KPU Langley Campus Waste Audit Report

Autumn 2017

Prepared by ENVI 2310
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& Dr. Elizabeth Worobec, Dean of Science & Horticulture, KPU

KWANTLEN POLYTECHNIC UNIVERSITY

EXECUTIVE SUMMARY

On October 19th, 2017 students from ENVI 2310: Solid Waste Management began the first of a five-stage waste audit of the KPU Langley Campus. Janitorial and cafeteria staff were informed prior to October 19th to forgo emptying waste receptacles as usual and instead leave all waste in place for student collection. In small teams, students emptied the contents of waste receptacles on campus and collected filled garbage bags which were used to establish a large pile outside the campus cafeteria (Stage 1). As a class, students worked cooperatively to open and sort through the contents of all garbage bags collected, separating waste into categories including: landfill garbage, mixed paper, refundable recyclables, non-refundable recyclables, coffee cups, and organic waste (Stage 2). ENVI 2310 students subsequently re-bagged the sorted materials and weighed bags in each category, recording the results (Stage 3). After these initial stages, ENVI 2310 students hosted an informative booth in the West Building hallway on KPU Langley campus as part of Sustainability Week to talk to students and faculty about waste management strategies (Stage 4). Finally, students worked to collectively compile this Waste Audit Report to showcase findings from the Waste Audit conducted. Results showed that substantial amounts of organic waste is thrown into landfill-designated receptacles, and that many coffee cups are used on a daily basis. The ENVI 2310 class recommends, based on findings, that systematic changes are required to reduce landfill waste generated on campus, such as reintroducing biodegradable coffee cups, mandating organic waste separation in cafeteria food preparation, and modifying waste receptacle type and availability.

23
Garbage Bags Filled

98.4
Kgs Collected on Campus

266
Coffee cups Collected

ACKNOWLEDGEMENTS

The ENVI 2310 class would like to thank the following faculty and staff members at KPU Langley for their cooperation with, and support of, the 2017 Waste Audit, without whom the Waste Audit could not have been successful.

PAUL RICHARD – Thank you, Paul, for assisting the ENVI 2310 class with the planning and execution of the 2017 Waste Audit. As the instructor of ENVI 2310, the relevant materials you provided throughout the course as well as thought-provoking discussions about waste put this project in context for us. Thank you for making garbage - something once thought of as stinky, taboo, and boring - cool, fun, and interesting!

KPU JANITORIAL STAFF – Thank you to the KPU janitorial staff for cooperating with the 2017 Waste Audit and assisting students with accessing garbage bags. After emptying the campus waste receptacles for a mere 1.5 hours, we have gained a new appreciation for all your hard work and tireless dedication to keeping the KPU Langley campus clean and safe for students, staff, and faculty.

KPU CAFETERIA STAFF – Thank you to the KPU cafeteria staff for assisting ENVI 2310 with accessing cafeteria wastes, both in the canteen and 'behind the scenes' where food preparation takes place. Thank you for answering our questions and effortlessly maintaining cafeteria operations during our waste collection interruption.

With sincere thanks,

ENVI 2310 Students, Fall 2017

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TABLE OF CONTENTS

INTRODUCTION

During the 2017 fall semester, the KPU students of ENVI 2310: Solid Waste Management conducted a waste audit to determine the composition and quantity of garbage, organic materials, and recyclables disposed of in a single day at the KPU Langley campus. The overarching objective of the Audit was to construct a profile of waste at KPU and address the following questions: What materials compose most of our waste? How compliant are students and faculty with separating their garbage at waste stations? How much waste (in kg) is produced on average at KPU Langley?

The Waste Audit was completed in five stages: Stage 1, Waste Collection, Stage 2, Waste Sorting & Initial Weighing, Stage 3, Secondary Weighing, Stage 4, Report Composition and Stage 5, Sustainability Week Outreach. Stages 1 through 3 were all completed on October 19th by gathering, weighing, and sorting bagged waste that had accumulated on the KPU Langley Campus over roughly six hours (7:00 am to 1:00 pm) on Thursday, October 19th.

OBJECTIVES & SCOPE OF PROJECT

The objectives of the Waste Audit were as follows:

1. To quantify the amount (mass) of waste generated on the KPU Langley Campus mid-week.
2. To evaluate waste contents and determine the most common waste types by categorizing individual waste items into pre-determined classes.
3. To determine the quantity of disposable coffee cups that are deposited into KPU's waste bins over a single day.
4. To make waste management recommendations for KPU based on findings produced by the Waste Audit, in combination with 1) previous waste audits conducted at KPU Langley and 2) successful waste management strategies demonstrated by comparable academic institutions.

The scope of the Waste Audit was limited by time and resources; however data can be extrapolated to apply observed trends in campus waste production to KPU Langley in general. Temporal limitations were grounded in ENVI 2310 scheduling; the class itself runs Thursdays from 1:00 pm to 4:00 pm and therefore confined the duration of the Waste Audit. Resource limitations were grounded in students available (ENVI 2310 includes only 11 students), and access to waste (locked classrooms or private offices were not included). Therefore, the Waste Audit represents a snapshot of KPU Langley's waste production and efficiency of current waste management strategies, and looked at a six-hour waste accumulation on campus (7:00 am to 1:00 pm) on an arbitrary Thursday in October.

KPU WASTE MANAGEMENT STRATEGIES

Table 1.0. Waste audit comparisons, 2016 and 2017

Audit Year	Organics (Kg)	Paper Towels (Kg)	Plastics (Kg)	Mixed Paper (Kg)	Garbage (Kg)	Refund-ables	Coffee cups	Total
2016 Audit 1	35.4	20.3	14.5	55.8	19.5	27.5	6.2	179.2
2016 Audit 2	31.3	28.4	6.4	17.4	41.4	2	6.1	133.0
2017 Audit	29	14.8	6	9.7	20.6	9.8	8.5	98.4

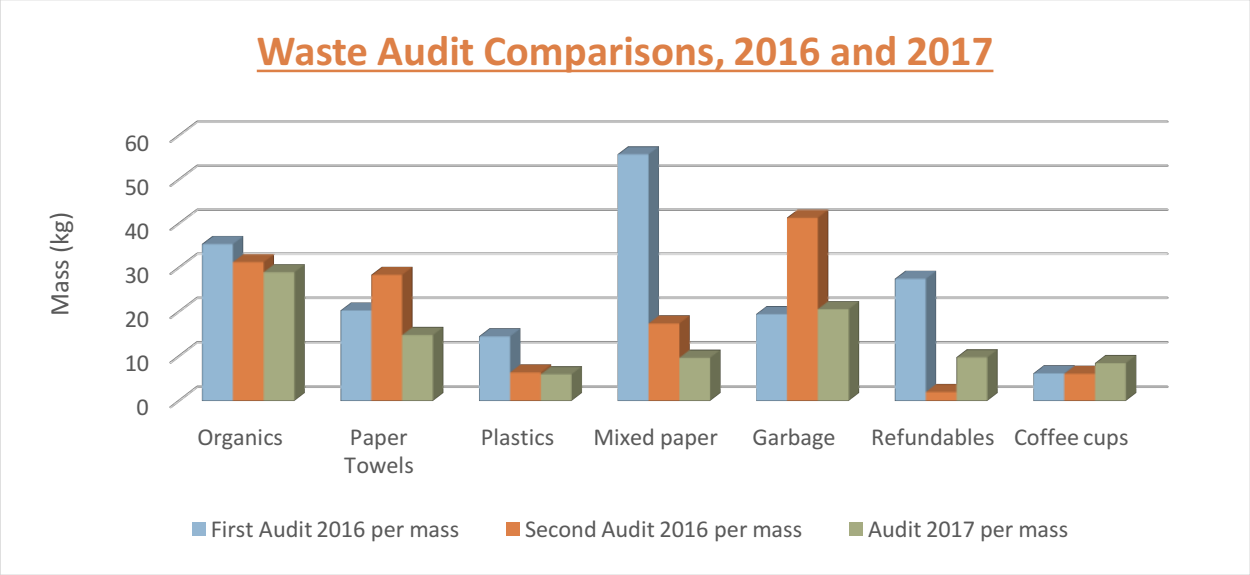


Figure 1.0. Waste audit comparisons, 2016 (2 audits), and 2017.

In the 2016 school year, the KPU Facilities Department introduced a 5-bin waste receptacle system (KPU, 2016) in hopes to separate waste into separate categories: mixed paper, refundable recyclables, non-refundable recyclables, organics, and waste. Currently, there are just two of these stations, but it is the hope of the ENVI 2310 class that with each year of data collected, the introduction of more stations is needed to promote effective waste disposal among students and faculty.

METHODOLOGY

The Waste Audit process consisted of five stages: Stage 1, Waste Collection, Stage 2, Waste Sorting & Initial Weighing, Stage 3, Secondary Weighing, Stage 4, Report Composition and Stage 5, Sustainability Week Outreach. Stages 1 through 3 took place on October 19th as part of the manual Waste Audit process.

The Waste Audit was conducted under a limited scope using several standards. First, the Waste Audit was conducted midweek, mid-semester during the Fall 2017 semester. By conducting the Audit during the school week, the weekend influence was reduced (which may have led to reduced waste produced if students took Friday or Monday off, particularly if either end of the school week was a holiday). By conducting the Audit mid-semester, the variables stemming from the influx of new students or students dropping out was eliminated, if, by mid-October, there is consistency in weekly school attendance by students. Second, the Waste Audit was not conducted after an usual event or anomaly (such as a festival, farmer's market, or class party), which may have inflated waste collected. Third, the Waste Audit looked at roughly six hours worth of accumulated waste, from 7:00 am (when KPU Langley opens) to 1:00 pm (when the Waste Audit began).

STAGE 1: WASTE COLLECTION

On October 19th, 2017 ENVI 2310 students conducted the Waste Audit. Students were initially divided into five groups and assigned to specific areas of the campus to collect garbage (see Table 2.0 below). Paul Richard, ENVI 2310 instructor, communicated with KPU Langley janitors and cafeteria staff to see that waste receptacles and sorting stations were not emptied throughout the day on October 19th.

Table 2.0: Waste Audit Assignments

Campus Area, Waste Collected	Number of Students Assigned
Women's Washrooms	2
Men's Washrooms	2
Cafeteria & East Building	3
South (Nursing) Building	2
West Building	2

Two female students were assigned the female washrooms around the campus and two male students were assigned the male washrooms. These two groups communicated during Stage 1 and decided amongst themselves which group would collect from gender-neutral or handicapped washrooms. Two students were assigned the South Building, two assigned to the West Building, and the remaining three assigned to both the cafeteria and east building.

Materials used by groups during Stage 1 included:

1. Nitrile Gloves (providing protection from contaminated substances and hazards)
2. Tongs (for moving or lifting waste items)
3. New garbage bags (used to replace collected garbage bags)
4. Masking Tape (used to label collected bags with location/origin details)
5. Markers/Pens (used to label collected bags with location/origin details)
6. Clipboards & Paper (used to record details of bags collected)

The collection took approximately 1.5 hours to complete. Each group was given a floorplan of the area of the campus that they were assigned to. Each group went around emptying out all the bins; this included waste bins, recycling bins, organic bins, bottle bins, and can bins. The bins were then replaced with new bags. After taking out the garbage bags, each tied bag was tagged with the name or area of the building, the floor and the type of garbage. If garbage was obtained from a classroom or office, then the classroom or the office number was written down as well. If a classroom or office were not able to be accessed at the time, it was recorded on the floorplan.

LIMITATIONS

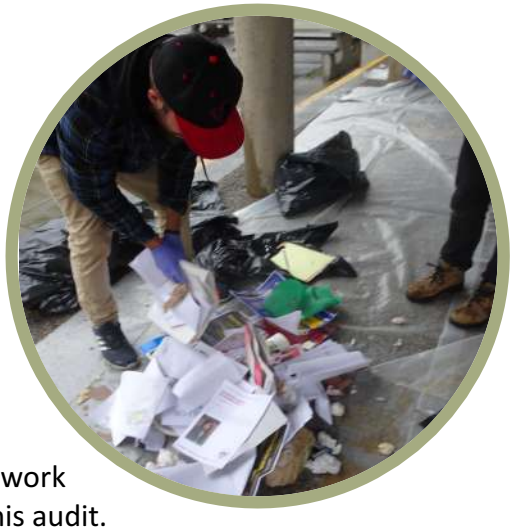
Table 3.0 (below) exhibits areas and buildings omitted from Stage 1, accompanied by justifications.

Table 3.0: Waste Collection, Omitted Areas and Buildings

Area or Building Omitted from Waste Collection	Justification / Reason for Omission
Outdoor campus receptacles	Time constraints, access.
Locked private offices	Access.
Locked classrooms	Access.
Brewery Building	Safety.
Horticulture Building	Safety.
Department Offices	Access.
Laboratories	Access, safety.

STAGE 2: WASTE SORTING & INITIAL WEIGHING

In Stage 2, all individual groups from Stage 1 melded to form a collective team of ENVI 2310 students. Garbage bags from around the campus were compiled in one area outside the cafeteria. A tarp was placed on the ground as this was where the garbage was going to be opened and segregated. To start off, each bag was weighed and the area it was retrieved from was recorded. After weighing each bag, the bag was put aside on the tarp in separate piles for garbage, organics, refundable bottles/cans, non-refundable items, recyclables and paper towels. Students recorded down what was found inside each bag and went through the garbage. While sorting through the bags, waste in the bags were further sorted into the categories (see Table 4.0).



A safety concern during the audit was coming across sharp objects while going through the garbage. Students made sure that, when going through the waste, the garbage bags were dumped out on the tarp and then were carefully segregated. Tongs were provided so that if students felt unsafe handling the garbage, the tongs could be used to pick and sort. To assure the area we did the sorting in was kept clean and safe afterwards, we used a tarp so that if there were any spills or any mess it was all on the tarp. At the end the tarp was disposed of as well as all the garbage bags. The class worked as a team so that the work load was distributed out eventually resulting in a safe, fair and steady work environment. There were no safety issues reported during this audit.

Materials used by ENVI 2310 during Stage 2 included:

1. Nitrile Gloves (providing protection from contaminated substances and hazards)
2. Tongs (for moving or lifting waste items)
3. Clear plastic tarp sheets (used to cover the ground outside on which to conduct Stage 2)
4. Masking Tape (used to label bag contents)
5. Markers/Pens (used to label bag contents)
6. Clipboards & Paper (used to record details of bags collected)
7. Scale (used to weigh bag contents)

Table 4.0: Waste Categories

Waste Category	Common Items in Category
Landfill	Plastic fragments, food wrappers, non-recyclable materials, non-organic materials.
Refundable Recyclables	Pop cans, bottles, TetraPaks, juice boxes
Non-refundable Recyclables	Food containers, plastic items with recycle symbol
Paper	Mixed paper, cardboard
Organics	Food waste, paper towels, biodegradable food containers
Coffee Cups	Non-biodegradable coffee cups

STAGE 3: SECONDARY WEIGHING

In Stage 3, waste sorted into categories (see Table 4.0) were bagged and weighed collectively to determine the total mass of waste collected (kg) and the mass percentage of each waste category (kg).

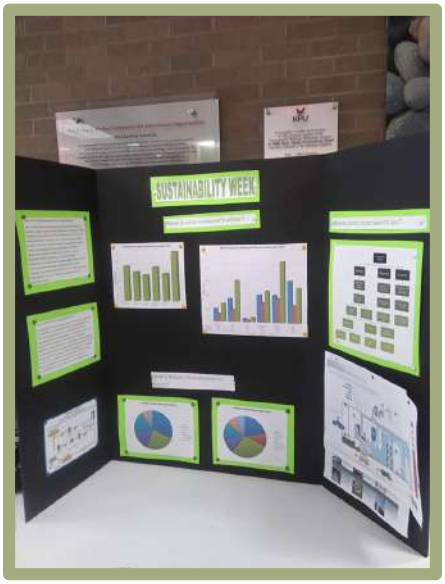
Stage 3 was accomplished by using handheld spring scales, weighing bags in each category, and recording results. The purpose of the secondary weighing was to render percent-by-mass data, although the limitation of this method was that percent-by-volume was not considered.

STAGE 4: REPORT COMPOSITION

Immediately after Stage 3 concluded on October 19th, Stage 4 began. The report composition stage of the Waste Audit involved translating collected data into a simple, readable format and analyzing data in context supplemented by historical information and recommendations. ENVI 2310 worked collectively to complete the report between October 20th, 2017 and December 5th, 2017.

STAGE 5: SUSTAINABILITY WEEK OUTREACH

As part of Sustainability Week at KPU, ENVI 2310 presented Waste Audit results to students on October 27th, 2017. Students set up in the West Building hallway and encouraged students and faculty to guess how many coffee cups were in a clear bag (collected from the Waste Audit). ENVI 2310 students engaged with people and discussed



the objectives and findings of the Waste Audit. The winner of the Coffee Cup Challenge (as per above) was awarded a KPU mug courtesy of Paul Richard, the ENVI 2310 instructor.

Clockwise from top: Figures 2.0, 3.0, and 4.0. Sustainability Week Presentation by ENVI 2310, October 2017.

RESULTS

Table 5.0: Sum of weight and classification of collected garbage.

	No. of Garbage Bag Filled	weight per bag 1 (kg)	weight per bag 2 (kg)	weight per bag 3 (kg)	weight per bag 4 (kg)	weight per bag 5 (kg)	% out of total weight
Landfill Waste	5	3.2	3.0	7.1	4.5	2.8	20.9
Refundable (Cans, bottles)	2	4.8	5.0	0.0	0.0	0.0	10.0
Organics/food waste	4	10.5	11.0	3.0	4.5	0.0	29.5
Paper Recyclables	3	2.0	3.2	4.5	0.0	0.0	9.9
Paper towel	4	2.2	6.8	2.0	3.8	0.0	15.0
Non-refundable recyclables	2	2.4	3.6	0.0	0.0	0.0	6.1
Coffee-cups	3	3.5	3.4	1.6	0.0	0.0	8.6
					TOTAL	98.4	100%

MASS AND COMPOSITION OF TOTAL WASTE

The total mass of unsorted waste produced at KPU Langley campus weighed in at 101.07Kg, with a final weight of 98.4Kg once sorted into seven waste categories (Figure 2). Organics came in as the most waste generated at 29.5%. However, due to the nature of this type of waste (moisture content, etc.) it is expected to outweigh other waste streams. On the other hand, unsoiled paper towel (weighing in at 14.8Kg) surprisingly outweighed such waste categories as recyclables and refundable waste which are made up of heavier materials such as plastic and glass. There were 266 coffee cups, and more than 170 plastic utensils (landfill bound) generated in a single day by the allotted audit time on October 19, 2017.

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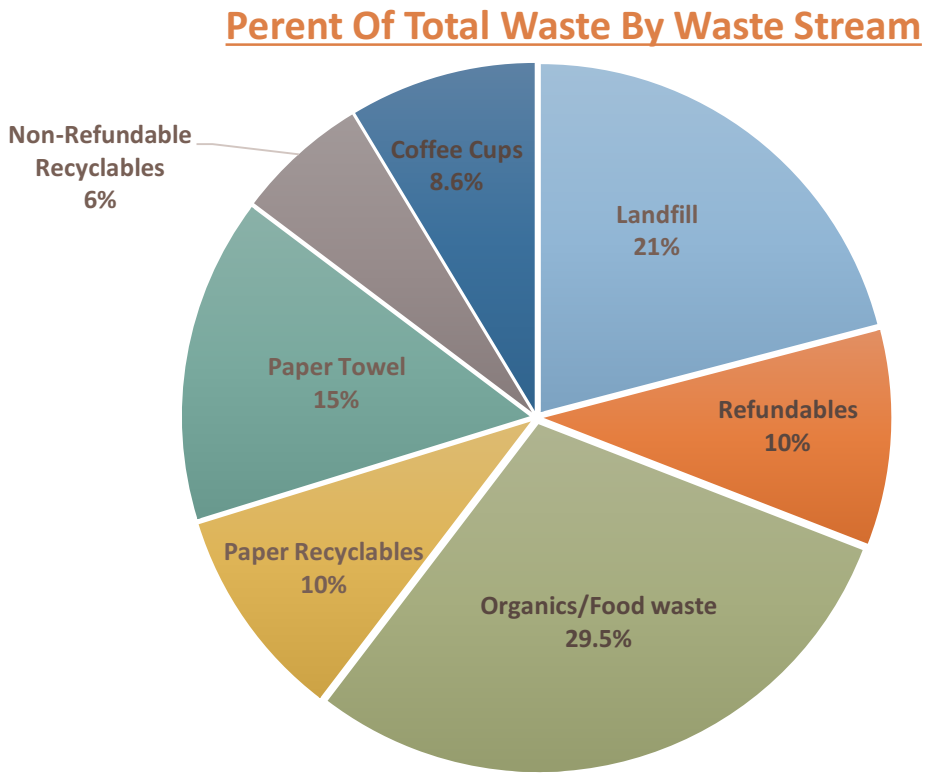

Figure 2.0. Percentages by mass of total sorted waste generated in one day by KPU Langley Campus, categorized into seven waste streams.

WASTE ORIGIN & HIGH PRODUCTION AREAS

As shown in Figure 3.0, both the west and east building produced nearly the same amount of waste. The east building generated slightly more at 47.5%, followed by the west building at 41.5%, and the south building contributing only 11% of total waste.

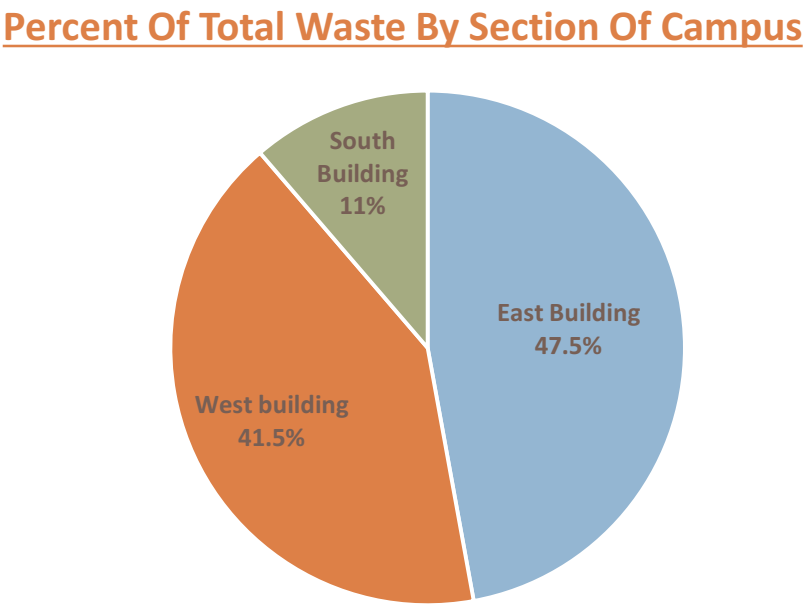

Figure 3.0. Percentages by mass of total waste produced in one day by the three wings.

Figure 4.0 below provides further insight of waste origin, by individual floors of the three campus wings. As predicted, the first floor of the east building generated the most waste. This can be explained by the fact that it is the location of the cafeteria and kitchen, and reflects the results of organics being the highest amount of waste produced.

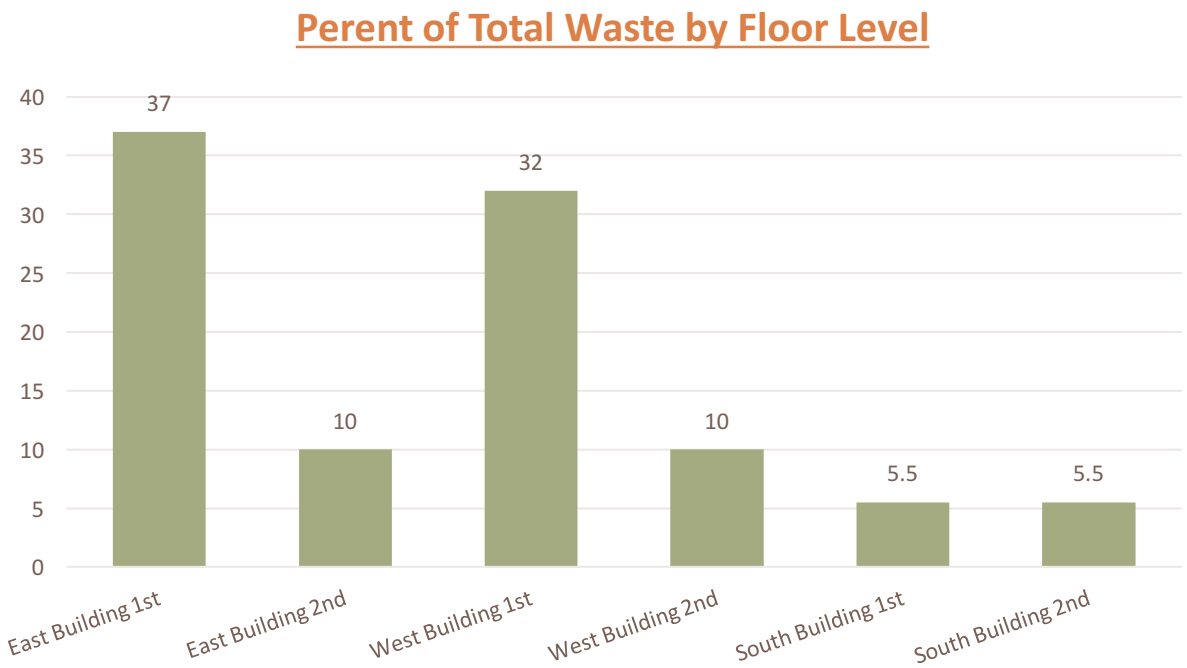

Figure 4.0. Percentages by mass of total waste produced by each floor of the three wings

Figure 5.0 below shows the unsorted waste produced by the cafeteria. With waste placed in the garbage bins weighing in at 21.8Kg, this far exceeds all other waste streams, compared to the weight of the waste found in the organics bin, at 2.7Kg. These results do not mirror the results found in sorted waste, with organics ranking as the most waste produced. This reveals that much of the waste produced by the cafeteria is never sorted, but rather into one collective receptacle.

The three recyclable categories together only accounted for 1.6% of the total waste found in the individual bins. Note figure 4 and 5 categories reflect type of waste container, not actual waste content found in each container.

With waste placed in the garbage bins weighing in at 21.8Kg, this far exceeds all other waste streams, compared to the weight of the waste found in the organics bin, at 2.7Kg. The three recyclable categories together only accounted for 1.6% of the total waste found in the individual bins.

Figure 5.0. Mass (Kg) of five unsorted waste streams generated in the cafeteria. Each category reflects type of waste bin. Not actual type of waste found in each bin.

With Figure 6.0 showing total weights of the five waste streams in the hallways, with the landfill bound garbage weighing in at a whopping 31.75Kg. This mass alone exceeds the mass for total sorted landfill waste for the whole campus.

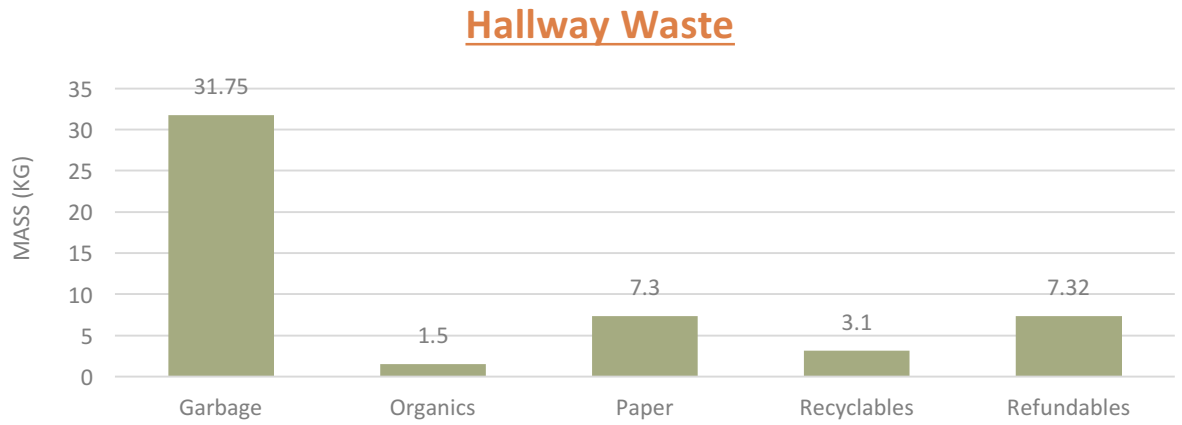

Figure 6.0. Mass (Kg) of five unsorted waste streams generated in the hallways.

POTENTIAL WASTE DIVERSION FROM LANDFILL

In terms of potential waste diversion from the landfill, Table 7.0 reveals the amount of categorized waste improperly disposed of. These results were found by calculating the difference between unsorted and sorted waste, and further calculating the percentage of each that would be landfill bound. Aside from the landfill bins, organics ranked first at a staggering 85.5% of it not placed in the organics bin. Non-refundable recycling came in second at 45%. Conversely, the results for landfill garbage bins shows the opposite, with a steep decline in mass once sorted. Nearly four times the amount of actual landfill garbage was material from

other waste streams. A total of 30.98Kg, or 31% of total waste was improperly disposed of and a staggering 73.5% of waste headed to the landfill was organic or recyclable material.

Table 7.0. Difference in mass of five waste streams pre-sorting and post-sorting, and percentage improperly disposed of. Values indicate amount of waste lost from proper disposal, whereas + value indicates the amount of waste not properly disposed of.

Waste Category	Unsorted Waste (Kg)	Sorted Waste (Kg)	Difference (Kg)	% incorrectly disposed of
Organics	4.2Kg	29Kg	-24.8Kg	**85.5%**
Refundable Waste	7.82Kg	9.8Kg	-1.98Kg	**20%**
Recyclable Paper	8.2Kg	9.7Kg	-1.5Kg	**15.5%**
Non-Refundable Recyclable	3.3Kg	6.0Kg	-2.7Kg	**45%**
Landfill	77.5Kg	20.6Kg	+56.95Kg	**276.5% or 73.5% of unsorted**

Figure 7.0. Mass Percentage of each waste stream from the total amount of waste incorrectly disposed of.

DISCUSSION

Results from the Waste Audit demonstrated compliance by people on KPU Langley campus who discard of waste materials, as receptacles were shown to contain largely their intended materials. ENVI 2310 speculates that waste receptacle availability, design, and systematic waste management flaws bring about the generation of an excessive amount of solid waste on campus. Recommendations for improving waste management at KPU Langley are detailed in the subsequent section (Recommendations).

RECOMMENDATIONS

The following recommendations have been developed from the Waste Audit, addressing both systematic changes and modifications to available future-waste materials.

SYSTEMATIC CHANGES

Implementing top-down changes to the KPU solid waste management strategy is likely to render the most noticeable results and generate the largest impact. Modifying the waste management system itself and addressing processes that are insufficiently curbing waste generated on campus (as evident by this Waste Audit), will likely reshape how waste is viewed by students, staff, and faculty.

INCREASING WASTE STATIONS

There is an urgent need to provide additional waste-separating stations on campus, to provide people with the opportunity to separate their waste. As of November 2017, there are only two adequate stations on Langley campus that offer a receptacle for organic materials. Unfortunately, both waste stations are located only on the first floor of campus, and only in the West and East buildings. This does not meet the needs of KPU Langley students. While there are multiple three-bin receptacles that allow separation of landfill waste, paper, and all recyclables located throughout the school, these pseudo-stations are insufficient as they still only provide limited waste separating streams and do not include an organics receptacle. It is recommended that each KPU Langley building (East, West, Nursing, Brewery, ISH, Horticulture, etc.) be provided with at minimum one waste-separating station per floor.

MODIFYING WASTE STATIONS

In addition to installing more waste-separating stations, it is recommended that they be updated to discourage landfill waste. Currently, the landfill bin and organics bin at the stations are of similar size and capacity. To reduce landfill waste and encourage separation of waste, it is recommended the landfill bin be considerably smaller than the organics bin to promote sustainable disposal.

REDUCING SINGLE-WASTE RECEPTACLES

Currently, there are many single-waste receptacles located throughout campus, including traditional small, metal garbage cans or taller plastic swing-door bins. These bins are distributed in classrooms, private offices, or hallways, and promote single-stream waste disposal. From this waste audit, it is speculated that less single-waste receptacles would encourage individuals to visit waste sorting stations in the school instead and thus properly separate their waste. By reducing the availability of garbage bins, people at KPU Langley campus will be forced to deposit solid waste into appropriate streams.

CAFETERIA WASTE SEPARATION

The KPU Langley cafeteria does not currently separate their organic waste, and yet generates a substantial mass of food waste each day, presumed to result directly from food preparation. The cafeteria can divert large amounts of landfill waste into organics bins and should be held accountable for the food waste they dispose of each day.

HAND DRYERS

Paper towels accounted for 15% of the waste in this audit. The best way to reduce that waste would be to install hand dryers. According to Restroom Direct (Restroom Direct, 2017), hand dryers are much cheaper to operate than using paper towels: 0.02-0.18 cents per dry whereas paper towels are around 1 cent per sheet. At some point the cost of the installation of the hand dryers would be nullified by the amount that is being saved instead of using paper towels.

WASTE MATERIALS

DISPENSERS INSTEAD OF DISPOSABLE PACKETS

A choice Sodexo recently made was changing from ketchup dispensers to individual ketchup packets. It is recommended that Sodexo change back to ketchup dispensers. This would eliminate the waste made by the ketchup packets (the paper cups used with the dispensers can be put into the organics bin).

COFFEE CUPS

The largest amount of waste produced by one thing was, like previous years, coffee cups. In 2016, upon recommendation, Sodexo switched to providing compostable cups to the KPU Langley cafeteria. However, at the start of the following Fall Semester 2017, they reverted back to providing non-compostable cups after receiving complaints that the coffee did not taste as good. Speaking with Sodexo staff at the Langley Campus, they informed us switching coffee brands meant purchasing the Starbucks brand of disposable cups as part of a combination deal. The choice was between Starbucks coffee or compostable cups. The end decision was to go back to Starbucks.

A discount is given for using a reusable mug at Sodexo, Grassroots, and Tim Hortons: $0.25, $0.15 and $0.12 respectively (Zaida, S., 2014). One recommendation is to advertise that more, perhaps put up a sign by the cafeteria. Another recommendation is to raise that refund slightly, maybe to 10% off the coffee. This would motivate people more to reduce the waste of disposable coffee cups if they could save money. Sodexo could also switch back to the compostable cups, to minimize the waste going to the landfill.

COMPOST

The audit revealed that the largest contributor to waste at KPU is organics and food waste. The Langley campus has onsite composting for food and plant waste that is used in landscaping and gardening. Currently, only the School of Horticulture Field Labs and the greenhouses, and Sodexo as needed, compost their waste (Zaida, S., 2014). UFV has a few compost bins around campus in areas such as the cafeteria where they are most useful (UFV, n. d.). Having compost bins in areas where people consume food would reduce the amount of organic waste going to the landfill. Considering organics and food waste is the largest contributor to waste at KPU, separating food waste from organics and having more compost bins would be beneficial for KPU as the compost produced could be used for landscaping and there would be a reduced cost of green waste pick up.

EDUCATION

Education plays one of the most important roles in reducing waste at Kwantlen since without the participation of all KPU members, all effort goes to waste.

Out of the 3 organics bins, 2 of them were contaminated with other kinds of waste. Students and faculty need to learn how to properly use bins to remedy this issue and other cross-contamination. Educating all members of KPU through Sustainability Week posters, articles in the KPU magazine "The Runner" and activities through the S.A.F.E. club (Students Active for the Environment) at Kwantlen would increase awareness of sustainability issues and proper usage of bins. Also, at the beginning of each semester, an e-mail could be sent to all students, staff and faculty about how to properly use the recycling, garbage, and compost bins to either teach and/or remind proper use. This email could be sent in the form of a poster or pdf file for easy viewing, and it could also be part of a project for an EPT student.

Something that UFV is trying is their program "Bin-be-Gone", where there are less garbage cans around the university and more recycling stations (UFV, 2017). The rationale behind this is it is now easier to recycle than to just throw something in the garbage, so recycling is now the more convenient option. With the easy option of just blindly throwing things in the garbage gone, students are forced to pay more attention and sort their waste into the appropriate recycling container.

RECOMMENDATIONS FOR FUTURE AUDITORS

To reduce field work time, it is advisable that all necessary forms are made, printed and photocopied before the audit. It is also advisable that the class creates an online poll to investigate whether students, faculty and staff would be interested in buying their food at a discount when using their own reusable containers.

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APPENDICES

A: CURRENT KPU WASTE STRATEGIES

Waste Diversion Report 2015 – 2016 KPU Facilities Department (KPU, 2017)

http://www.kpu.ca/sites/default/files/Facilities%20Services/Sustainability%20at%20KPU%20-%20where%20are%20we%20now%20-%20Saima%20Zaida%20Final%202014%2001%2030_0.pdf

Table 8.0 Supplementary Waste (weight) at all KPU Campuses.

Campus	Paper, kg	Glass, Metal, Plastic,kg	Compost, kg	Cardboard, kg	Green Waste, kg	Mixed Construction, kg	Clean Wood	Recycling Total, kg	Waste, kg	Total Removed, kg
Surrey	22765	1935	7375	15415				47490	100815	148305
Langley (M)	8115	380	2050	5990				16535	61130	77665
Langley (H)	0	0	0	0				0	6195	6195
Cloverdale	2225	676	1815	6430				11146	51310	62456
Richmond	8805	1371	6890	12275				29341	74830	104171
Large bins all campuses					19980	59981	7640	87601	45130	220332
Total	41910	4362	18130	40110		59981	7640	192113	339410	619124

"The recycling processes at KPU divert approximately 25 consumer materials away from landfills with the opportunity for more diversion being explored. A summary of the waste diversion activities is provided in the table below with detailed waste management categorized using the 3 "R's": Reduce, Reuse, and Recycle (KPU, 2016)."

Table 9.0. Waste Diversion by Third Parties. *Sustainability at KPU, Where are we Now?* (Zaidi, 2013).

WASTE/ RECYCLEABLE RECYCLING PRODUCT	CONTRACTOR RESPONSIBLE	DEPARTMENT RESPONSIBLE
OFFICE PAPER	SUPERSAVE	FACILITIES
CORRUGATED CARDBOARD	SUPERSAVE	FACILITIES
FLUORESCENT LAMPS, BALLASTS	NULIFE	FACILITIES
BATTERIES/BALLASTS	NULIFE	FACILITIES
PRINTER AND TONER CARTRIDGES	IKON	MATERIAL MANAGEMENT
METALS	LOCAL & R&P METALS	IET AND FACILITIES
COMPUTER/ ELECTRONIC SCRAP	ABC METALS	IET
MASONRY DEBRIS	SUPERSAVE	FACILITIES
USED OIL	M&R MOBILE, PLASTICGRIND	FACILITIES
USED OIL FILTERS	M&R MOBILE, PLASTICGRIND	FACILITIES
TIRES	LOCAL COMPANIES	AUTOMOTIVE
USED ANTIFREEZE	M&R MOBILE, PLASTICGRIND	FACILITIES
KITCHEN OIL/ GREASE	WEST COAST REDUCTION	FACILITIES
SCIENCE LAB CHEMICALS	NEWALTA	SCIENCES
COMPOST/ GREEN WASTE	SUPERSAVE	HORTICULTURE
BOTTLES/CANS/DOMESTIC PLASTICS	SUPERSAVE	FACILITIES
CONFIDENTIAL PAPERS	SHRED-IT	MATERIAL MANAGEMENT
GENERAL WASTE	SUPERSAVE	FACILITIES
HARD COVER BOOKS	URBAN IMPACT	FACILITIES
HAZARDOUS FLUIDS	NEWALATA	FACILITIES
PALLETS	VARIOUS	FACILITIES
FARRIER SHOP ORGANIC WASTE	SUPERSAVE	FACILITIES
DRYWALL	CONTRACTORS / INHOUSE	FACILITIES
PAINT	CONTRACTORS / INHOUSE	FACILITIES

B: RAW WASTE AUDIT DATA

Table 5.0. Sum of weight and classification of collected garbage.

	# of Garbage Bags Filled	Weight per bag 1 (kg)	Weight per bag 2 (kg)	Weight per bag 3 (kg)	Weight per bag 4 (kg)	Weight per bag 5 (kg)	TOTAL WEIGHT (KG)	% of total weight
Landfill Waste	5	3.2	3.0	7.1	4.5	2.8	20.6	***20.9***
Recyclable Refundable (Cans, bottles)	2	4.8	5.0	0.0	0.0	0.0	9.8	***10.0***
Organics/food waste	4	10.5	11.0	3.0	4.5	0.0	29.0	***29.5***
Paper Recyclables	3	2.0	3.2	4.5	0.0	0.0	9.7	***9.9***
Paper towel/ mixed paper	4	2.2	6.8	2.0	3.8	0.0	14.8	***15.0***
Non-refundable recyclables	2	2.4	3.6	0.0	0.0	0.0	6.0	***6.1***
Coffee-cups	3	3.5	3.4	1.6	0.0	0.0	8.5	***8.6***
						TOTAL (KG):	**98.4**	

Table 10.0. RAWDATA - Location and Weight (kg) of Collected Bags

Building (E,W,S)	Floor	Location	Type	Note	Weight (kg)
E	1	Caf	cans	-	0.4
E	1	Hallway	cans	-	0.8
E	2	hallway	cans	-	0.8
E	1	1540	garbage	-	1.7
E	1	Caf (1)	garbage	coffee	0.6
E	1	Caf (12)	garbage	w.s	0.1
E	1	Caf (2)	garbage	-	6.4
E	1	caf (3)	garbage	-	2.7
E	1	Caf (4)	garbage	-	0.5
E	1	Caf (5)	garbage	-	1.2
E	1	Caf (6)	garbage	-	0.7
E	1	Caf (7)	garbage	till	0.5
E	1	Caf (8)	garbage	swing	4.6
E	1	Caf (9)	garbage	-	2.4
E	2	H.R	garbage	-	0.6
E	1	Hallway	garbage	-	1.5
E	1	Hallway	garbage	-	0.5
E	1	Hallway	garbage	-	0.1
E	1	Hallway	garbage	-	1.1
E	1	hallway	garbage	w.s	1.5

E	2	hallway	garbage	-	1.1
E	2	hallway	garbage	w.s	2.8
E	1	HW	garbage	-	0.1
E	1	MW	garbage	caf	1.1
E	1	WW	garbage	-	2.4
E	2	WW	garbage	-	2.1
E	1	Caf (11)	garbage	w.s	1.5
E	2	hallway	garbage	-	1
E	1	Caf (10)	organics	w.s	2.7
E	1	Caf (15)	paper	w.s	0.4
E	1	Caf (16)	paper	w.s	0.5
E	1	Hallway	paper	-	0.3
E	1	Hallway	paper	w.s	0.1
E	2	hallway	paper	w.s	1.4
E	2	hallway	paper	w.s	0.1
E	1	Caf (13)	recyclables	w.s	0.2
E	1	Caf (14)	refundables	w.s	0.1
no label	2	Hallway	garbage	-	0.1
no label	2	WW	garbage	-	0.1
no label	2	WW	garbage	-	1
no label			garbage	-	1
S	2	hallway	bottles	-	0.1
S	1	hallway	bottles	-	0.4
S	1	hallway	cans	-	0.02
S	1	hallway	cans	-	1
S	2	hallway	cans	-	0.1
S	1	hallway	cans	-	0.1
S	1	hallway	cans	-	0.1
S	2	hallways	cans	-	0.2
S	1	1860	garbage	-	0.1
S	2	2010	garbage	-	0.1
S	2	Caf	garbage	-	0.6
S	1	Gathering	garbage	-	1.1
S	1	Hallway	garbage	-	0.2
S	1	hallway	garbage	-	0.05
S	1	Hallway	garbage	-	0.9
S	1	hallway	garbage	-	0.1
S	2	hallway	garbage	-	2
S	2	HW	garbage	-	0.1
S	1	W.H	garbage	-	0.1
S	2	W.W	garbage	-	0.5

S	1	W.W	garbage	-	0.4
S	2	hallway	paer	-	0.1
S	1	Hallway	paper	-	0.1
S	2	Hallway	paper	-	1.8
S	1	hallway	paper	-	0.8
S	1	hallway	recyclables	-	0.1
W	1	Hallway	cans	music	1.8
W	1	Hallway	garbage	music	3.2
W	1	Hallway	garbage	-	0.4
W	1	Hallway	garbage	music	1
W	2	Hallway	garbage	-	1.2
W	1	hallway	garbage	-	2.2
W	1	hallway	garbage	-	3.5
w	1	hallway	garbage	-	1.9
W	1	hallway	garbage	-	2
W	2	hallway	garbage	-	1.4
W	2	hallway	garbage	-	0.9
W	1	HW	garbage	-	0.2
W	1	HW	garbage	music	0.1
W	1	MW	garbage	music	0.9
W	2	MW	garbage	-	1.7
W	2	W.W	garbage	-	1.4
W	1	WW	garbage	-	3
W	1	WW	garbage	-	3
W	1	WW	garbage	-	1.3
W	1	WW	garbage	music	1
W	1	Hallway	organics	-	1.5
W	1	Hallway	paper	music	0.6
W	2	Hallway	paper	-	1
W	1	Hallway	paper	-	0.5
W	2	Hallway	paper	-	0.5
W	2	Hallway	recyclables	-	1
W	1	Hallway	recyclables	-	1.2
W	1	hallway	recyclables	-	0.4
W	2	hallway	recyclables	-	0.4
zW	1	hallway	refundables	-	1.9

Table 12.0. RAW Data Set – Location, Bin Type, Waste Type

W/S/E	Location	Floor #	note	Type of. Bin	Misc.	Waste	Utensils	Ref.	Non-ref	Rec. Paper	PPT, napkins	Organics	Coffee-cups
W	Hall	1	-	refundables	0	0	0	3	3	0	0	0	3
W	Hall	2	-	garbage	0	20	0	4	>1	>1	>1	0	15
W	Hall	1	-	garbage	0	>1	0	0	>1	>1	0	0	3
W	Hall	1	-	garbage	0	0	0	0	>1	>1	0	>1	6
W	Washroom M	1	Music Wing.	garbage	0	0	0	0	0	0	>1	0	0
W	Washroom M	1	-	garbage	0	0	0	0	0	0	>1	0	0
W	Hall	1	-	garbage	0	>1	0	0	0	0	0	>1	25
W	Washroom F	1	-	garbage	0	0	0	0	1	0	0	0	3
W	Hall	1	Music Wing.	garbage	0	>1	0	0	0	>1	0	>1	13
W	Hall	1	-	garbage	0	>1	0	0	>1	0	0	0	15
W	Washroom M	2	-	garbage	0	0	0	>1	0	0	>1	0	1
W	Cafeteria(1)	1	till	garbage	0	0	0	2	0	>1	>1	>1	3
W	Cafeteria (3)	1	coffee station	garbage	0	>1	0	0	5	0	>1	>1	0
W	Hall	1	Music Wing.	garbage	0	>4	0	0	3	1	0	1	2
W	Hall	2	-	garbage	0	4	0	2	1	2	0	2	7
W	Hall	1	-	garbage	0	>3	1	0	4	0	0	>1	13
W	Hall	2	-	garbage	0	0	0	0	5	0	>1	3	6
W	Washroom F	2	-	garbage	0	>1	0	0	0	0	>1	0	2
W	Washroom H	1	Music Wing.	garbage	0	0	0	0	0	0	>1	0	0
W	Washroom M	1	library	garbage	0	0	0	0	0	0	>1	0	0
W	Washroom M	1	Music Wing.	garbage	0	0	0	0	0	0	>1	0	0
W	washroom m	2	above library	garbage	0	>1	0	0	0	0	>1	0	0
W	Hall	1	-	organics	0	0	0	0	0	0	0	>1	0
W	Hall	1	-	paper	0	>1	0	0	0	0	0	>1	>1
W	Hall	1	-	paper	0	0	0	0	3	>1	0	0	0
W	Hall-way	2	-	paper	0	0	0	0	0	>1	0	0	0
W	washroom F	1	Music Wing.	paper	0	0	0	0	0	>1	0	0	0
W	Hall	1	-	recyclables	0	0	0	23	0	0	0	0	1
W	Hall	2	-	recyclables	0	0	0	12	2	0	0	0	0
W	Hall	1	-	refundables	2 (extra coffee lids)	3	2	26	3	0	>1	0	5
W	Hall	1	-	refundables	0	0	0	25	2	0	0	0	3
W	Hall	2	-	returnables	0	0	0	13	0	0	0	0	2
S	Classroom	1	-	garbage	0	0	0	0	0	>1	0	>1	0
S	Hall	1	-	garbage	0	0	0	0	1	>1	0	0	0
S	Classroom (2010)	2	-	garbage	0	0	0	0	0	0	0	1	0
S	Hall-way	2	-	garbage	1 (aluminum tray)	>1	>40	1	>1	>2	>1	>1	4
S	Gathering	1	-	garbage	>1 (ciggarrette butts)	>1	2	0	0	0	0	>1	0
S	Gathering	1	1802	garbage	0	>1	0	0	>3	>3	0	0	3
S	Hall-way	1	-	garbage	0	>1	1	0	0	1	0	0	0
S	Sitting Space	2	-	garbage	0	>3	3	0	1	>2	>1	3	2
S	Gathering	1	-	garbage	0	>2	>2	0	0	>1	0	0	8
S	Washroom H	1	-	garbage	0	0	0	0	0	0	>1	0	0

S	Washroom F	2	-	garbage	0	1	0	0	0	0	>1	0	0
S	Washroom H	1	-	garbage	0	0	0	0	0	0	>1	0	0
S	Hallway	2	-	garbage	0	>1	>1	0	0	0	0	>1	3
S	Hall-way	2	-	paper	0	0	0	0	0	>1	0	0	0
S	Hall-way	2	-	paper	0	0	0	0	0	>1	0	0	0
S	Hall-way	2	-	recycling	0	>1	0	2	>1	>1	0	0	0
S	Hall-way	2	-	recycling	0	0	0	0	0	0	0	0	1
S	Hall-way	1	-	recycling	0	0	0	0	>1	0	0	0	1
S	Hall-way	1	-	Refundable	0	0	0	2	1	0	0	0	1
S	Hall-way	1	-	Refundable	0	>5	0	2	0	0	0	>1	0
S	Hall-way	1	-	Refundable	0	0	0	3	3	0	0	0	0
S	Hall-way	1	-	Refundable	0	0	0	8	0	0	0	0	0
S	Hall-way	2	-	Returnable	0	1	0	2	1	0	0	0	1
S	Hall-way	2	-	Returnable	0	1	1	9	0	0	0	0	0
No label					*0*	1	1	8	1	0	0	0	3
E	Cafeteria (4)	1	Kitchen	garbage	>1 (aluminum tray) + Foil	0	8	1	3	>1	0	>1	0
E	classroom (1540)	1	-	garbage	0	0	0	0	2	>1	0	>1	11
E	Cafeteria	1	Waste-station	garbage	0	>1	29	0	>1	13	0	>1	6
E	Cafeteria	1	-	garbage	0	>1	32	0	10	40	0	>1	9
E	Washroom F	1	-	garbage	0	5	0	0	0	>1	>1	0	0
E	Washroom M	2	-	garbage	0	1	0	0	0	0	>1	0	0
E	Washroom H	1	-	garbage	0	0	0	0	0	0	>1	0	0
E	Hall-way	2	-	garbage	0	>1	0	0	0	0	0	>1	11
E	Washroom M	1	-	garbage	0	>1	0	0	0	0	>1	0	0
E	Hall-way	2	Waste-station	garbage	0	>1	0	0	0	0	>1	0	9
E	Hall-way	2	-	garbage	0	0	0	0	>1	0	0	>1	9
E	Cafeteria (1)	1	Waste-station	garbage	0	>1	0	0	>1	0	0	>1	2
E	Classroom (1535)	1	-	garbage	0	0	0	0	0	0	0	0	2
E	Cafeteria (6)	1	-	garbage	0	>1	0	0	1	>1	0	>1	0
E	Hall-way	1	-	garbage	0	>4	0	1	0	0	>1	2	7
E	Classroom (1650)	1	-	garbage	0	8	1	0	0	1	0	0	12
E	Cafeteria (2)	1	kitchen	garbage	0	>1	0	0	0	0	0	>1	>1
E	Hall-way	1	Waste-station	garbage	1 (stucco wiring)	>3	0	0	0	>1	0	>1	9
E	Cafeteria (5)	1	Kitchen	garbage	0	0	0	0	>1	>1	0	>1	0
E	Office (1538)	1	-	garbage	0	>1	0	0	2	1	1	0	0
E	HR	2	-	garbage	0	>1	0	0	0	0	0	>1	1
E	washroom m	2	above cafeteria	garbage	0	0	0	0	0	0	>1	0	0
E	washroom m	1	across cafeteria	garbage	0	0	0	0	0	>1	>1	0	0
E	Cafeteria	1	Waste-station	Organics	0	>1	877	0	>1	9	>1	>1	6
E	Cafeteria	1	Waste-station	Organics	0	0	0	0	0	0	0	0	5
E	Cafeteria	1	Waste-station	paper	0	0	0	0	0	>1	0	>1	0
E	Hall-way	2	-	paper	0	0	1	0	0	0	0	>1	0
E	Hall-way	1	-	paper	0	1	0	1	1	>1	0	0	1
E	Cafeteria (15)	1	Waste-station	paper	0	0	0	0	1	>2	0	0	0

E	Office	1	-	paper	0	0	0	0	0	>1	0	0	0
E	human resources	2	-	paper	0	0	1	0	>3	>1	0	1	2
E	Hallway	1	Waste-station	paper	0	>1	0	0	0	>1	0	0	1
E	Cafeteria	1	Waste-station	recycling	0	0	0	2	>1	0	0	0	0
E	Cafeteria	1	Waste-station	Refundable	0	2	0	0	0	0	0	>1	2
E	Hall-way	2	-	Refundable	0	1	0	16	5	0	0	0	3
E	Hall-way	1	Waste-station	Refundable	0	0	0	6	6	0	0	0	1
2024?	Washroom F	?	-	garbage	0	0	0	0	0	0	>1	0	2
2537	Washroom H	-	-	garbage	0	0	0	0	0	0	>1	0	0
2032	Washroom H	-	-	garbage	0	>1	0	0	0	0	>1	0	0

C: WASTE MANAGEMENT: OTHER INSTITUTIONS

The themes that emerged from other institutions are very similar to what Kwantlen Polytechnic University is doing with waste management. The first theme that emerged were the type of waste bins in the institutions of McGill University (McGill, 2017), University of Victoria (UVIC, 2017), UFV (UFV, 2017), UBCO (UBCO, 2017) and Douglas College (Douglas College, 2017).

Like Kwantlen, each of these intuitions have a waste system set up where there is a separate bin for the type of waste being thrown out. For example, there will be a different bin for garbage, recyclables, paper, and bottles. These bins are set up in this way in the hopes of having students throw out their waste accordingly. Another theme is the composting system on campus which UFV and KPU have in common. The campuses turn perishables into soil that can be used for gardening and landscaping purposes on the campus. Instead of discarding the food and plant waste, these campuses are making great use of it by creating it into soil for the on-campus use.

A third theme relatable to KPU that emerged were the water stations set up around the campuses. These water stations allow students to refill their own bottles and this promotes the reduction of plastic waste as students will not be purchasing new water bottles. The campuses that share this strategy with KPU are McGill University and UVIC.

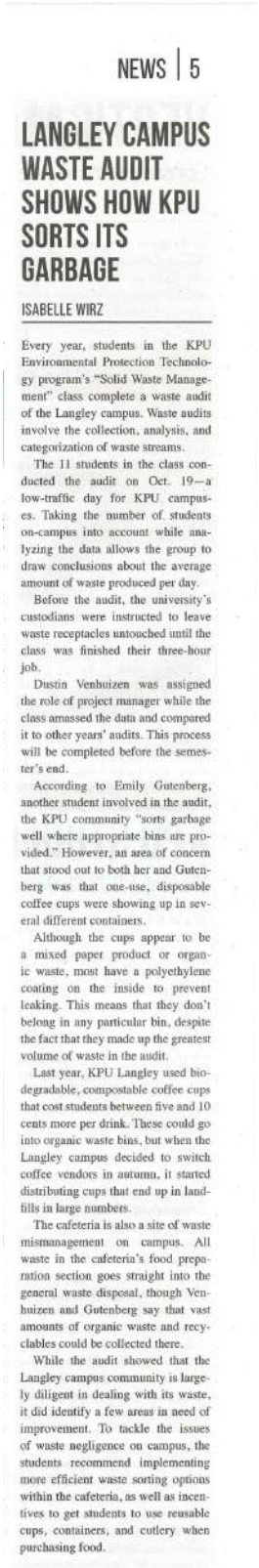
D: SHORELINE CLEANUP DATA

On September 21, 2017, ENVI 2310 conducted a garbage and litter pickup as part of the Great Canadian Shoreline Cleanup initiative (Great Canadian Shoreline Cleanup, 2017). The class walked along Logan Creek on the KPU Langley campus from roughly 1:00 pm to 2:30 pm in small groups with garbage bags, tongs, and plastic gloves. Groups collected litter, debris, and garbage found, and deposited full garbage bags into the campus dumpster bins. Keeping safety in mind, students used their own discretion when picking up sharps, biohazardous wastes, heavy items, or items outside safe areas. The length of the Logan Creek reach cleaned up was roughly 500 meters, and stretched from Glover Road to the Langley Bypass. A total of 1,163 items were collected, averaging approximately 2.3 items collected per meter. Connor Sheepwash, ENVI 2310 student, was the event organizer and class representative for the initiative.

Table 13.0. Great Canadian Shoreline Cleanup Raw Data, KPU Langley, September 21st, 2017

Item Collected	Quantity of Item
Cigarette Butts	749
Soft Plastic	85
House Building Materials	3
Dirty Paper	69
Tin Foil	44
Used Wet wipes	2
Needle/Needle Supplies	41
Bottle Cap	3
Styrofoam	37
Glass Pipe	2
Wood Debris	4
Token	1
Hard Plastic	66
Plastic Straws	6
Plastic Bag	11
Cardboard	10
Lighter	7
Rubber	3
Battery	3
Metal Fragments	11
Car Part	2
Horse Chess Piece	1
Saline Solution	1
Ant Trap	1
Bag of dead rats	1
Total Amount of Items	**1163**

E: KPU RUNNER NEWSPAPER ARTICLE



NEWS | 5

LANGLEY CAMPUS WASTE AUDIT SHOWS HOW KPU SORTS ITS GARBAGE

ISABELLE WIRZ

Every year, students in the KPU Environmental Protection Technology program's "Solid Waste Management" class complete a waste audit of the Langley campus. Waste audits involve the collection, analysis, and categorization of waste streams.

The 11 students in the class conducted the audit on Oct. 19—a low-traffic day for KPU campuses. Taking the number of students on-campus into account while analyzing the data allows the group to draw conclusions about the average amount of waste produced per day.

Before the audit, the university's custodians were instructed to leave waste receptacles untouched until the class was finished their three-hour job.

Dustin Venhuizen was assigned the role of project manager while the class amassed the data and compared it to other years' audits. This process will be completed before the semester's end.

According to Emily Gutenberg, another student involved in the audit, the KPU community "sorts garbage well where appropriate bins are provided." However, an area of concern that stood out to both her and Gutenberg was that one-use, disposable coffee cups were showing up in several different containers.

Although the cups appear to be a mixed paper product or organic waste, most have a polyethylene coating on the inside to prevent leaking. This means that they don't belong in any particular bin, despite the fact that they made up the greatest volume of waste in the audit.

Last year, KPU Langley used biodegradable, compostable coffee cups that cost students between five and 10 cents more per drink. These could go into organic waste bins, but when the Langley campus decided to switch coffee vendors in autumn, it started distributing cups that end up in landfills in large numbers.

The cafeteria is also a site of waste mismanagement on campus. All waste in the cafeteria's food preparation section goes straight into the general waste disposal, though Venhuizen and Gutenberg say that vast amounts of organic waste and recyclables could be collected there.

While the audit showed that the Langley campus community is largely diligent in dealing with its waste, it did identify a few areas in need of improvement. To tackle the issues of waste negligence on campus, the students recommend implementing more efficient waste sorting options within the cafeteria, as well as incentives to get students to use reusable cups, containers, and cutlery when purchasing food.

Figure 8.0. Wirz, I. (2017) Langley Campus Waste Audit Shows How KPU Sorts Its Garbage, KPU Runner Newspaper Article, published November 28, 2017