

# The Feasibility of a Campus Wide Composting Program at the University of Waterloo

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## Summary

The University of Waterloo states its environmental goals through the WATgreen department which envisions “transforming itself into a showcase of sustainability, a true ecosystem in harmony with its environment” (University of Waterloo, WATgreen, 2004). There have been numerous attempts to implement composting programs to handle the large amount of organic waste that is produced on campus. It is our objective to investigate a new campus-wide organic recovery program targeting five major kitchens on campus to start. The purpose of this project is to provide a comprehensive and theoretical program which future studies can further investigate by following up on our recommendations to reduce costs and to expand the possibilities for organic recovery at other locations at the University of Waterloo. The suggested program will initially involve Bon Appetit and Tim Hortons (Davis Centre), Brubakers (Student Life Centre), Festival Fare (South Campus Hall), Mudies Café (Village One), and REVelation (Ron Eydt Village). This program will involve the cooperation and education of students, staff, faculty, visitors, administration, the waste transportation company, and the receiving processing facility to allow for best results. The result of the diversion efforts through composting of organic wastes will lead to ‘Greening the Campus’ and the university acting as a leader to the community and other academic institutions. This type of project has been accomplished at several other comparable universities in North America, which has demonstrated the potential for success at the University of Waterloo.

This report investigates the number of people serviced at the University of Waterloo, the approximate amount of organic wastes produced per year, the associated costs, and a recommended process to recover organic wastes. There are multiple recommendations included for further studies prior to the actual implementation of the program, different companies that could be used, and suggestions for a trial implementation. There were several companies contacted to provide the needed transportation service for collecting the organic material from campus. There are two promising companies that expressed interest in this business opportunity. The main facility for the actual processing of the organic waste would be the Guelph Wet-Dry facility. It is also suggested that this program be implemented in conjunction with other small-scale composting efforts such as vermicomposting in offices on campus to provide maximum success.

## **1.0 Introduction**

The University of Waterloo does not currently have a campus-wide composting program. Due to organic waste entering the garbage stream, the University of Waterloo pays more for transportation and landfilling of waste than they should. The cost of landfilling waste is high because wastes that can be composted (reused) comprise most of the weight. Since tipping fees are based on weight, reduction in weight of materials going to the landfill would result in lower costs to the university. A campus-wide composting program is therefore an obvious way of accomplishing reuse.

## **2.0 Purpose**

The purpose of this project is to investigate the feasibility of implementing a composting program at the University of Waterloo campus targeting five major kitchens. The suggested program will initially involve Bon Appetit and Tim Hortons (Davis Centre), Brubakers (Student Life Centre), Festival Fare (South Campus Hall), Mudies Café (Village One), and REVELation (Ron Eydt Village). The purpose of this project is to provide a comprehensive and theoretical program which future studies can further investigate.

## **3.0 Objectives**

- To investigate companies that would be able to transport and process the organic waste created at the University of Waterloo.
- To reduce the amount of food waste entering the landfill from the University of Waterloo.
- To create a more sustainable campus.
- To identify economic constraints and discover the most economically feasible alternative to composting on campus.
- To create a program that would be both convenient and easy to follow for staff, students, faculty, and visitors to the University of Waterloo.

## **4.0 Background Information**

### **4.1 What is composting?**

Composting is a specialized part of recycling in which organic wastes are biologically decomposed under controlled boundaries that convert them into a product that can be applied to the land beneficially without environmental harm (Tammemagi, 1999, p. 51).

## 4.2 History of composting

It is believed that composting began shortly after humans started to cultivate food. The type of compost was most likely animal manure. Compost was known to the Romans, the Greeks, and the Tribes of Israel. The act of composting was discussed in the tenth or twelfth century by Ibn al Awam, in his “Book of Agriculture” or “Kitab al Falahah” (Vermont State Agency of Natural Resources Compost Center, 1992). In North America the native tribes and the European settlers both used compost. Jean Baptiste Boussingault of France laid the foundations of agricultural chemistry in 1834, by disproving the humus theory by demonstrating that plants obtain nourishment from certain chemicals in solution and not the humus itself (Vermont State Agency of Natural Resources Compost Center, 1992). Post World War II, agriculture became more mechanized and synthetic fertilizers began to reduce the use of manure and compost to help soil fertility (Cooperband, unknown). In 1940, Sir Albert Howard published “An Agricultural Testament” which started the movement of organic farming and gardening (Vermont State Agency of Natural Resources Compost Center, 1992). Today organic methods of farming and gardening are more popular than ever as farmers are moving away from harmful fertilizers and pesticides. With this growing movement, ironically, there comes a return to past methods involving the use of natural compost or manure to re-nourish soils. Over the past two to three decades, farmers have not exclusively been the ones to see the benefits of large scale composting. Cities, towns, and municipalities are starting to become aware of the value of large scale composting because of the disappearing space in landfills and the difficulty and cost associated in establishing new ones.

## 4.3 The Composting Process

Microorganisms break down complex organic molecules (i.e. proteins, amino acids, carbohydrates, etc.) into simpler ones like cellulose (Tammemagi, 1999, p. 52). The microorganisms require an aqueous or moist environment and plenty of oxygen. The exothermic reaction is depicted as:

**complex molecules + oxygen + microorganisms = compost + new cells + dead cells + heat + carbon dioxide + water + nitrous oxide + sulphur dioxide**

The activity of living organisms releases the energy and nutrients stored in the tissues of the plant and animal residues in the starting compost.

Many organisms have different purposes in the composting process. The microorganisms, for example algae, break down the bulk of the organic material. This is one of the most important aspects of composting. The protozoa feed on the microorganisms; insects feed on the protozoa and other small insects. Finally, larger organisms, like worms, speed up the composting process by mixing materials and reducing the particle size of the compost (Tammemagi, 1999, p. 53).

#### **4.4 Problems Associated with Composting**

**Cost:** The University of Waterloo is hesitant to implement an organics recovery program due to increased costs in comparison to landfilling. Until the university is willing to accept higher costs for participating in a sustainable activity, the cost of composting will remain a barrier for the implementation of an organics recovery program. For additional cost information refer to section 9.5.

**Education:** Due to the large turnover of students, there will be a need for continuous education to decrease contamination and to encourage participation.

**Maintenance:** In general, people are uncomfortable with change. The program suggests the food service location employees would be involved by emptying and disinfecting organic waste bins several times per day. This presents possible resistance from staff and may require additional staff to perform this duty.

**Rodents:** Small rodents are a nuisance that can accompany composting. In order to avoid having rodents attracted to the compost, having a tightly fitting lid prevents the scent from escaping to attract the rodents, and thus prevents the rodents from gaining access to the compost. A hardware cloth is a very strong material that small rodents cannot bite or cut through. Lining the outside of compost bins with the hardware cloth will prevent small animals from gaining access to the compost and creating a mess. This solution could be used if the university find they are having problems with rodents (City of Toronto, 2003).

**Smell:** One of the major complaints with composting is the smell that is generated. There are simple solutions that can be used to take care of this problem. The size of the materials composted change the amount of scent produced. Large un-chopped items do not break down quickly. Small items offer more surface area for decomposition, therefore reducing the smell (City of Toronto, 2003). Another solution is to ensure that the container has a tight fitting lid.

#### **4.5 List of Terms**

**Contaminants:** Materials that may enter the compost stream that would cause the compost materials to be unusable. Examples of contaminants are glass, plastic bottles, and other non food items.

**Compostables for Organic Waste Bins:** Any unwanted food (food that would be emptied into the garbage). Please refer to the list of compostables found in figure 5.

**Compostables for Vermicomposting:** Fruit and vegetable organic matter and egg shells.

**Core Actors:** The main people involved in the project who directly affect the outcome.

**Organic:** Food wastes that are naturally produced that can decompose quickly.

**Rodents:** Small animals that reside in the outdoors that would be attracted to food wastes. Examples of these animals would be squirrels, rats, mice, or chipmunks.

**Shadow Actors:** People that are indirectly involved with the project, but nonetheless affect the outcome.

**Supporting Actors:** People who directly affect the project, but are not always involved in the implementation or changes made.

***Sustainability:*** Meeting the needs and aspirations of present generations without compromising the ability of future generations to meet their needs (Eyers et al., 1998).

***Tipping Fee:*** The amount of money associated with disposing of one tonne of waste at a disposal facility.

## **5.0 Current Composting Programs at the University of Waterloo**

### **5.1 St. Jerome's University**

St. Jerome's University participates in a unique composting program in their cafeteria. There are large yellow bins the size of regular garbage receptacles located throughout the cafeteria used for the disposal of any type of organic materials including wasted or unwanted food and napkins. The students have responded well to the program by following the disposal rules. Any cafeteria trays that are not emptied properly are caught in the kitchen where several additional compost bins are located. This allows for 100% capture of the organic materials. The yellow bins are emptied three times a day (after each meal) into 64 gallon bins located outside near the garbage bins. The yellow bins are also rinsed and disinfected each time they are emptied by the cafeteria staff. There is minimal garbage produced at St. Jerome's due to this program in addition to their participation in the UW recycling program.

There has been a huge reduction in garbage since this program was implemented in the fall of 2002 after many failed attempts with backyard composters. Planet Earth Recycling Ltd. is a company based out of Concord, Ontario that charges a pick up fee of \$13 per bin. It is estimated that St. Jerome's roughly has 12 bins per week and the number of pick ups ranges between one and two. Although the program is a large expense costing between \$7,500 to \$10,000 per year, Director of Residences, Darren Becks, believes it "is the right thing to do" (Becks, 2004).

### **5.2 Environmental Studies Coffee Shop**

The Environmental Studies (ES) Coffee Shop is a small lounge area that is located in ES1. The Coffee Shop has a small service area that serves beverages, sandwiches, and snacks to students, staff, and faculty. Patrons to the Coffee Shop can either buy or bring a packed lunch. The ES Coffee Shop began composting in August of 1993. A small six litre container is located in the Coffee Shop where compostable food can be disposed of. During most months, the

container is emptied once per day into the composter located outside in the north-west corner of the building adjacent to the small parking lot and loading area (Fetterly et al., 1994).

The initial costs associated with composting in the ES Coffee Shop were minimal. ES staff member, Larry Lamb, donated two SoilSaver composters in the first year of the composting project. Since then over \$550.00 has been spent on composting in the ES Coffee Shop. This has included several composters, compostainers (indoor collection devices for compostable materials), and a vermicomposter (Cook, 2004). A Waste Management Facilitator is also hired to manage both the composting and recycling systems within ES. This facilitator is paid \$30.00 per week to empty the compostainer into the outdoor compost and turn the compost once a week (Fetterly et al., 1999).

The soil produced from the composter is used in the Dorney Garden outside the ES1 building. There are a few current issues with the composting program in the ES Coffee Shop. One of the volunteers who managed the composting has since gone on co-op, so the manager was forced to delegate these duties to other volunteers, who were not always willing. There is a large demand for coffee and therefore, many grinds are produced. The compost has since reached capacity and with the compostables frozen over winter; the program has since been put on hold. Composting does occur during the winter months, but the rate of decomposition is much slower. An additional storage container would be necessary to handle the load of compostable material that is generated in the ES Coffee Shop (Brown, 2004).

### **5.3 Vermicomposting in Offices on Campus**

Vermicomposting is a form of composting that involves the use of red wiggler worms to decompose organic waste. Vermicomposting is typically done at a smaller scale in a Rubbermaid-type container with small holes drilled into the top and bottom. This allows for air exchange and the draining of leachate from the container. The worms bury themselves in a bedding (peat, shredded newspaper, and water) and consume up to their own weight in organic food waste daily (Eyers et al., 1998).

According to a WATgreen project conducted in 1998, vermicomposting was implemented in three offices on campus: Earth Sciences, B.C. Matthews, and Chemistry 2. In two of the three offices, the vermicomposters were relatively well accepted. It is important to note that the office

where the vermicomposter failed was because the participating professor was leaving the university and therefore lost interest in the project (Eyers et al., 1998).

## **6.0 Comparable Campus-Wide Composting Programs at Other Universities**

### **6.1 University of Toronto, Ontario, Canada**

In the early 1990's the University of Toronto attempted to compost on campus. This was quickly found to be too time consuming and they did not have enough space for this operation. In 1992, the University of Toronto began a swill program on campus. This allowed for the collection of organic material to be used for pig feed. In July of 1994, an organics recycling program was started which collected food waste from fifteen different food service locations on campus. The organics recycling program quickly proved to be so effective that the swill program was discontinued in 1996. A chart that can be found in Appendix 1 illustrates the weight of food waste per month associated with each of the two projects. The material is collected by building staff in 64 gallon totters. The material is then picked up by Recycle Plus, a Toronto-based company that collects the organic material on a scheduled basis. The material is then transported to the Resource and Innovation Centre in Guelph, Ontario. This facility converts the organic material into compost which is sold to the Boy Scouts of Ontario who use the compost as a fundraising event. It is estimated that the cost of the organic collection program is between \$3,000 and \$4,000 per month, which is individually covered by each food service location. University of Toronto also has a forty cubic yard organics bin for yard waste such as grass, branches, and tree/bush trimmings. This bin is emptied as necessary (Strano, 2004).

The City of Toronto and Scarborough have recently introduced a Greenbox Program which allows residents to dispose of their organic materials. The residents are given green recycle boxes to put in their home along side their blue boxes. The residential compost materials are picked up weekly by curbside. The material is then transported to the new Dufferin Organics Processing Facility. Upon arrival, the compost is visually inspected so the unwanted contaminants are removed. The pure compost is then put into a large blender to mix it thoroughly until it is a pulp. After fifteen days the compost is finished the process and there are two by-products: biogas and pure, usable compost. The biogas is disposed of in the processing plant, and the compost is taken to the Niagara region where it is sold and used for horticultural purposes (City of Toronto, 2003).

The University of Toronto is comparable in size to the University of Waterloo. There was an obvious desire to implement a composting program at the University of Toronto and when the swill program failed, they looked into alternatives and have since been successful with their organic collection program. There is a similar desire to that of the University of Toronto to voluntarily comply with a large-scale composting program in the City of Toronto. If such a populous city and comparable university are able to maintain a successful composting program, there is no reason why a similar program cannot be implemented on the University of Waterloo campus.

## **6.2 University of Guelph, Ontario, Canada**

In 1995, The City of Guelph began operating a Wet-Dry program where waste was divided into two streams. The dry stream contained both recyclables and waste and the wet stream was for food waste and a number of other items considered compostable. This program was modified in March of 2003 to allow for more efficient processing and to reduce the amount of contamination. The new program entitled Wet-Dry+ was a three stream system that included separate bags for recyclables, compostables, and waste (City of Guelph, 2003).

The University of Guelph participated in the city-wide Wet-Dry program from 1996 to 1998. The university withdrew their participation due to an unacceptable amount of contamination in both streams. The contamination was attributed to the difficulty of educating a high turnover student population. The university has currently switched to small-scale composting, which began in the fall of 2002. The residences with kitchens have backyard composters set up outside including the Living Learning Centres (LLC), Eco-House, French House (La Maison Française), Arts House, and International House. The Eco- and French Houses are part of the suite-based, apartment style East residence in Dundas Tower. There are approximately 5 or 6 composters set up for the tower. Arts House and International House are in their own separate buildings and house about 50 students each. Although these are both dorm style residences, they have a communal kitchen. Students are expected to take their compostables to the outside composting unit. Kristi Mahy, the composting coordinator, has found that in the non-LLC areas, she needs to make pick ups to encourage the use of the outside composters. People do not seem to want to take their food waste downstairs and outside. The

manure produced through The Animal Science and Ontario Veterinary College is shipped free of charge by the City of Guelph to the Wet-Dry facility (Maurice, 2004).

As demonstrated above, the turnover of students at a university is an issue requiring a continuous education to students in order to sustain a successful composting program. This also proves that different composting types are required to accommodate different locations and situations.

### **6.3 Cornell University, Ithaca, New York, U.S.A.**

In December 1997 the Cornell University Farm Services Department, with the guidance of Cornell's Waste Management Institute and cooperation from the University's Dining Services, began composting food scraps from the campus' dining facilities. With nearly 19,000 students, Cornell produces an estimated 700 tons of compostable food scraps annually, about 17% of the University's waste stream that had been going to a landfill. Cornell staff in the dining halls separates the food scraps on campus. Both pre- and post-plate wastes are collected. Scraps are collected in 32-35 gallon plastic barrels on casters. The majority of the scraps is ground and de-watered by dining staff in a pulping machine which was in operation prior to composting. Once the project was up and running, the project manager held hour-long training sessions with the staff at all of the dining halls (Cornell Waste Management, 2002).

Food scraps are collected daily in a small pickup truck with a sealed dump body and taken to a staging area at the Farm Services Complex for mixing. Once collected, the scraps are dumped into a dump truck bed, which is lined with six to eight inches of bedding material consisting of sawdust and manure from cleaning stalls at the Veterinary College facilities. The bedding is built into a dam at the rear of the truck bed to prevent leaks on steep inclines. It also allows the scraps to slide out of the truck cleanly, avoiding daily washing. Two staff members spend about an hour collecting food scraps from four facilities. Currently, a truck is being retrofitted with a lift so that campus facilities without loading docks will be able to participate in the program (Cornell Waste Management, 2002).

The finished compost is spread on agricultural fields. Runoff/leachate is stored in the retention a pond and is used to irrigate dry piles and adjacent hay fields. Complete curing is not required for this agricultural use (Cornell Waste Management, 2002).

An estimated 700 tons of food scraps will be composted through this program on an annual basis. Although their food services department is still paying to have the scraps composted, the "tipping fee" may be adjusted accordingly after the program has been in place long enough to gauge its cost. There are no plans to sell the compost due to state regulations, but the university benefits from the use of compost as a soil amendment (Cornell Waste Management, 2002).

Careful planning and good communication have prevented many potential public relations problems. Convincing the local town planning board was somewhat of a challenge because of the public's perception of how a large-scale composting operation would look and smell. In the end, Cornell's history as a 'good neighbour' and the clean operation of the prior program allowed the project to expand (Cornell Waste Management, 2002).

At Cornell University, the staff played an intricate role in the success of the composting program due to formal training. Over time, a composting program such as at Cornell University can be perfected and operate with few problems. It is hoped that with time and appropriate staff training, a similar situation may be achieved at the University of Waterloo.

## **7.0 Project Parameters**

### **7.1 Boundaries**

The proposed composting system will be restricted to the University of Waterloo's campus, excluding the church colleges on campus. Therefore, the following would not be involved in the proposed composting system:

St. Jerome's University  
Renison College  
Conrad Grebel College  
St. Paul's College

The boundaries are further limited to the five main kitchen locations on campus suggested where the project should be first implemented. Therefore, the project boundaries would be further limited to the following kitchen areas:

Brubakers, Student Life Center  
Mudies Café, Village One  
REVelevation, Village Two  
Bon Appetit and Tim Hortons, William G. Davis Computer Research Centre  
Festival Fare, South Campus Hall

In terms of the actual compost itself, the boundaries would be as far as the processing facility which it would be sent to (most likely Guelph Wet-Dry).

## **7.2 Actors**

### ***Core Actors***

- *Patti Cook*: the waste management coordinator at the University of Waterloo. She would play an important role in the decision making process, the outline, and implementation of the actual project.
- *The Transportation Company*: They would be in charge of picking up the compost from campus and transporting it to the processing facility.
- *The Organics Processing Plant*: This would be the facility where the organic material from the campus would be sent for composting.
- *Food Services Staff*: They are the front line workers who will deposit the kitchen wastes into the collection bins and empty to the exterior bins. The staff would also clean and disinfect the interior bins.
- *University of Waterloo Administration*: They would be responsible for consenting to the implementation of the project and the associated funding necessary.

### ***Supporting Actors***

- *University of Waterloo Students*: They would be the people who would be in charge of the actual disposal of food wastes into the designated bins.
- *Visitors*: These are people who participate in the program when they are briefly associated with the university.

### ***Shadow Actors***

- *Consumers*: These are people who support the composting program in an indirect way. They purchase the compost that was processed from the university.

## 8.0 Proposed Campus-Wide Composting Program at the University of Waterloo

### 8.1 Locations

Food Services operate five main locations at the University of Waterloo which will be the main focus for the implementation of composting on campus. Figure 1 displays the names of the food service location, where they are located on campus, the hours of operation, and the number of garbage receptacles currently observed at the location.

**Figure 1: Food Services Locations at the University of Waterloo**

<b>Name of Operation</b>	<b>Location</b>	<b>Hours</b>	<b>Number of Garbage Receptacles</b>
Bon Appetit	Davis Centre	Mon-Thurs 10:30 am – 7:00 pm Fri 10:30 pm – 3:00 pm	6 in eating area
Tim Hortons		Mon-Thurs 7:30 am - 7:30 pm Fri 7:30 am – 4:00 pm	
Brubakers	Student Life Centre	Mon-Fri 7:30 am – 7:30 pm Sat 10:00 am – 4:00 pm	5 behind counters 12 in eating area
Festival Fare	South Campus Hall	Mon-Fri 11:00 am – 2:00 pm	4 in eating area
Mudies Café	Village 1	Mon-Fri 7:00 am – 12:30 am Sat-Sun 8:00 am – 12:30 am	3 behind counters 5 in eating area
REvelation	Ron Eydtt Village	Mon-Fri 7:00 am – 7:00 pm Sat-Sun 11 am – 7:00 pm	3 behind counters 8 in eating area

It is suggested that vermicomposters be initially implemented in several offices across campus. The offices across campus would be consulted to determine whether or not they would be interested in participating in the vermicomposting program. Over time, additional offices would be encouraged to also participate.

### 8.2 Logistics

The food services staff at the five main food locations will be responsible for ensuring the smooth operation of the program. The custodians are involved in disposing of the garbage and recycling produced at each location. The organics collection program would add a third disposal program, but would decrease the amount classified as garbage. The number of garbage

receptacles currently located in each food service facility would be greatly reduced due to the addition of organic bins which will be placed throughout the facilities. The organic bins will be accessible to patrons of the various locations as well as in the kitchen for the staff to use during meal preparations. Figure 2 illustrates the number of organic bins and garbage receptacles suggested for each facility.

**Figure 2: Proposed Number of Organic Bins and Garbage Receptacles**

<b>Name of Operation</b>	<b>Proposed Number of Organic Bins</b>	<b>Proposed Number of Garbage Receptacles</b>
Bon Appetit	4	2 in eating area 2 total behind counters of Bon Appetit and Tim Hortons
Tim Hortons		
Brubakers	8	3 in eating area 2 behind counters
Festival Fare	2	2 in eating area 1 behind counters
Mudies Café	5	3 in eating area 2 behind counters
REVellation	6	4 in eating area 3 behind counters

### **8.3 Suggested Program Process**

The following steps outline the proposed process for the organics collection program at the University of Waterloo. A visual display of this process can be found in Appendix 2.

- Patrons will purchase meals or bring food onto campus and settle at one of the different locations on campus.
- Once patrons are finished their meals, they will proceed to the closest disposal station to separate their waste. The disposal stations will consist of an organic food waste bin, a garbage receptacle, and recycling bins. There will be signs located at the disposal bins to identify the types of waste to be disposed of in each receptacle.
- Staff would be responsible for emptying the organic bins after every major meal or as necessary. The organic bins would be emptied at the site specific loading dock where the waste is currently stored. Staff will also have to rinse and disinfect the organic bins before replacing the bins. Due to different hours of operation for each facility, the frequency of organic disposal and disinfection will vary. Figure 3 displays the suggested frequency of organic bin removal.

**Figure 3: Proposed Frequency of Organic Bin Removal**

Name of Operation	Proposed Frequency of Organic Bin Removal and Disinfection
Bon Appetit	Mon-Thurs – 2/day Fri – 1/day
Tim Hortons	
Brubakers	Mon-Fri – 3/day Sat – 2/day
Festival Fare	Mon-Fri - 1/day
Mudies Café	Mon-Sun - 4/day
REVelation	Mon-Fri - 3/day Sat-Sun – 2/day

- A truck would go to each location once per week to empty the full organic bins from the loading docks.
- The truck will take the organic waste to a large-scale composting facility depending on their particular affiliation. An example of such company would be the Guelph Organic Processing Plant.
- At the large-scale composting facility, the food waste is broken down into usable compost and sold to residents and companies.

#### **8.4 Companies Involved**

Appendix 3 contains the companies contacted to inquire about organic transportation. Most of the companies contacted were unable to provide the transportation of organics from the University of Waterloo campus to a processing facility for a variety of reasons, which are also listed in Appendix 3. The companies that proved most promising as an organic transportation medium were Recycle Plus and Planet Earth Recycling Ltd. The likely location for the delivery of the organic waste from the transportation company would be the Guelph Wet-Dry Facility due to proximity. This may change due to processing plant affiliations with the transportation company.

#### **8.5 Quantity of Food Waste**

A waste audit was not conducted for this study for several reasons. First, after examining many WATgreen projects where waste audits were conducted, it was obvious there was a need for composting. Second, the composting program itself can be implemented at any time, but it is felt that waste audits should be completed prior to project interest from administration. Lastly,

recent WATgreen projects were able to provide current estimates of food waste from the five main kitchens on campus, which were acceptable figures for our project. The project entitled “Campus Food Waste Composting: Past Failures and Future Possibilities” suggested there was 306.8 tonnes of food waste on campus in 2001. If this large amount of food waste (306.8 tonnes) is produced in 2004 at the five main kitchens on campus, with an associated tipping fee of \$47.50 per metric tonne plus approximately \$10 per lift, it would cost the University of Waterloo approximately \$26, 933.00 to dispose of food waste. Due to limited detailed research on the actual amount of food waste produced at the five main kitchens on campus, the following cost analysis should be used as rough estimation. The actual costs would be lower than those presented due to the overrepresentation of the amount of food waste produced.

Cost of Landfilling Organic Waste per year at the five main kitchens:

306.8 tonnes per year x \$ 47.50 per tonne	=	\$14, 573
\$10.00 per lift x 1236 lifts* per year	=	\$12, 360
Cost of tonnes + Cost of lifts	=	\$14, 573 + \$12, 360
<b>TOTAL</b>	=	<b>\$26, 933</b>

\* lifts were calculated using figure 4

**Figure 4: Number of Lifts**

<b>Name of Operation</b>	<b>Number of Lifts in Fall and Winter Terms</b>	<b>Number of Lifts in Summer Term</b>
Bon Appetit Tim Hortons	10	6
Brubakers	5	3
Festival Fare	3	3
Mudies Café	5	3
REVelation	5	3
<b>TOTAL Lifts per Term</b>	<b>28</b>	<b>18</b>
Number of weeks per term	30 (30 term weeks including exams)	22 (14 term weeks + 8 lighter waste weeks during transition times or holidays)
<b>Total Lifts</b>	<b>840</b>	<b>396</b>

**TOTAL LIFTS = 840 + 396 = 1236** (Cook, 2004)

Therefore, the cost for landfilling the organic food waste generated from the five main kitchens would be approximately \$27, 433 per year.

Amount of Organic Waste per year at the five main kitchens:

1 pound = 0.0004535924 tonne

306.8 tonnes = 676378.1756484456 pounds

200 pounds = 64 gallon cart

676378.1756484456 pounds / 200 pounds = 3381.891 full carts per year

Therefore, there would be approximately 3382 organic waste carts containing 200 pounds each to be collected each year.

Cost of Composting with Recycle Plus per year:

3382 organic waste carts x \$12.00 per cart = \$40 584.00 per year

Cost of Composting with Planet Earth Recycling Ltd. Per year:

3382 organic waste carts x \$13.00 per cart = \$43, 966.00 per year

Note: With the double cohort, the number of students has increased, which may affect the amount of food waste produced on campus.

## 8.6 List of Compostables

Figure 5 contains items deemed compostable on the University of Waterloo campus if the proposed system is implemented based on acceptable items from the Guelph Wet-Dry Facility:

**Figure 5: List of Compostables**

Baby wipes/Wet naps	Food scraps	Pizza
Bones	Fruit	Plants
Bread	Giblets & fish parts	Plate scrapings
Butter	Grease & lard (solidified)	Popcorn
Cake & Candy	Gum	Poultry
Cereals & grains	Hair (Human & animal)	Pumpkins (in pieces)
Cigarettes & butts	Herbs	Rice
Coffee filters & grounds	Left-overs	Salad & dressing
Cooking oils (solidified only)	Mayonnaise	Seeds
Corn cobs & husks	Meat	Shellfish (including shells)
Cotton balls/swabs	Muffin paper cups	Sour cream
Dairy products	Nail clippings	Sugar & spices
Dried flowers	Napkins (paper)	Sunflower seeds
Eggs & eggshells	Noodles	Tea bags
Fat	Nuts & shells	Tissues
Feathers	Oatmeal & oats	Vegetables
Fish & fish parts	Pads from meat trays	Yogurt
Flour	Paper towels/ Serviettes	
Flowers	Pasta	
	Peanut butter	

(City of Guelph, 2003)

## 9.0 Limitations and Assumptions

### 9.1 Biases and Assumptions

- We are Environmental Studies students and assume other people feel the same way we do in regards to being environmentally friendly and sustainable.
- We believe that in order to be taken seriously by the University of Waterloo administration, the implementation and course of the program should be affordable.
- There have been so many similar proposals in the past that administration may dismiss the project without making an informed decision.
- It is assumed that students are busy people and do not have time to separate food wastes.
- It is assumed that the University of Waterloo would like to be called a 'green campus.'
- It is assumed that any food waste found in the garbage stream demonstrates a need for composting on campus.

- It is thought that the University of Waterloo would do the ‘right thing’ and pay additional costs to compost food waste as an alternative to paying for landfill tipping fees.

## **9.2 The Use of Past Projects**

### *Waste Audit of Brubakers (2003)*

The waste audit of Brubakers by Coghlin et al. in 2003 included looking at seven different garbage cans and four recycle bins. They looked everything in the garbage and took note of the ‘compostables.’ The group predefined ‘compostables’ as being “organic materials free of dressing or fat (for example apple cores).”

The total compostable waste weighed 2, 145 grams over five days. The group’s recommendations included having a compost bin to eliminate the compostables that are currently ending up in the garage. The findings of this project brought the amount of food waste in the garbage at Brubakers to our attention.

### *Waste Audit of Mudies Cafeteria (2003)*

An audit was done over a five day period from February 10 to 14, 2003 in Mudies Cafeteria located in Village 1 residence by Bowie et al. At this location there are presently no composting facilities. There were four garbage cans randomly chosen for inspection that were emptied 4 times daily. The cafeteria serves, on average, 1,379 students each day. The amount of compostable food waste that was identified was about 25,000 cm<sup>3</sup> and other food scrap was 224, 750 cm<sup>3</sup>. This gave us reason to think that composting was also required at this location.

## **9.3 Number of People on Campus**

On campus there are:

- 18, 913 Full time undergraduate students
- 2, 637 Part time undergraduate students
- 2, 039 Full time graduate students
- 446 Part time graduate students
- 787 Faculty
- 2, 094 Staff (University of Waterloo, 2004)
- Approximately 14, 000 visitors per year (Reid, 2004)

These numbers include people from the church colleges which were identified to not be included in the project because of their independence from the university in regards to waste collection.

#### **9.4 Contamination**

Any item that is not able to break down in the composting process, or is inorganic, is considered a contaminant (Turnbull, 2000). Otherwise, all items that are put into the wet stream of the system are kept and processed.

The City of Guelph, for example, relies heavily on the separating techniques of their residents when it comes to avoiding contaminants entering the wet stream of their garbage. Residents are also required to use clear blue bags to store their wet items which allow the collectors to detect and refuse any contaminants contained in the bags. Some residents insist on using grocery bags to hold their compostables which does not allow the contents to be seen and therefore permits contaminants to enter the system (Turnbull, 2001). The Guelph wet stream of their wet/dry recycling considers plastics and over sized materials which can not be crushed or reduced in size to be contaminants and are removed before the compost is processed manually (Themelis, 2000).

If the University of Waterloo were to implement a composting program, there would be minimal contamination issues. Considering the program would accept all food wastes including food preparation items such as napkins and bones there would be little that would be classified as a contaminant. An education program would be necessary to decrease the amount of contaminants. Student studies should be conducted to determine the most effective delivery of education on the program. If contaminants did enter the system they would be removed at the processing plant.

#### **10.0 Conclusions**

After an extensive literature review regarding composting at university campuses in North America, it is concluded that a campus-wide composting program could be implemented at the University of Waterloo. This program would best divert waste from the landfill through use of multiple forms of composting such as vermicomposting. It is evident that the University of Waterloo would like to be recognized as a sustainable campus as it would encourage potential

students to attend this university, increase its attractiveness to potential financial donors, and make it a leader among Ontario universities. This program holds strong possibilities to be incorporated in the University of Waterloo's future.

The Guelph Organic Waste Processing Facility is potentially willing to accept food waste from the University of Waterloo. This is based on whether or not they follow through with their plans for expansion (Turnbull, 2004). After conversing with several transportation companies to pick up food waste from the locations on campus, it was found that Recycle Plus and Planet Earth Recycling Ltd. are two potential transportation companies interested in the business provided by the University of Waterloo. Recycle Plus provided the most competitive price for organic waste collection.

## **11.0 Recommendations**

From the information gathered concerning composting on campus from this project and past WATgreen projects, it is believed that there is a need for multiple forms of composting. The use of vermicomposting (to handle the composting needs of smaller offices) in conjunction with the large scale composting at the major food locations is required to maximize composting on campus (Eyers et al., 1998). This would aid in the capture of organic wastes from individuals not in close proximity to the organic bins, thus, further diverting waste from landfill and associated landfill tipping fees.

There would be the opportunity to hire several students to act as waste managers for the new program. The required positions would involve educating the campus population, providing advice, and ensuring that the project is properly implemented. The university would provide work experience for students and the chance to be directly involved in the decision making process with respect to the project.

There are future possibilities for expansion of the program to other food outlets on campus such as university clubs and student societies. This would increase the amount of compostables that could be diverted from the waste stream.

We believe that successful implementation of vermicomposting in offices around campus will require monitoring the composters and providing the users with solutions to any problems. If individuals do not desire a vermicomposter in their personal office, a centralized vermicomposter could be located in the main department office. Problems such as pest

infestation, mould, bad odours, too damp or dry conditions and too acidic conditions all have the potential to be rectified. The student ambassador for vermicomposting would be responsible for education on proper use, solutions to problems, and make regular follow-up visits.

At the time of implementation of the program, the companies considered regarding the transportation of organic waste should be contacted to obtain the most economically feasible option. Appendix 3 provides a list of companies involved in organic waste. Some of the companies were not able to provide such services at this present time, but should re-contacted in the future in case their services have changed.

### **12.1 Recommendations for future research include**

- Determine how many staff and professors would be willing to participate in a vermicomposter program.
- Determine the number of offices on campus, the number of vermicomposters required, and the associated set-up costs.
- Research what should be done with the highly organic soil created from vermicomposters.
- Number and size of bins required to fulfill the composting needs of different areas on campus.
- The creation of a list of people currently vermicomposting on campus (Eyers et al., 1998).
- Further study is needed to determine the frequency of emptying the organic bins at each location.
- Investigate an education program with a catchy name, slogan, posters, and information sessions to increase public awareness.
- Investigate the impact of the new proposed Tim Horton's in the SLC starting September 2004 on the waste stream.

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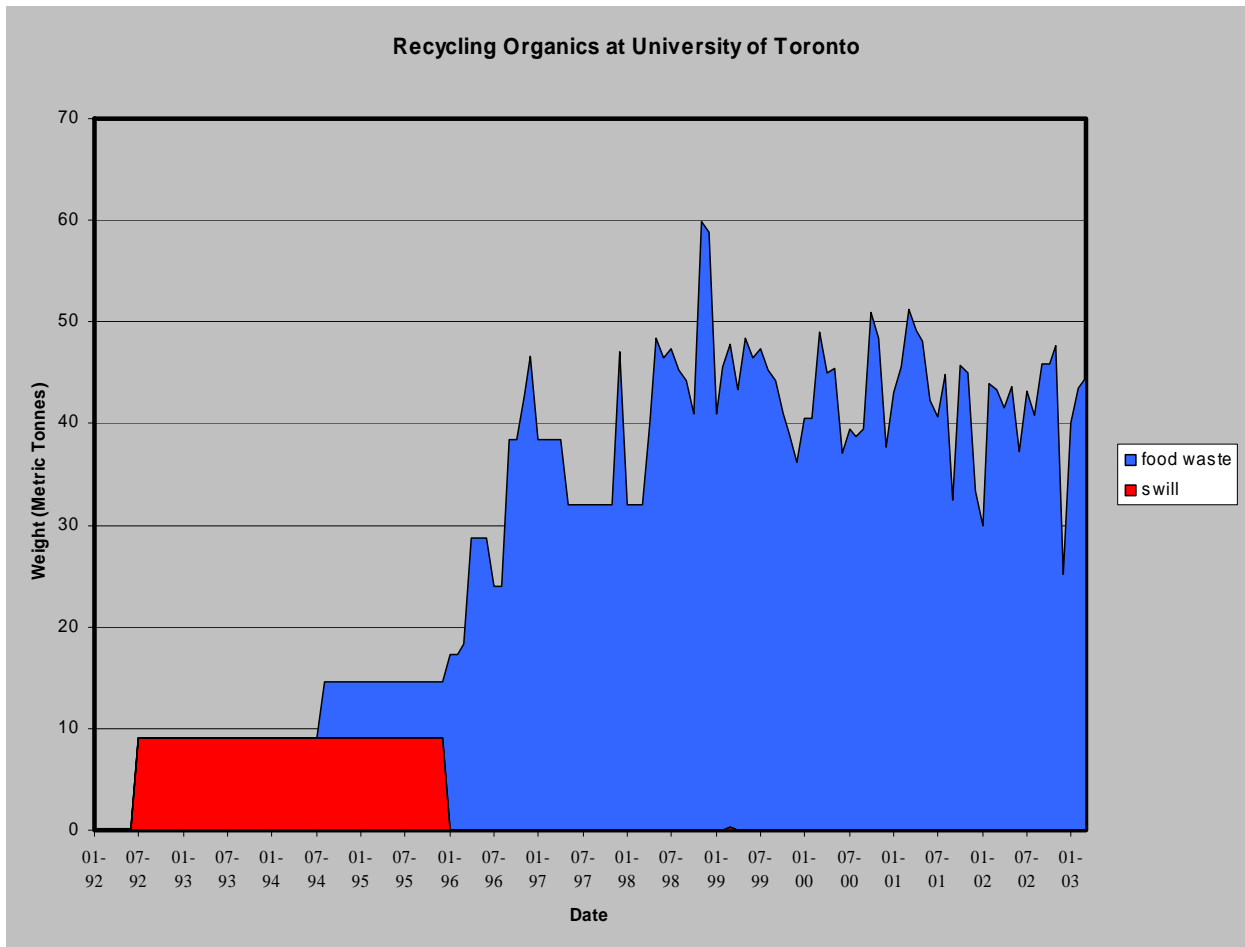
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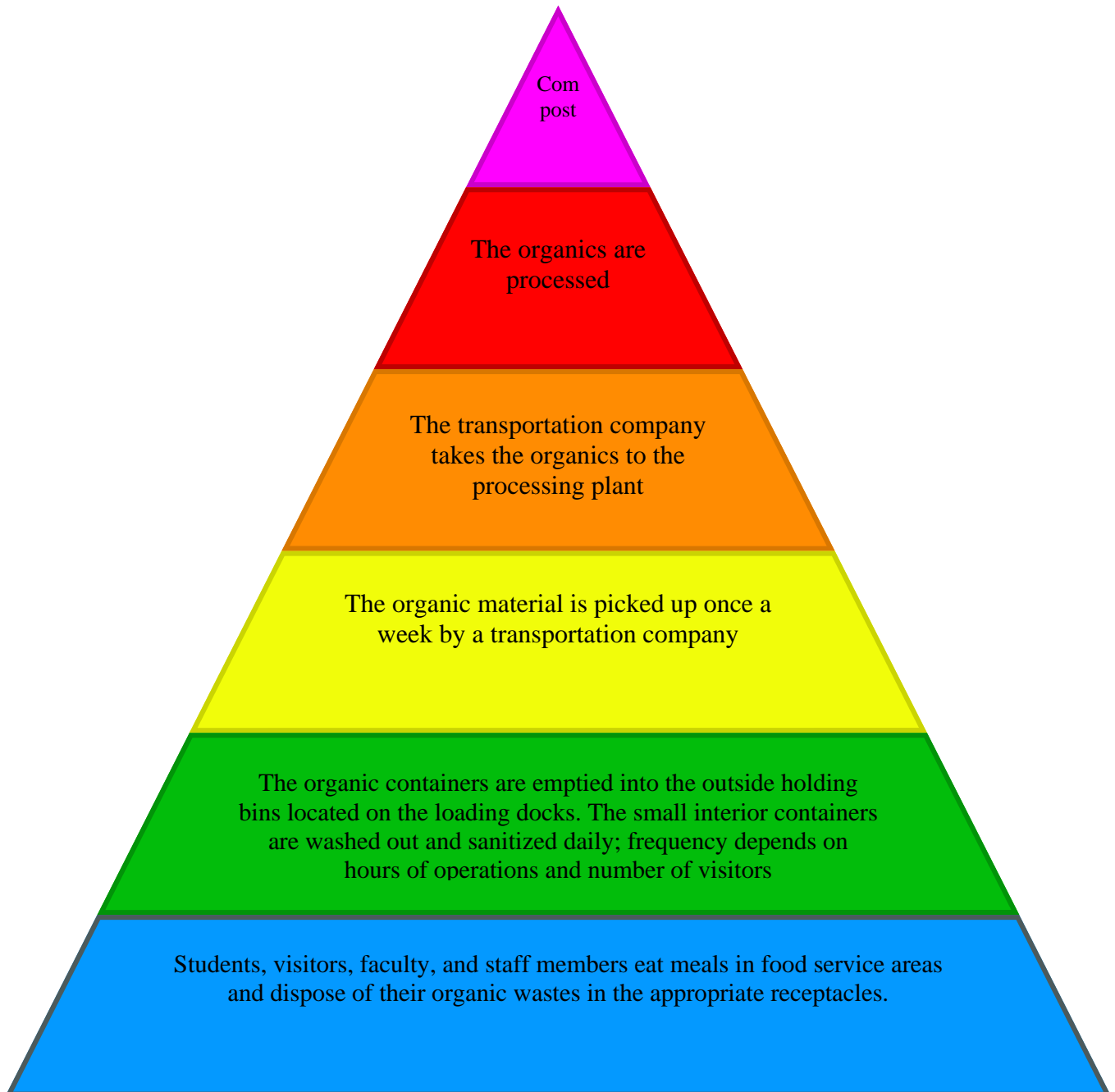
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## 13.0 Appendices

# Appendix 1: Amount of Food Waste Collected per Month at the University of Toronto from 1992 to 2003



## Appendix 2: Proposed Organics Collection Process at the University of Waterloo



### Appendix 3: Company Contact Information

Company	Contact Information	Additional Information
All Treat Farms Limited	7963 Wellington Rd. 109, RR #4 Arthur, ON N0G 1A0 Tel: 519-848-3145 Fax: 519-848-2598 Email: <a href="mailto:lyndaw@alltreat.com">lyndaw@alltreat.com</a> Website: <a href="http://www.alltreat.com">www.alltreat.com</a> Contact Name: George White	- yard waste only
Canada Composting Inc.	390 Davis Drive, Suite 301 Newmarket, ON L3Y 7T8 Tel: 905-830-1160 Fax: 905-830-0416 Email: <a href="mailto:ccikevin@attglobal.net">ccikevin@attglobal.net</a> Website: <a href="http://www.canadacomposting.com">www.canadacomposting.com</a> Contact Name: Kevin Matthews, President	- no response
Cold Springs Farm Limited	149 Brock Street Thamesford, ON N0M 2M0 Tel: (519) 285-3940 Fax: (519) 285-3181 Email: <a href="mailto:jon@coldsp.com">jon@coldsp.com</a> Website: <a href="http://www.coldsp.com">www.coldsp.com</a> Contact Name: Jon Gingerich, Agronomy Manager	- agricultural operation
Green Lane Environmental Group Ltd.	P.O. Box 790, Lambeth Station 4645 Wellington Rd. S. London, ON N6P 1R7 Tel. : (519) 652-9284 Fax. : (519) 652-9447 Email: <a href="mailto:andreaw@greenlanegroup.com">andreaw@greenlanegroup.com</a> Website: <a href="http://www.greenlanegroup.com">www.greenlanegroup.com</a> Contact Name: Andrea Woodhouse, Manager - Compost Facility	- distance is an issue (too far)
Miller Waste Systems	P.O. Box 4080, 8050 Woodbine Ave. Markham, ON L3R 2N8 Tel: 905-475-6356 Fax: 905-475-6396 Email: <a href="mailto:tomh@millergroup.ca">tomh@millergroup.ca</a> Website: <a href="http://www.millergroup.ca">www.millergroup.ca</a> Contact Name: Thomas Hennessey - Manager, Business Development	- distance is an issue (too far)
Planet Earth Recycling Ltd.	149 Bowes Road Concord, ON L4K 1H3 (905) 669-9121 Tel: 905-669-9121 Email: <a href="mailto:davebardocz@aol.com">davebardocz@aol.com</a> Contact Name: Dave Bardocz	- \$13 per lift - supply 64 gallon carts

### Appendix 3: continued

Company	Contact Information	Additional Information
Recycle Plus	63 Medulla Ave. Etobicoke, ON M8Z 5L6 (416) 410-9969 (800) 269-2485 (toll-free) Email: <a href="mailto:info@recycleplusltd.com">info@recycleplusltd.com</a> Website: <a href="http://www.recycleplusltd.com/index.html#">http://www.recycleplusltd.com/index.html#</a> Contact Name: Ernie Pietrobon ext.8	- \$12 per lift - supply 64 gallon carts - take organics to Guelph Wet-Dry facility
Super Blue Box Recycling Corp. (SUBBOR)	304 The East Mall Toronto, ON M9B 6E2 Tel: 416-234-1301 Fax: 416-234-8336 Email: <a href="mailto:estrnpr@interlog.com">estrnpr@interlog.com</a> Contact Name: Gregory M. Vogt, President	- facility in Guelph was shutdown
Try Recycling and Aggregates	R.R. #1 Arva, ON N0M 1C0 Tel: 519-457-1566 Fax: 519-457-1570 Email: <a href="mailto:rick.vandersluis@tryrecycling.com">rick.vandersluis@tryrecycling.com</a> Website: <a href="http://www.tryrecycling.com">www.tryrecycling.com</a> Contact Name: Rick Vandersluis, Vice President - Operations	- not licensed to handle food waste - compost yard waste only - possibility for the future