	0
10.4 k-cups	0	0	0	0
5.1 Electronic Waste	0	0	27	0
7.1. Refundable beverage containers	2	0	3	0
8.5. On-campus paper food containers	0	0	0	0

Animal Health Technology Garbage

Animal Health Technology (AHT) contributed an estimated 172 kg per week of waste to the landfill in 2018. Figure 26 shows the % of each material group in 2018 and each expanded material group from 2015-2018 found in the stores samples. Table 20 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The Animal Health Technology sample consisted mainly of the landfill material group (91%), most of which was animal feces (87%). Approximately 150 kg per week of feces was sent to landfill in 2018, an increase from 2017 levels of 80 kg per week. Eight % of the AHT sample was pet food waste, possibly regurgitated or otherwise expired, resulting in approximately 14 kg per week of food waste sent to landfill. Residuals consisted mainly of plastic laminates (pet food bags).

Figure 32 Animal Health Technology Sample Composition by Material Group 2018 and Expanded Material Group 2015-2018

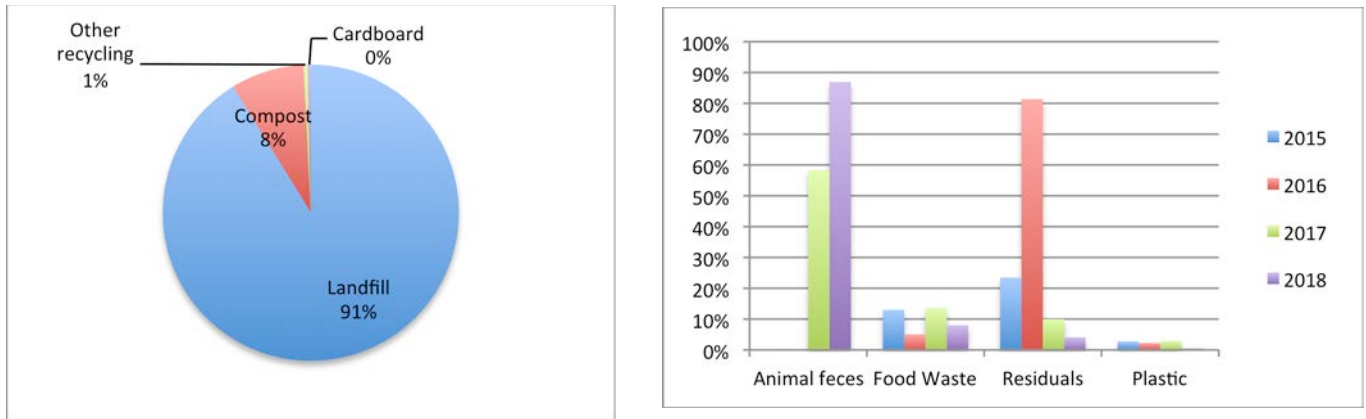


Table 20 Animal Health Technology Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
AHT	188	127	137	172
8.8. Dog and cat feces	included in remainder	included in remainder	80	150
8.3. Food waste - preventable	17	4	7	12
10.5. Remainder / miscellaneous	44	101	10	7
8.2. Food waste - scraps	7	2	12	2

2.3. Plastic film	3	1	1	1
1.2 Cardboard	0	0	0	1
1.1. Paper	4	1	1	0
1.3. Coffee cups	1	1	2	0
2.2. On-campus plastic food containers	0	0	0	0
1.5. Other paper containers	0	0	0	0
10.1. Garbage bags	0	2	2	0
10.3. Liquids	3	0	0	0
10.4 k-cups	0	0	2	0
2.1. Plastic packaging	3	1	2	0
3.1. Metal food packaging	0	1	1	0
4.1. Glass food containers	0	0		0
5.1 Electronic Waste	0	0	0	0
7.1. Refundable beverage containers	0	0		0
8.4. Compostable paper	4	11	14	0
8.5. "To-go" paper food containers	0	0	0	0
9.1. Reusable	100	0	1	0

Science Lab Garbage

Science labs contributed an estimated 33 kg per week of waste to the landfill in 2018. Figure 27 shows the % of each material group in 2018 and each expanded material group from 2015-2018 found in the stores samples. Table 21 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The science lab sample consisted mainly of the landfill material group (82%), most of which was residual material consisting of autoclaved /sterilized biohazardous waste (16 kg per week in 2018) and compostable paper (10 kg per week in 2018).

Figure 33 Science Lab Sample Composition by Material Group 2018 and Expanded Material Group 2015-2018

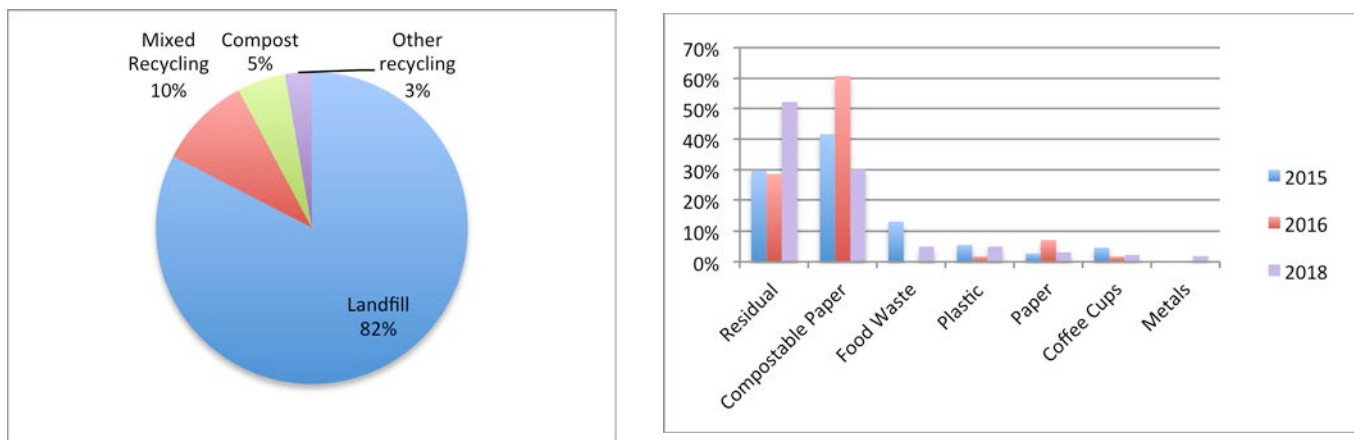


Table 21 Science Labs Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Science Labs	27	19		33
10.5. Remainder / miscellaneous	7	3		16
8.4. Compostable paper	11	11		10
8.2. Food waste - scraps	3	0		2
1.1. Paper	1	1		1
2.3. Plastic film	0	0		1
1.3. Coffee cups	1	0		1
10.1. Garbage bags	1	3		1
2.2. On-campus plastic food containers	0	0		1
3.1. Metal food packaging	0	0		1
10.3. Liquids	0	1		0
2.1. Plastic packaging	1	0		0
7.1. Refundable beverage containers	0	0		0
8.3. Food waste - preventable	0	0		0
9.1. Reusable	0	0		0

Stand Alone Garbage

Stand alone garbage bins are rare on campus and contributed only 8 kg per week of waste to the landfill in 2018. Figure 28 shows the % of each material group in 2018 and each expanded material group from 2015-2018 found in the stand alone bin samples. Table 22 shows the estimated weekly amount of each material generated based on the composition of the samples and the estimated total output in kg per week for 2015 - 2018.

The stand alone sample mainly consisted of mixed recycling (43%) and landfill (36%) material groups in 2018, as seen in the pie chart below. Compostable paper was the most abundant material (3 kg per week in 2018), followed by coffee cups (2 kg per week).

Figure 34 Stand Alone Sample Composition by Material Group 2018 and Expanded Material Group 2017, 2018

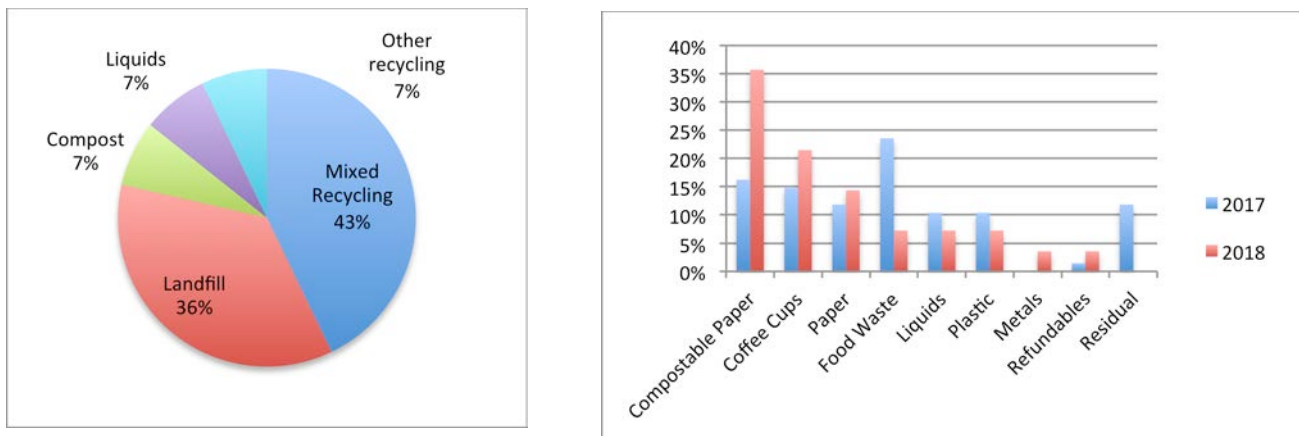


Table 22 Stand Alone Estimated Weekly Output By Material (kg/week) 2015-2018

	2015	2016	2017	2018
Stand Alone	0	0	4	8
8.4. Compostable paper	0	0	1	3
1.3. Coffee cups	0	0	1	2
1.1. Paper	0	0	0	1
10.3. Liquids	0	0	0	1
2.2. On-campus plastic food containers	0	0	0	1
8.2. Food waste - scraps	0	0	1	1
3.2. Metal products	0	0	0	0
7.1. Refundable beverage containers	0	0	0	0
10.1. Garbage bags	0	0	0	0
10.5. Remainder / miscellaneous	0	0	0	0
2.1. Plastic packaging	0	0	0	0
2.3. Plastic film	0	0	0	0
3.1. Metal food packaging	0	0	0	0
8.3. Food waste - preventable	0	0	0	0
8.5. On-campus paper food containers	0	0	0	0

Event Garbage

Event waste was audited for composition only. Event waste varies on campus and is generated and managed by a various user groups. The event that was audited was a performance in which there were food vendors. Event waste was collected in garbage and refundable beverage container bins, as shown in the photo on the right. 500 or more people attended the event, as shown in the photo below.



The event generated approximately 56 kg of garbage (volume was 680 L). It is unknown how much refundable beverage containers were recycled at the event, although. Figure 29 shows the composition of the sample by material group based on weights. Table 23 shows the composition of the materials found during the audit as well as the total weight for each material.



46 % of the waste generated at the event was in the landfill material group, which consisted on food contaminated paper containers (24 %), remainder/ residuals (seven %), garbage bags (six %), compostable paper (five %), and disposable utensils (four %).

Figure 35 - Event Sample Composition By Material Group 2018

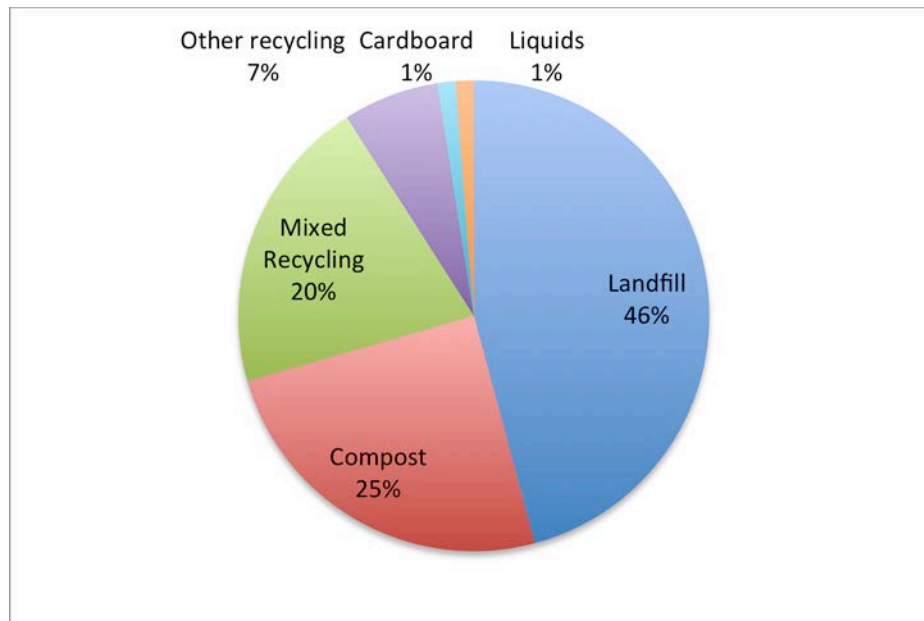


Table 23
and
(kg) By Material 2018

- Event Sample
Composition
Total Weight

	(kg)	
Event - IDays	100%	56
8.3. Food waste - preventable	24%	14
8.5. On-campus paper food containers	24%	13
1.1. Paper	8%	5
10.5. Remainder / miscellaneous	7%	4
10.1. Garbage bags	6%	3
1.3. Coffee cups	6%	3
8.4. Compostable paper	5%	3
2.1. Plastic packaging	4%	2
10.6. Disposable utensils	4%	2
2.4. Styrofoam	4%	2
7.1. Refundable beverage containers	2%	1
2.2. On-campus plastic food containers	2%	1
1.2 Cardboard	1%	1
10.3. Liquids	1%	1
3.1. Metal food packaging	1%	0
8.2. Food waste - scraps	1%	0
2.3. Plastic film	0%	0

Zero Waste Station All Streams

Samples from three different buildings were labeled and collected to determine the breakdown of materials across zero waste stations (compost, mixed recycling, garbage and refundable beverage containers) as well as composition of each stream. The following section discusses the results of all the streams of zero waste station samples. The garbage stream was not audited for composition, as this waste stream is discussed in detail above.

Figure 36 - Breakdown of Streams From Zero Waste Stations 2018

Zero Waste Station Streams

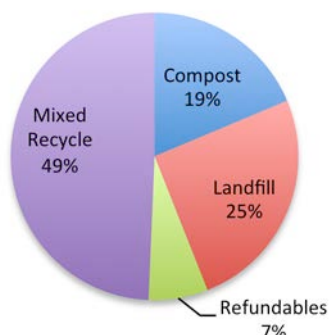


Figure 36 shows the breakdown of zero waste station streams. As shown in the chart, mixed recycling was the most prevalent material in the zero waste stations, comprising nearly half of the material collected in the stations. Landfill material made up 25 % of the stations, compost was 19 % and refundable beverage containers were seven % of the waste station. Contamination is included in these totals, and is discussed in the composition results for each stream below.

Figure 37 shows the composition of the compost waste stream from zero waste stations. Contamination rates in the compost bins reduced in 2018 to 16 %, from 19 % in 2017, but higher than 2016 rate of 11 %.

Figure 37 - Zero Waste Station Compost Composition 2016 - 2018

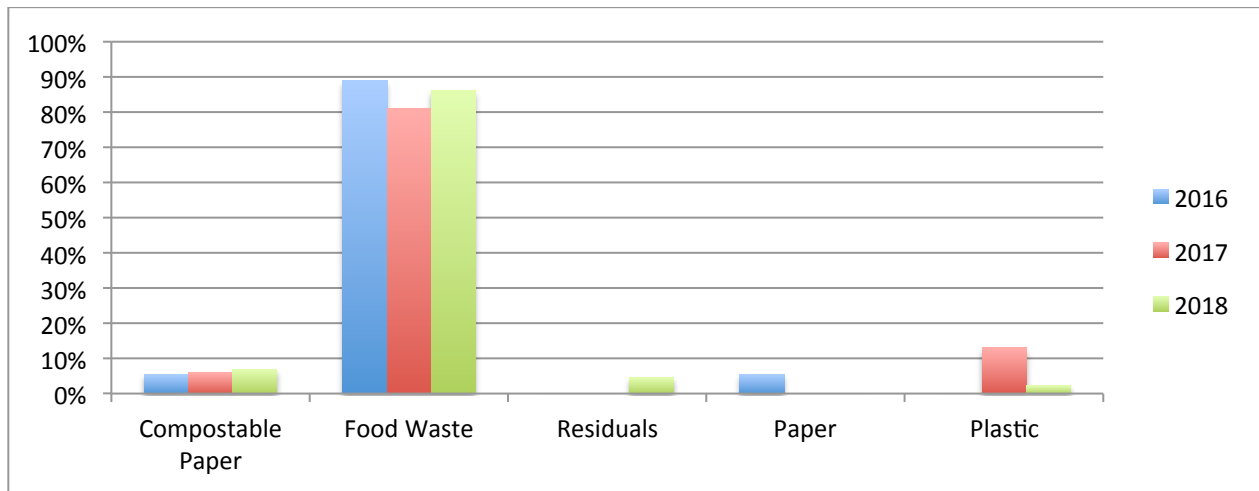


Figure 38 shows the composition of the mixed recycling stream from zero waste stations. Contamination rates in mixed recycling bins increased in 2018 to 45 %, up from 32 % in 2017, and 42 % in 2016. The most common source of contamination was from compostable paper, including napkins, and food contaminated paper containers (15 %). Residuals were also significant type of contaminant (14 %), which included items like plastic laminates (e.g. chip bags)

Figure 38 Zero Waste Station Mixed Recycling Composition 2016 - 2018

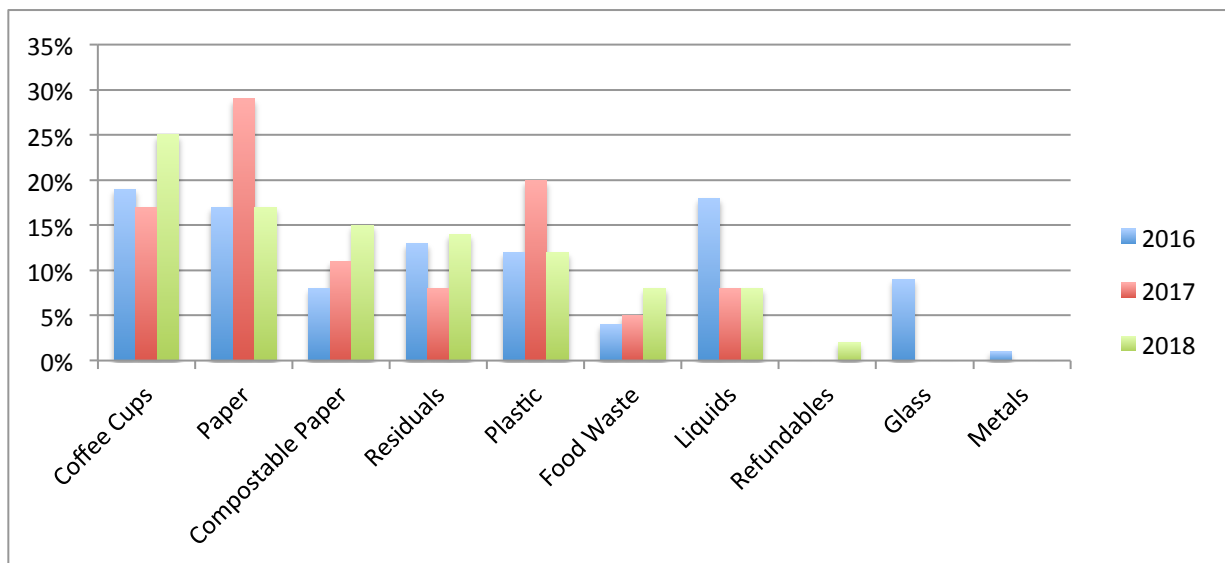
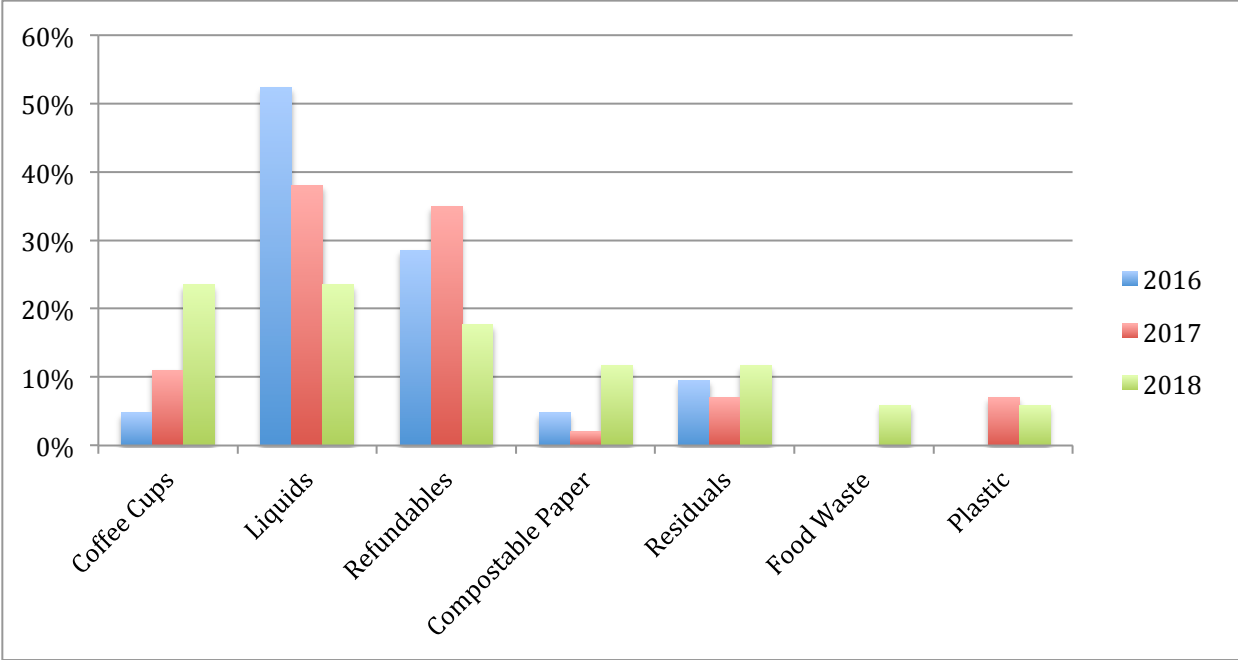


Figure 39 shows the composition of the refundable beverage container bins in zero waste stations. Coffee cups were the most abundant material found in 2018, with 24 % found in the sample. Liquids accounted for 24 % of the sample, and refundable beverage containers

accounted for 18 % of the sample. Contamination from paper (12 %), residuals (12 %), food waste (six %) and plastic (six %) was also found in this stream for 2018.

Figure 39 Zero Waste Station Refundable Beverage Container Bin Composition 2016 - 2018



8 Review of 2017 Recommendations

The 2017 audit made recommendations for policy, outreach/ education and infrastructure targeting each source of waste to help reduce and divert waste on campus. The following section shows a summary of the recommendations made in the 2017, the metric used to measure success, and the 2018 audit data to gauge success.

Nine of the 24 recommendations made in 2017 were implemented to some extent. Of the recommendations implemented, five were considered successful, two were somewhat successful, and two were unsuccessful. The remaining 14 recommendations were not implemented.

Successes

The most successfully implement recommendation came from replacing the plastic film bins in zero waste stations with stand-alone bins to collect plastic bags. Contamination levels were extremely high in plastic film bins in 2017 (84%), which reduced to almost no contamination in 2018.

Presentations to staff on “Why Waste Matters” during a professional development day took place in 2017. Attendance was by choice, with approximately 100 staff attending the presentations. Office waste composition improved significantly. The composition of residuals increased from nine % in 2017 to 19 % in 2018, which means that more materials that belong in the garbage were found in the garbage. The composition of food waste and mixed recycling reduced over the period, however there was an increase in the composition of reusable material and refundable beverage containers in offices in 2018 over 2017 levels.

The composition of residuals the stores waste reduced from 16 % in 2017 to 15 % in 2018, despite high composition of wood waste found during the audit which was thought to be not accepted in the wood bin due to a mix-up with communication with respect to contaminated wood. Most of the material found in the stores waste outside the wood waste otherwise belonged in the garbage.

Campus Activity Centre kitchen and café waste composition also improved. Residuals found in the audit increased from 13 % in 2017 to 22 % in 2018 for the Campus Activity Centre kitchen, and from 33 % in 2017 to 36 % in 2018 in the Cafes. Food waste composition reduced in the CAC Kitchen from 73% in 2017 to 57% in 2018 and in the Cafes from 35% in 2017 to 30% in 2018.

Reuse donation bins were brought onto campus in early 2018. The amount of reusable items found during the audit reduced significantly in the Stores waste composition from 17 % in 2017 to two % in 2018, and overall sources from 24 % in 2017 to 23 % in 2018.

Cardboard collection bins inside the trades building were implemented in 2017. Cardboard composition in the trades waste reduced from two % in 2017 to one % in 2018.

Somewhat Success

Signs for zero waste stations were updated to include images of common materials belonging in each waste stream. Despite efforts to improve communication of what belongs in each waste

stream for the zero waste stations, contamination levels in zero waste stations remain high. Contamination in compost and garbage streams reduced in the compost and garbage streams from 19 % in 2017 to 16 % in 2018 and 74 % in 2017 to 67 % in 2018, respectively. Contamination levels increased in the mixed recycling and refundable beverage streams from 32 % in 2017 to 45 % in 2018 and 65 % in 2017 to 82 % in 2018, respectively. The amount of liquids found in zero waste stations significantly reduced in 2018, from 21 % in 2017 to just one % in 2018.

Campus Activity Centre kitchen and Café food waste composition levels reduced from 73 % in 2017 to 57 % in 2018, and from 35 % in 2017 to 30 % in 2018 in the Cafes. Although the composition of food waste was reduced, the total output increased due to higher amounts of overall waste in 2018.

Not Successful

Only one of the recommendations implemented from the 2017 did not have metrics to support success. Custodial staff were asked to empty bags before placing material into mixed recycling carts in 2018. Bagged material was found in most recycling carts during the 2018 audit.

Table 24 - Review of 2017 Recommendations

Recommendation	Implemented?	Metric	Success?
Replace plastic film stream from zero waste stations with separate plastic film collection	Yes	Reduced contamination rates in plastic film bins	Yes - plastic film contamination rates reduced from 84% to nearly 0%
Communicate results of waste audit for offices to all staff. 'What goes where' short video clips or presentations to staff and administration.	Partial - Presentation during professional development day with attendance by choice	Increase residual composition in office garbage	Yes - significant increase in the composition of residuals found in office waste in 2018
Educate Stores staff on waste reduction and why waste matters.	Partial - Presentation during professional development day with attendance by choice	Increase residual composition in Stores garbage	Yes - composition of wood waste (69%) found in Stores in 2018 skews results, which otherwise would have found high levels of residuals
Engage and support contract staff to set up internal waste diversion systems. Educate contract staff on 'what goes where'.	Partial - CAC Kitchen staff engaged to improve food waste diversion	Reduce composition of food waste in kitchens and cafes	Yes - there was an reduction in food waste composition in both café and CAC kitchen samples

Reuse system - donate usable items to non-profit reuse (i.e., Big Brothers and Sisters/ Habitat for Humanity ReStore) for Stores	Reuse bins were brought onto campus but not specifically for Stores	Reduced levels of reusable items	Yes - there was an reduction in reusable items found in 2018 audit
Cardboard collection bin for Trades	Bins to collect cardboard were setup inside the trades building	Reduced cardboard in trades bin	Yes - reduced amount of cardboard found in Trades in 2018 over 2017 levels
Update zero waste signs using images	Yes	Reduced contamination in zero waste stations	Somewhat - contamination levels increased for mixed recycling and refundable beverage containers but reduced for compost.
Waste station ambassadors at events and throughout the year	Partial - waste station ambassadors at the back to school BBQ	Reduced contamination in zero waste stations	Somewhat - contamination levels increased for mixed recycling and refundable beverage containers but reduced for compost.
Donation system for surplus food (student food bank?)	Student food bank exists but unsold food is not donated to the food bank	Reduce preventable food waste composition in Kitchen and Cafe	Somewhat - food waste composition in Café and Kitchen samples reduced, however total output increased.
Remove bags from mixed recycling stream before placing in collection carts	Communication to custodial staff was delivered but not enforced	No bagged material in mixed recycling	No - plastic bags were observed in most mixed recycling carts
Hand dryers in all washrooms and remove paper towel	No	-	-
Reduce number garbage bins in washrooms	No	-	-
Language in contracts (Aramark, custodial, etc.) for waste reduction and diversion	No	-	-
'Kick the can' in offices	No	-	-
Wood waste collection bin for	No	-	-

Trades			
Investigate diversion of sawdust bin	No	-	-
'Save a tree' campaign in washrooms	No	-	-
Posters in washrooms reminding people to sort into zero waste stations	No	-	-
Why source separating DLC waste matters presentation for Trades	No	-	-
Designing for deconstruction - Trades	No	-	-
3D signage in each building	No		-
Waste reduction week event (October) - themes could include reusable coffee cup, food waste reduction	No	-	-

9 Recommendations 2018

In review of the 2017 recommendations and of the data presented in this report, there are areas in which TRU has made improvements in diverting waste from landfill through the many waste diversion systems. While systems are in place to divert materials, there are challenges with ensuring the campus population takes advantage of the systems. The trend appears that waste is increasing and opportunities to reduce and divert exist.

The five largest sources of waste and the greatest opportunities for improvement are reduction and diversion of waste from zero waste stations, trades, Culinary Arts kitchen, Campus Activity Centre kitchen, and cafes. Opportunities also exist to ensure that diverted materials collected in stations across campus are properly managed (and not placed in the garbage).

Financial impacts to implement recommendations could be partially offset by cost saving opportunities through adjusting collection frequencies.

Zero Waste Station Garbage - Communication & Reduction

Zero waste stations are the largest source of waste on campus and generate an estimated 1700 kg of garbage per week. Ongoing and enhanced communication on proper use of stations is needed to engage the constantly changing campus population. The growing international population as well as population of domestic students from outside the local area TRU creates additional challenges, as recycling programs may be new or different where they come from.

A communication plan targeting both foreign and domestic students would help reduce contamination in zero waste stations. Community-based social marketing techniques have been

effective in addressing behaviour for proper waste disposal. It is recommended that TRU develop and implement a communication plan to reduce contamination in zero waste stations.

Reduction of waste in zero waste stations could be supported in a number of ways. On-campus plastic and paper food containers were among the five most abundant materials in the zero waste station garbage, with an estimated combined weekly output of 440 kg.

Engaging with stakeholders who provide the packaging material that comprises zero waste station garbage to minimize packaging materials would reduce waste and handling costs. Identifying opportunities for reusable packaging in cafes and eateries across campus, like the [Go Box](#) program in Portland where vendors provide reusable packaging that is returned at drop-sites and reused.

Coffee cups were also a significant source of waste with an estimated weekly output across all sources of 145 kg, with 90 kg in zero waste station garbage. Coffee cups were also abundant in zero waste station mixed recycling (25%) and refundable beverage container bins (24%). Coffee cup share programs are starting to emerge. In a student-developed model in New York City called [Good To Go](#), café visitors pay a small deposit on the purchase of a cup with coffee, keep the lid as a membership, return cups to participating cafes, and get discounts on refills with their lid. TRU should consider the viability of bringing a coffee cup share program to campus.

Trades - Wood Waste

Trades generates a unique waste stream that consists of both institutional-type and construction-type garbage. The trades DLC bin was the second largest source of waste by weight in 2018, generating approximately 1300 kg per week. High levels of wood waste were present in both the 2017 (58%) and 2018 (54%) audits. Although some wood is diverted for firewood in trades, roughly 700 kg of wood was found in the garbage over the week in 2018. Diverting wood waste would help increase diversion rates, however reducing the stream would save resources and reduce waste disposal rates.

Trades has two 6 cu.yd. bins collected three times per week at a cost of roughly \$8600 per year. The cost to bring in a wood bin could be partially offset by removing one of the garbage collection bins and reducing frequency of collection of the other bin to twice per week.

Reduction of wood waste in the trades program would reduce overall waste and costs as well as community benefits in delivering curriculum that supports source reduction in construction and demolition. It is recommended that TRU engage with stakeholders in the trades program to develop curriculum that supports salvage of wood for construction, and designing for deconstruction. There are resources available that could be introduced in curriculum, such as the EPA's [Best Practices for Reducing, Reusing and Recycling Construction and Demolition Materials](#).

Kitchens - Compost It!

The Culinary Arts and Campus Activity Centre kitchens are among the top five sources of waste on campus, generating approximately 800 kg and 600 kg of waste per week respectively. High levels of food waste were present in kitchen garbage, even though compost program exists in

the kitchens. There was a significant increase in the amount of food waste in the Culinary Arts kitchen in 2018 over 2017 levels (600 kg from 70 kg).

According to staff in the Culinary Arts program, in 2017 students were engaged at the beginning of their program about the compost program at TRU. As a result, there was minimal food waste observed in 2017 audit of the Culinary Arts kitchen samples. In 2018, there was no communication about the compost program with the students and high levels of food waste were observed. It is recommended that TRU ensure that this group of students is engaged on an annual basis to ensure food waste is composted.

The Campus Activity Centre kitchen food waste composition reduced from 73% in 2017 to 57% in 2018, however estimated output increased from 278 kg to 338 kg as a result of increase overall output of waste. According to staff, the head chef in the kitchen initiated efforts of address issues with compost (ensuring they had enough compost bins, and the frequency of collection). Engaging with kitchen staff to support food waste diversion would help improve waste diversion in kitchens.

Food waste has a direct impact on profitability. Minimizing food waste in kitchens not only reduces waste and costs associated with handling and disposal, but also has a direct impact on the bottom line. It is recommended that TRU engage with stakeholders to address opportunities to reduce wasted food in campus kitchens, such as inventory management, reviewing portion sizes and options on menus. Having kitchen staff perform audits of their own waste can help create awareness about what types of food are being wasted and where opportunities to reduce exist.

Appendix A - Waste Outputs and Source Allocation Tables

Table 25 - Waste Output and Source Allocation by Weight

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Dumpster location	Waste output by weight (kg/week)	% weight	AHT	Zero Waste Stations	Offices	Kitchen	Café	Daycare	Washrooms	Trades	Stores	Stand Alone	Science labs
R1	AHT	176.9	3.0%	2.9%		0.1%	-	-	-	0.0%	-	-	-	-
R2	Arts & Education	160.5	2.7%	-	2.6%	0.1%	-	-	-	0.1%	-	-	-	-
R3	CAC	947.1	16.0%	-	2.3%	0.5%	10.1%	1.2%	-	0.7%	-	1.2%	-	-
R4	CA	1410.1	23.8%	-	5.3%	2.3%	13.2%	1.5%	-	1.5%	-	-	0.0%	-
R5	Daycare	244.7	4.1%	-	0.6%	0.7%	-	2.1%	0.6%	0.1%	-	-	0.1%	-
R6	Old Main	749.7	12.6%	-	8.1%	0.3%	-	2.7%	-	1.0%	-	0.5%	0.0%	-
R7	SC/GYM	548.2	9.2%	-	7.5%	0.5%	-	0.5%	-	0.2%	-	-	-	0.6%
R8	Stores	155.4	2.6%	-	0.3%	0.4%	-	-	-	0.03%	-	2.0%	-	-
R9	Trades (bags)	212.9	4.0%	-	1.8%	0.3%	-	0.7%	-	0.8%	-	-	-	-
R10	Trades (DLC)	967.3	16.3%	-	-	0.0%	-	-	-	-	16.3%	-	-	-
R11	Trades Sawdust	361.3	6.1%	-	-	-	-	-	-	-	6.1%	-	-	-
R12	Total	5934.1	100.0%	2.8%	28.4%	5.1%	23.2%	8.74%	0.60%	4.4%	22.4%	3.7%	0.1%	0.6%
R13	Waste Output By Source (kg/week)			137.0	1686.9	299.9	1374.9	518.6	35.6	260.0	1328.6	216.6	7.7	32.9

Table 26 - Waste Output and Source Allocation by Volume

		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
	Dumpster location	Waste output by volume (cu.y/ week)	% volume	AHT	Zero Waste Stations	Offices	Kitchen	Café	Daycare	Washrooms	Trades	Stores	Stand Alone	Science labs
R1	AHT	1.8	1.6%	1.4%	-	0.1%	-	-	-	0.1%	-	-	-	-
R2	Arts & Education	4.8	4.2%	-	3.9%	0.2%	-	-	-	0.2%	-	-	-	-
R3	CAC	11.1	9.6%	-	3.1%	0.5%	5.1%	-	-	0.6%	-	0.3%	-	-
R4	CA	27.6	23.9%	-	9.5%	1.9%	7.5%	1.3%	-	3.7%	-	-	0.0%	-
R5	Daycare	5.7	4.9%	-	0.8%	0.8%	-	1.6%	0.7%	1.1%	-	-	0.0%	-
R6	Old Main	22.6	19.5%	-	14.5%	0.6%	-	2.1%	-	1.8%	-	0.5%	0.0%	-
R7	SC/GYM	13.6	11.8%	-	9.5%	0.4%	-	0.6%	-	0.6%	-	-	-	0.7%
R8	Stores	4.2	3.6%	-	0.4%	0.8%	-	-	-	0.2%	-	2.2%	-	-
R9	Trades (bags)	4.5	3.9%	-	2.2%	0.4%	-	0.8%	-	0.6%	15.1%	-	-	-
R10	Trades (DLC)	17.5	15.1%	-	-	-	-	-	-	-	2.0%	-	-	-
R11	Trades Sawdust	2.3	1.9%	-	-	-	-	-	-	-	-	-	-	-
R12	Total	115.65	100.0%	0.4%	43.8%	5.5%	12.6%	6.4%	0.7%	8.7%	17.1%	3.0%	0.1%	0.7%
R13	Waste Output By Source (cu.y/ week)			1.7	50.7	6.4	14.5	7.3	0.8	10.0	19.8	3.5	0.1	0.8

Appendix B - New Trades Building LEED Construction Project

A new building for the Trades and Technology department was under construction at the time of this audit. The building is aiming for LEED certification, which is scored based on a number of factors, one of which is construction waste management.

Data was provided about the materials diverted and landfilled during the period from July 2017 through January 2018. The following table shows the total amount of waste diverted and landfilled during this period. Note that although drywall was being separated and delivered to the landfill, drywall is not currently being diverted in Kamloops and therefore the weight of drywall is included in the total landfilled material. The diversion rate for the period was 93%.

Material	Weight (kg)
Clean Wood	31880
Concrete	13490
Drywall	2450
Mixed DLC	1989
Metal	14727
Grand Total	64536
Total Diverted Waste	60097
Total Landfilled Waste	4439
Diversion Rate	93%

