GM Waste Reduction Pilot Project: Final Report

Faisal Shennib, Environmental Coordinator, July 10, 2014

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Overview of GM Waste Reduction Pilot Project

The GM Waste Reduction Pilot Project was conducted over three weeks in April 2014 on the 4th, 8th, and 11th floors of the GM building. The pilot involved changes to the manner in which waste

is sorted and collected from office spaces. The pilot consisted of procedural changes and educational initiatives.

Initiated by EHS, the pilot was completed with the collaboration of Custodial Services, Arcturus and GDI (Subcontracted Property Management and Cleaning Services for GM Building). The units involved were:

- 4th floor: Center for Co-operative Education, Hospitality Concordia
- 8th floor: President's Office, Provost's Office, VP Services, VPDERSG
- 11th floor: Facilities Management, Environmental Health and Safety

Procedural Changes

- Removal of 150 trash bins from offices and hallways
- Adding 9 new compost bins in kitchenettes
- Conversion of 6 washroom trash bins into organic waste collection bins for compost

Educational Initiatives

- Two educational info lunch sessions
- Waste info posters mounted in kitchenettes and in washrooms

The following tools were used to assess the effectiveness of the pilot:

- Waste audits (pre- and post-pilot)
- Site visits
- Client satisfaction survey

Results

Waste Audits

Waste auditing was conducted prior to and during the last week of the GM Waste Reduction Pilot Project to evaluate the impacts on waste reduction of the following procedural changes and educational initiatives.

Waste Audit Results

- Landfill waste was **reduced by 80%**
- Composting and recycling increased by 80%
- 6% Contamination of compost

Details are provided in the section "*Waste Audit Result Details*".

Site Visits

Site visits during the pilot project served to inspect new waste infrastructure, assess occupant satisfaction and identify any issues. While the majority of clients were satisfied with the new waste procedures and expressed interest in seeing it continue, the following issues were identified:

- Communication was not sufficiently effective prior to the start of the project
- Some clients found it cumbersome to make frequent trips from office to kitchenettes to sort waste.
- Recycling collection was not always frequent or regular enough.
- Some clients complained of the risk of attracting fruit flies with open lids.
- Some clients were concerned that the open lids lead to spilling of food waste on the lids.

Client Satisfaction Survey

The occupants of the 4th, 8th, and 11th floors who participated in the pilot project were surveyed in order to gather data on:

- Satisfaction levels with new procedure
- Issues and/or suggested improvements
- Interest in operationalizing the pilot project

Client Satisfaction Survey Results

- 37% of occupants responded to the survey and only one respondent listed the survey as unsatisfactory
- 98% support maintaining composting in kitchenettes
- 100% support maintaining composting in washrooms
- 76% support maintaining removal of trash bins from offices

Details are available in the section "*Client Satisfaction Details*".

Conclusion

The GM Waste Pilot Project proved successful overall. Identified issues will need to be resolved. The impact of the pilot project is two-fold: reduction of landfilled waste and reduction of waste collection and disposal costs.

Reduction of Landfilled Waste

If we extrapolate the audit results to estimate the potential landfill savings if this initiative were expanded to all offices across both campuses, approximately 120 metric tonnes of regular compactor waste could be diverted from landfills each year, which represents slightly more than a **15% reduction in landfill waste**.

Details are available in the section "*Per Capita Waste Changes and Extrapolated Results*".

Reduction of Waste Collection and Disposal Costs

If we expanded this initiative to all offices at both campuses, extrapolating the changes in costs of collection service and waste disposal, we find that a net savings of 65,000$ per year can be achieved, based on the assumption that compost bags can be obtained for one third the current price paid for them. A capital investment of 115,000$ would be required to expand this initiative assuming that we do not exceed our on-site composting capacity, yielding a payback period of less than 2 years after completing the expansion. This needs to be explored more prior to university-wide expansion.

Details are available in the section "*Financial Analysis Report*".

Next Steps

GM Waste Reduction Pilot Project: Phase 2 involves expanding the initiative to all floors of the GM building to be run between October – November 2014. During the planning of Phase 2, all issues identified during Phase 1 will have to be addressed in order to ensure buy-in from the users.

Waste Audit Result Details

Waste Audit Methodology

Inventorying

All waste bins on the 3 floors were inventoried prior to the implementation of the pilot project.

Sample Selection

Sample waste bags were selected based on the inventory, to ensure adequate representation of all bin and location types.

- For the **pre-campaign audit**, all waste bags were collected for weighing at least once during the 3-day audit. Kitchen and office trash bins all had their contents audited in detail.
- For the **post-campaign audit**, all kitchen bins were audited in detail.

Sample Collection and Auditing

- Waste bin samples were collected by GDI cleaning staff and delivered to the EV loading dock.
- Samples consisted of the bag and contents from each identified bin.
- Each bag was labeled with stickers provided to the GDI cleaning staff, indicating waste type (trash, container recycling, paper recycling, or compost), the room type, and the date on which it was collected.
- A team consisting of the Environmental Coordinator, the Waste Education Coordinator, and volunteers separated and weighed bag samples collected two weeks in advance of the pilot project implementation.
- The standard waste audit methodology used in past audits at Concordia was used (see *Waste Audit Methodology* document for full details), however, certain categories were eliminated for the post-audit, since they were deemed as unnecessarily details that slowed down the auditing process.
- The follow-up audit was conducted during the third week of the pilot project, allowing enough time for users to adapt to the new conditions and for the auditing to reflect the changes in behavior.
- The same collection and auditing procedure was followed for the audit during the third week of the pilot project.

Bin Configuration Changes

150 small trash bins were removed on the first day of the pilot, mostly from offices, but additionally from hallways, meeting rooms, and photocopy rooms, as demonstrated in the chart below.

	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Room Type	Trash		Compost		Container/PGM		Paper	
Kitchenette	8	8	5	8	7	7	2	2
Office	120	2	-	-	-	-	120	120
Washroom	7	1	-	6	-	-	-	-
Hallway	15	0	-	-	-	-	3	3
Meeting Room	7	2	-	-	-	-	-	-
Photocopy Room	6	0	-	-	-	-	6	6
Total	163	13	5	14	7	7	131	131
Trash Bins Removed	150							
Compost Bins Added	9							

Small compost bins were already in place in kitchenettes on the 4th and 8th floors, however these were replaced by larger compost bins in anticipation of their increased use, particularly for the high volume of paper towels used.

Trash bins in washrooms were demarked as compost. No bins needed to be purchased for this change

Waste Audit Result Analysis

Detailed data from the waste audits are provided in the appendix. The following chart provides a summary of total masses and averaged waste composition during both audit periods:

Summary of GM Waste Reduction Pilot Project Audit Results		Total Weight	Plastic Glass Metal Recycling		Paper Recycling		Organics		Non-Recyclable/ Compostable	
Audit Period	Room Types Audited	Kg	Kg	%	Kg	%	Kg	%	Kg	%
Trash										
Pre-Audit	Office, Kitchenette, Washroom, Meeting Room	23.1	5.0	22 %	1.1	5%	13.7	59 %	2.9	13 %
Post-Audit	Kitchenette, Meeting Room	4.5	0.9	19 %	0.1	1%	2.9	65 %	0.6	14 %
	Daily Total Trash Reduction (3 floors)	18.6								
	Daily Organics Diverted						10.8			
	Daily PGM Diverted		4.1							
	Daily Paper Diverted				1.0					
	Daily Non-Recyclable Reduced								2.3	
PGM Recycling										
Pre-Audit	Kitchenette	1.6	0.7	41 %	0.6	38 %	0.2	12 %	0.1	9%
Post-Audit	Kitchenette	5.4	4.5	83 %	0.2	4%	0.5	8%	0.2	5%
	Daily PGM Increase (3 floors)		3.8							
Compost										
Pre-Audit	Kitchenette	1.5								
Post-Audit	Kitchenette, Washroom	11	0.5	4%	0	0%	10	94 %	0.1	1%
	Daily Compost Increase (3 floors)						9			

Organics are a majority of waste composition: As is frequently the case in waste audits at institutions, organics compose the highest proportion of trash composition (the figure 59% in

the Pre-Campaign Audit is highlighted in yellow). This is why encouraging composting participation is the most vital behavior change in reducing landfill waste in offices.

Composition of organics in trash: If we further examine the composition of those organics, we find that a total of 34% of waste are paper towels, paper bags, paper napkins, etc. while 22% is food waste and another 2% is liquid that should have been emptied in a drain (*these figures can be found in the detailed waste audit results spreadsheet*).

Compost collected had very low contamination: 94% of compost collected on the pilot floors was organic material, indicating that the educational efforts were very successful.
The following chart summarizes the total observed changes in waste composition on all three floors:

Daily Waste Changes on 3 Pilot Floors	Change (kg)	
Landfill Waste Reduction	18.6	kg per day
Organics Reduction		10.7
Plastic, Glass Metal Reduction		4.2
Paper Reduction		1.1
Non-Recyclable Waste Reduction		2.3
Composting and Recycling Increase	12.8	kg per day
Plastic, Glass, Metal Recycling Increase		3.8
Composting Increase		8.9
Paper Recycling Increase		1.0

As indicated in the chart above, landfill waste generated over the three floors per day was significantly reduced by 18kg, from 23kg to 4kg, **a reduction of nearly 80%.**

Primary Observations

1. Significant reductions in trash were found on all floors, complimented by equivalent increases in composting and recycling.

This indicates that users behaved as expected, taking compostable and recyclable items that would have been thrown in the trash bin in their offices out of convenience and placing them in the appropriate bins in kitchenettes.

2. The reduction in paper contents in the trash indicates that paper recycling did increase.

Paper recycling was not measured, since the project was not expected to have an impact on this figure. The figure for paper in trashes was quite low already, and was decreased to a near zero value. This can be accounted for by the removal of trash bins in hallways and meeting rooms unaccompanied by recycling bins.

3. Although the trash contents decreased dramatically, the **general distribution of waste types in the trash remained the same**, with mostly recyclable and compostable items remaining.

This indicates that there are still a few occupants who are not aware of proper recycling and composting procedures, or who lack motivation for proper sorting. **Most of the remaining items in the trash are compostable organics.**

Population Affected

The pilot affected approximately 124 occupants over three floors. The chart below indicates the distribution of occupants by department and floor.

Department	FTE Population
11th Floor	
Facilities Management	32
Environmental Health and Safety	10
Obuds/Rights Responsibilities	4
Sub-total	46
8th Floor	
President	11
Office of Provost	19
VP Services	7
VP Dev Ext Rel	11
Sub-total	48
4th Floor	
Hospitality / Conference Services	11
Inst Co-operative Ed	19
Sub-total	30
Total	124

Per Capita Waste Changes and Extrapolated Results

The chart below shows the result of dividing the mass changes by the 124 full-time space users on the floors, yielding per-capita mass change figures:

Category of Waste	Change Per Capita (g)
Landfill Waste Reduction	-150
Plastic, Glass, Metal Recycling Increase	31
Paper Recycling Increase	8
Composting Increase	72

We assumed that the average user has access to similar space configurations and exhibits similar waste-generating habits as users working on the pilot. Multiplying the per capita figures by the number of staff on both campuses and the average work days per year yields the following estimates of yearly changes in waste:

Extrapolated Waste Changes All Campus Users, Over Avg # Work

Days/Yr	
Category of Waste	Change/Yr (metric tonnes)
Landfill Waste Reduction	-106
Plastic, Glass, Metal Recycling Increase	22
Paper Recycling Increase	6
Composting Increase	51

For a list of all assumptions made and other details of the extrapolation, please see the sections *Assumptions for Extrapolation* and *Campus Office Users, Working Days, and Pick-ups Per Year* in the *Financial Analysis* section of the report.

A reduction of 106 metric tonnes per year in landfill waste would have significant impacts on Concordia's environmental performance, since overall landfill waste is on average around 600 tonnes per year.

Client Satisfaction Details

Summary of Issues Identified and Recommended Actions

Through site visits and surveying, a list of key issues was identified. These are summarized, along with the recommended remedial actions, in the list below:

Issue: Communication was not sufficiently effective prior to the start of the project
Recommended Actions:

- Contact DA's further in advance. Organize short presentations at staff meetings instead of educational lunches.
- Use clearer, more concise language in email memos. The title should be particularly clear.
- Continue to use effective communication outlets, like posters in kitchenettes.

Issue: Some clients found it cumbersome to make frequent trips from office to kitchenettes to sort waste.
Recommended Actions:

- Provide desktop waste receptacle for compiling waste to transport to kitchenettes.
- Investigate options for closer waste bin station locations for offices far from kitchenettes.

Issue: Recycling collection was not always frequent or regular enough.
Recommended Action: Integrate recycling collection into cleaning and waste collection contracts as opposed to relying on West Island Readaptation clients for collection.

Issue: Some clients complained of the risk of attracting fruit flies with open lids.
Recommended Action: Offer optional, closing, ventilated lids.

Issue: Some clients were concerned that the open lids lead to spilling of food waste on the lids.
Recommended Action: Integrate inspection and cleaning procedure for cleaning team.

Site Visit Findings Summary

37 instances of feedback were formally recorded during site visits. Most of the feedback was positive while some criticisms and suggestions were made. The most frequent complaints and suggestions became the basis for questions in the survey, which would help to more accurately determine the extent to which these opinions were held.

See the document GM Waste Reduction Pilot Project – Site Visit Feedback for full details.

Survey Findings Summary

Communications

Effectiveness of Memo and Feedback Opportunities

- Only 67% of respondents were aware of the project before it began

- 78% felt they had adequate opportunities to communicate their needs and concerns
- Site visits were most frequently listed as the mode used to communicate needs and concerns

Lunch Sessions

- Over 45% of occupants attended info lunch sessions
- 90% found them useful in understanding details about the project
- 80% found them useful in understanding how to sort waste and about Concordia's waste impacts and objectives

Posters

- 93% of respondents were satisfied with the clarity and content of posters in washrooms
- 83% of respondents were satisfied with the clarity and content of posters in kitchenettes
- Some expressed the desire for distribution of an additional, more comprehensive list of what is recyclable and compostable to be shared with them
  -

User Satisfaction

Kitchenette Compost

- 30% of respondents found the compost lid in kitchenettes got dirty too easily and were concerned with fruit flies
- 74% of respondents did not smell odors
- 96% did not notice any fruit flies
- 75% of users with access to the kitchenette equipped with the alternate, closing lid, found it improved odors and made it easier to throw items in the bin.

Washroom Compost

75% of respondents were able to easily find the nearest trash or recycling bin when they had a non-compostable item to throw in the washrooms.

Trash Removal from Offices

- 50% of respondents were able to adapt to the lack of trash bins in office with no or only slight difficulty, or were not affected by the project
- 56% of respondents who received or set up their own receptacle for transporting waste to kitchenettes found that this reduced the inconvenience of making multiple trips

Survey Results Analysis

The following sections provide an analysis of the results of the survey. *Please see the documents "Survey Responses – GM Waste Reduction Pilot Project" and "Survey Summary – GM Waste Reduction Pilot Project" for the data on which the analysis is based.*

Survey Participation and Satisfaction with Survey

The table below summarizes the Full-Time Equivalent (FTE) population per department affected by the pilot project, as well as survey participation by department.

Department	FTE Population	Survey Participants	% Participation
11th Floor			
Facilities Management	32	9	28%
Environmental Health and Safety	10	4	40%
Ombuds/Rights Responsibilities	4	2	50%
Sub-total	46	15	33%
8th Floor			
President	11	5	45%
Office of Provost	19	7	37%
VP Services	7	2	29%
VP Dev Ext Rel	11	0	0%
Sub-total	48	14	29%
4th Floor			
Hospitality / Conference Services	11	3	27%
Inst Co-operative Ed	19	6	32%
Sub-total	30	9	30%
Unidentified		7	
Total	124	45	37%

45 occupants out of 124 FTE occupants participated in the survey, representing 37% of all occupants. 38 survey participants reported the department they worked for.

When asked to rate their satisfaction with the survey, only one respondent replied that it was unsatisfactory. 89% of respondents listed the survey as satisfactory or more than satisfactory:

Please rate your satisfaction with this survey

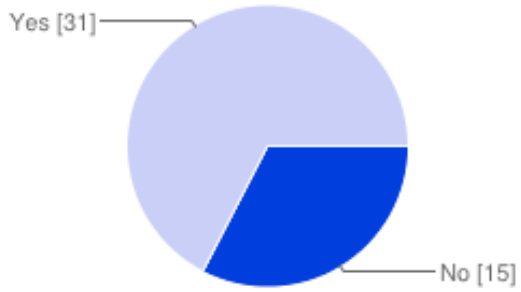
Unsatisfactory	1	2%
Somewhat satisfactory	4	9%
Satisfactory	28	61%
More than satisfactory	13	28%

Survey Feedback Details

Satisfaction with Initial Communications

To inform occupants in advance about the project, an internal e-mail memo was sent to directors or departmental assistants in order for them to send the email to the rest of their department.

Were you aware of the pilot project before it started?



As indicated by the chart on the left, only 67% of survey participants were aware of the project before it began. This, along with similar feedback obtained during site visits, indicates the need for improved communication prior to the implementation of the project.

How did you find out about the pilot project?

53% of survey participants were made actively aware of the project through the principle information vehicle, the internal email memo.

Internal email memo	28
Poster for the Luncheon	13
Departmental Meeting	7
Word of Mouth	14
I noticed my trash bin was gone	9
I noticed the compost bin in my kitchenette	3
I noticed the poster for the compost in the washroom	2
Other	4

Upon speaking to occupants, we discovered that many had seen the memo but not read the details. Some stated that they assumed the memo was only to inform about the Lunch Info Sessions and so did not continue reading.

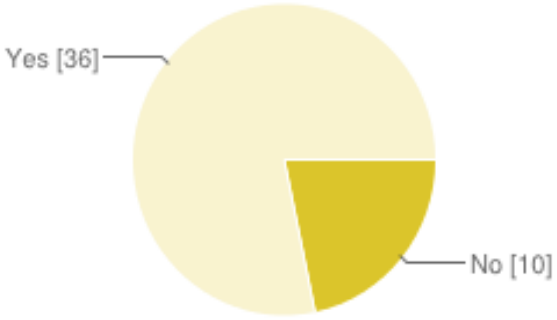
The consequence of the gaps in initial communications was that a fair number of occupants (33% of survey respondents) only learned about the project once their trash bin was gone.

Satisfaction with Communication and Feedback Opportunities

The following activities were conducted to provide additional information on the pilot project, to provide in-depth education on waste procedures, and to provide opportunities for occupants to present their questions and concerns:

- Site visits
- Two educational lunch sessions.

Did you have adequate opportunities to communicate your particular needs and concerns regarding this project?

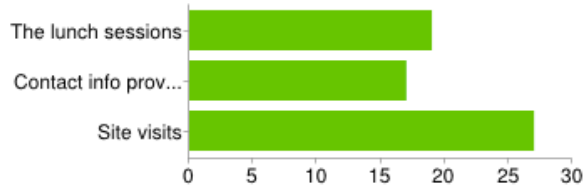


No	10	22%
Yes	36	78%

As indicated in the chart above, 78% of survey participants felt that the opportunities provided for feedback and to express their needs and concerns were adequate.

We asked survey participants which particular opportunities allowed them to communicate their needs. Site visits, as indicated in the chart below, were the most popular method, with 43% of participants indicating this was an opportunity they took advantage of:

Did any of the following opportunities allow you to communicate your particular needs and concerns regarding this project and have them addressed?



The lunch sessions	19	30%
Contact info provided in the memo	17	27%
Site visits	27	43%

Did you attend one of the lunch sessions?

No, I did not know about the lunch sessions	5	11%
No, I knew about the lunch sessions but was not interested	5	11%
No, I wanted to attend but was unable to	16	35%
Yes	20	43%

Attendance for the lunch info sessions was quite high, at a total of nearly 60 participants out of 124 occupants on the three floors. 35% of the survey participants had wanted to attend but were unable to, indicating that this was probably the case for many occupants.

If you attended one of the lunch sessions, did you find the session helpful?

In understanding the details of the pilot project	18
In understanding what is compostable, recyclable, and trash	16
In understanding the issues around waste, and Concordia's waste goals	16
In answering other questions about waste	14
Other	1

Out of the 20 survey participants who attended the lunch sessions, most found the session helpful. Based on site visits and informal feedback, we found that those who attended the sessions were more confident about how to sort waste and had fewer questions and concerns about the pilot project.

Effectiveness of and satisfaction with information posters

The chart below indicates that most survey participants noticed the info posters in washrooms and kitchenettes and were satisfied with the clarity and content.

Question	Yes	No	% Yes
Did you notice the posters in the washrooms?	42	4	91%
If yes, were you satisfied with the clarity and content of the poster?	39	3	93%
Did you notice the new waste info posters in the kitchenette?	40	6	87%
If yes, were you satisfied with the clarity and content of the poster?	35	7	83%

Survey participants expressed that although they were satisfied with the content of the kitchenette waste info posters, they still required more info on certain common office items. It was suggested that a more thorough list could be compiled and distributed.

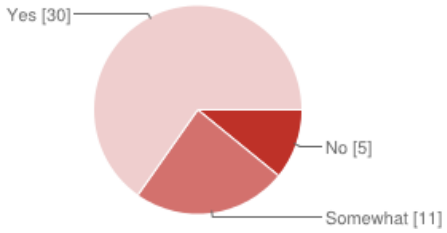
Satisfaction with User Experience: Composting

No	5	11%

Somewhat	11	24%
Yes	30	65%

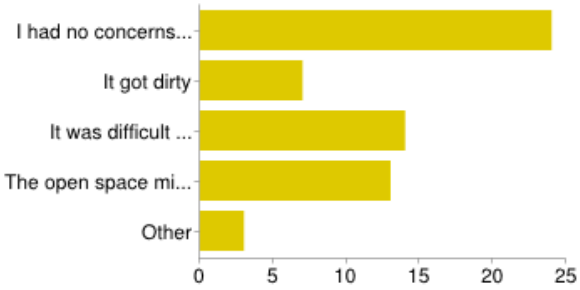
Occupants were provided with compost collection bins in their kitchenettes, including orange lids with a diamond opening. Site visits provided us with a sense of the concerns certain occupants had; those concerns were used as the basis for the questions asked in the section, with the goal of ascertaining to what degree they were shared by other occupants.

Were you satisfied with the orange lid provided for the compost bin in the kitchenettes?



The chart above indicates that 65% respondents were satisfied with the orange lids, with around 24% only somewhat satisfied and 11% not satisfied. We followed up this question by prompting which specific issues people had about the lid:

Please list any specific concerns you had about the orange lid provided for the compost bins

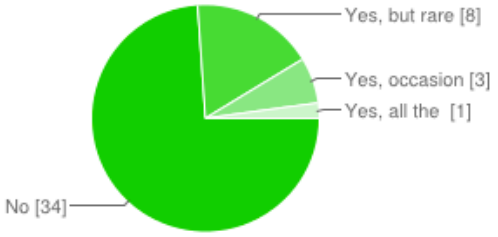


I had no concerns or issues	24	52%
It got dirty	7	15%
It was difficult to fit my food in the hole without dirtying the lid	14	30%
The open space might attract fruit flies	13	28%
Other	3	7%

Although half of respondents had no concerns, 30% found it difficult to fit their organics into the hole without dirtying the lid and 28% were concerned about the open space attracting fruit flies.

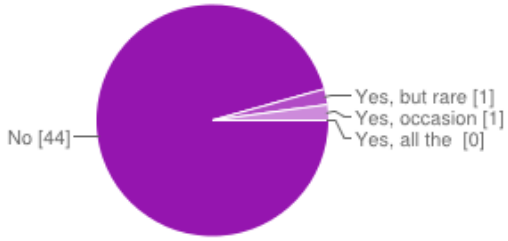
Most respondents, as shown in the charts below, did not notice any odors or fruit flies during the pilot project.

Did you notice any unpleasant odors emanating from the compost bin in the kitchenette?



No	34	74%
Yes, but rarely	8	17%
Yes, occasionally	3	7%
Yes, all the time	1	2%

Did you notice any fruit flies around the compost and recycling bin in the kitchenette?



No	44	96%
Yes, but rarely	1	2%
Yes, occasionally	1	2%
Yes, all the time	0	0%

Considering that a situation with fruit fly infestation can happen seemingly overnight, we were particularly responsive to this concern even though no issues arose during the pilot. We asked participants to inform us immediately if any fruit flies were seen.

One group in particular was completely opposed to having open lids, due both to sensitivity to odors and a concern about fruit flies, so we provided them with a closing, ventilated lid that we received as a sample from the same supplier that provided the orange, open lids.

This was a small group of people with access to a small kitchenette in the Provost's office. We received the following feedback from them regarding these lids:

- Much better lid, don't have bad smells in the kitchen as was the case with the orange lid N/A
- The closing lid was a much better option - it kept the smells to a minimum. Thank you.
- The green lid is much more practical than the orange lid. No smells or fruit flies were noticed once the green lid was in place.
- Don't feel it is necessary, but perhaps this will become needed in the summer months.

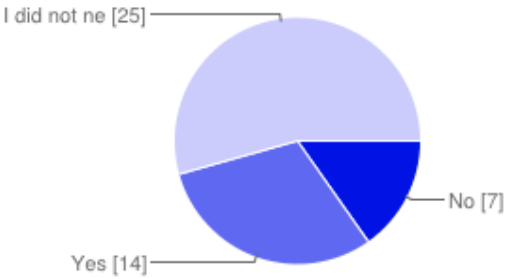
Three out of four responses reinforced that these occupants found the lid superior, while the fourth indicated that it might be needed during the summer months.

Satisfaction with User Experience: Washroom Compost

The only concern expressed regarding the conversion of washroom trash bins into compost collection bins was that some individuals could not find the nearest trash bin when they had a non-compostable item to throw out.

This was noted specifically in the women's washroom on the 8th floor, where the first stall was missing a trash bin for hygienic products (all women's stalls should be equipped with these). We notified the custodial team upon learning about this. Occupants who only used the first stall had assumed the bins had been purposefully removed.

If you needed to throw out items other than paper towels or compostables in the washroom, were you able to easily find the nearest trash or recycling bin?



No	7	15%
Yes	14	30%
I did not need to throw non-compostable items out	25	54%

As indicated by the chart above, most respondents either did not need to throw non-compostable items out or were able to easily find the nearest trash or recycling bin.

Satisfaction with User Experience: Office Trash Removal

This component of the project received the most vocal opposition, due to the slight disruption in routine that it caused. From site visit feedback, though, we found most occupants expressed being able to adapt to the change without too much difficulty.

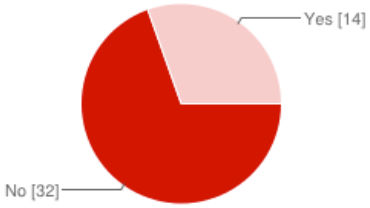
Please select the option that best represents your experience with the removal of the trash bin from your office:

I requested to keep my trash bin	1	2%
I found it very inconvenient	7	15%
I found it mildly inconvenient	15	33%
I was not affected by it	1	2%
I was able to adapt to the change with slight difficulty	3	7%
I was able to easily adapt to the change	19	41%

Half of respondents were either able to easily adapt to the change, to do so with slight difficulty, or were not affected by the change at all. A third of respondents only found the change mildly inconvenient, while only 15% found it very inconvenient.

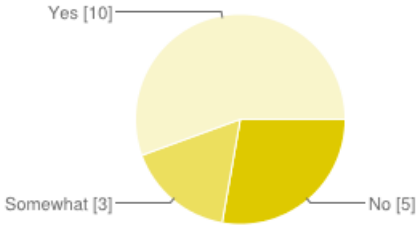
Some occupants created makeshift placeholders for their waste at their desks. They would compile waste in bags or baskets before transporting it for sorting to the nearest kitchenette. We decided to purchase a few baskets and provide them as an option to all occupants. The following questions examine whether these were seen as effective options.

Did you set up or receive a basket for compiling your waste at your desk?



No	32	70%
Yes	14	30%

If yes, did this help reduce the inconvenience of carrying waste to the nearest waste bin?



No	5	28%
Somewhat	3	17%
Yes	10	56%

As seen in the charts above, 30% of respondents received or set up their own basket for compiling waste at their desk. 73% of that group found that the baskets reduced the inconvenience of carrying waste to the nearest waste bin.

To verify to what degree other occupants shared some of the positive feedback regarding the experience of the pilot project, we asked what aspects of the project respondents considered beneficial.

Which of these would you describe as beneficial aspects of the project?

It encouraged me to get up from my desk more frequently	19	25%
It gave me an opportunity to interact more with my co-workers	4	5%
It encouraged me to improve my knowledge of what is compostable and recyclable	27	35%
It reduced the trash in my department noticeably	20	26%
Other	7	9%

A quarter of respondents reported that they appreciated being encouraged to get up from their desk more frequently. Another quarter of respondents appreciated the reduction of waste in their department. Finally, over a third of respondents appreciated that it required them to improve their knowledge of waste sorting procedures.

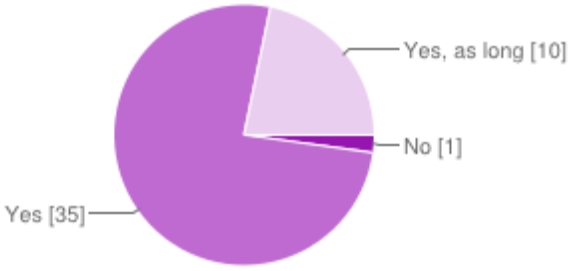
During site visits, occupants reported that **they preferred this approach,** so as **to minimize the amount of bags wasted** through personal trash collection.

Future of the Project

The survey demonstrated that most respondents supported all three aspects of the project; some supported the project with conditions they wanted to see met.

Only one respondent didn't support maintaining compost bins in kitchenettes:

Do you support the continued presence of compost bins in department kitchenettes?



No	1	2%
Yes	35	76%
Yes, as long as the following conditions are met	10	22%

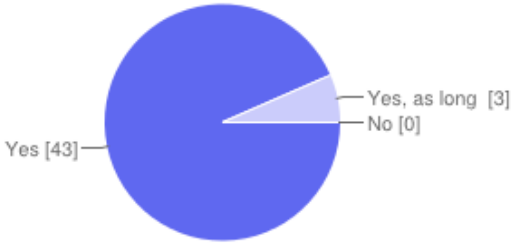
Conditions listed:

- Ensure daily collection of compost
- Replace orange lid with more convenient lid
    - Diamond shape opening not appropriate
    - Closed lid
    - Pedal for opening lid
- Frequent cleaning schedule
- Frequent checks for fruit flies
- Sorting basket for office desks to facilitate transport to kitchenettes

All of these conditions, with the exception of having a pedal operated lid, are ones that are planned on being addressed. Using a pedal would not be sustainable from a durability perspective, since the mechanical component would be likely to break down.

No respondents were opposed to maintaining compost collection in washrooms:

Do you support the continued collection of paper towels in washrooms for compost?



No	0	0%
Yes	43	93%
Yes, as long as the following conditions are met	3	7%

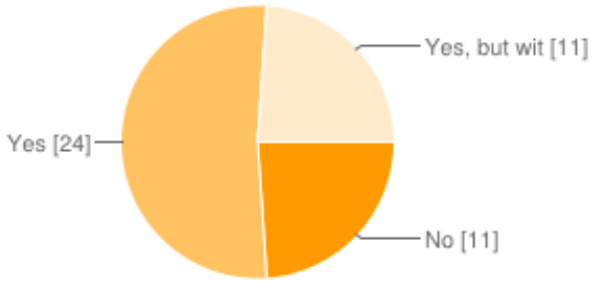
Conditions listed:

- Trash bin should be available in washroom as well

We will currently not be pursuing this recommendation, since including a trash bin would risk many paper towels being thrown out in that trash.

75% of respondents supported maintaining the removal of trash bins, 24% with conditions:

Do you support maintaining the removal of trash bins from offices?



No	11	24%
Yes	24	52%
Yes, but with conditions	11	24%

Conditions listed:

- Larger bins in kitchenettes.
- Compost and recycling bin close to offices that are not adjacent to kitchenettes (Co-op)
- Sorting baskets to facilitate transport to nearest bins should be provided

Despite initially hearing fairly vocal opposition from a small group of individuals in response to the removal of trash bins, the survey indicates that most people support the move, particularly when the condition of providing a basket for transporting waste is met.

Larger bins may be possible for kitchenettes; however, the concern about full bins can be addressed by ensuring daily collection of compost and container recycling.

Placing bins closer to offices will be considered for future incarnations of the project where space allows; it was found that hallways in offices were not designed for additional bins. This should be considered in future standards for construction and renovation.

Financial Analysis Report

Overview of Financial Analysis Report

This report examines potential financial scenarios for expanding the waste reduction initiatives conducted in the GM building during April 2014 to all office spaces on both campuses at Concordia University.

This report provides an estimate for costs and savings related to the following capital and operating costs:

Capital Costs:

- Compost containers and lids
- Waste info signage
- Desktop waste sorting bins
- 240L Compost and Recycling transport bins
- Coordinator salary for implementation, education, and waste auditing

Operating Costs and Savings:

- Landfill and recycling fees
- Trash, recycling and compost collection fees
- Trash bag and compost bag costs
- Wood pellet costs
- Compost operator salary costs

Assumptions for Extrapolation

The extrapolations made in this report will be made based on the following assumptions:

1. The average waste change observed during the GM Waste Reduction Pilot project per capita will be the same for the average campus office occupant.

2. The average occupant at office spaces at Concordia University has access to the same number of kitchenettes and washrooms as did the average occupant during the GM Waste Reduction Pilot project.

3. The infrastructure changes and service needs required for the GM Waste Reduction Pilot project will be the same for all campus offices.

4. Faculty and administrative offices are included while student offices are currently not, since that data was not available at the time this report was written.

Campus Office Users, Working Days, and Pick-ups Per Year

Concordia's online directory was used to obtain data on the number of listed staff members in each building. It was assumed that only full-time equivalent (FTE) occupants were listed. This data was summarized by campus, as shown below:

FTE Campus Office Users, Work Days/Yr, Trash Pick-ups/Yr	
Directory Listed Staff at SGW	2820
Directory Listed Staff at Loyola	540
Total Directory Listed Staff	3360
Average Work Days/Yr	211
Yearly Trash Pick-up Trips	50

The **average work days per year** of 211 days was calculated as follows:

(50 work weeks x 5 days / week) – 7 holidays – 22 vacation days – 10 sick days = 211 days

Since the pilot project was conducted during a busy work period and an unpopular time for vacations (April), it is assumed that the waste generated during that period was slightly higher than the average yearly waste generated. Therefore, when extrapolating, an average number of sick days and the maximum number of vacation days will be removed.

The **yearly trash pick-up trips** was calculated by assuming that trash will only be picked up once per week, since this is likely to become the new standard.

Extrapolated Landfill and Recycling Fees

In order to estimate the impacts of bringing the waste reduction pilot project to all campus staff and faculty offices, the daily changes observed during the pilot project were recalculated on a per-capita basis.

This chart shows the daily changes during the pilot project, measured in grams. The figures were compiled over 3 days of auditing before the project and 3 days during the project:

1 Day Waste Changes on 3 Pilot Floors	Change (g)	
Landfill Waste Reduction	18601	
Organics Reduction		-10714
Plastic, Glass Metal (PGM) Reduction		-4159
Paper Reduction		-1087
Non-Recyclable Waste Reduction		-2295
Composting and Recycling Increase	12750	
Plastic, Glass, Metal Recycling Increase		3849
Composting Increase		8901
Carbon Materials		4900
Paper Recycling Increase		1000

These figures were divided by 124, the number of FTE staff participating in the pilot project, yielding the following per-capita changes in waste:

Category of Waste	Change Per Capita Per Day (g)
Landfill Waste Reduction	-150
Plastic, Glass, Metal (PGM) Recycling Increase	31
Paper Recycling Increase	8
Composting Increase	72

Multiplying the per capita figures by the number of FTE staff and faculty on both campuses and the average work days per year yields the following estimates of yearly changes in waste:

$$Waste\ Change\ Per\ Year = Waste\ Change\ Per\ Capita\ Per\ Day\ (g) \times FTE\ Staff\ \&\ Faculty \times Avg\ Work\ Days\ Per\ Year \times \frac{metric\ tonne}{1000\ kg} \times \frac{kg}{1000\ g}$$

Extrapolated Waste Changes All Campus Users, Over Avg # Work Days/Yr	
Category of Waste	Change/Yr (metric tonnes)
Landfill Waste Reduction	-106
Plastic, Glass, Metal Recycling Increase	22
Paper Recycling Increase	6

Composting Increase	51

The following table shows the cost savings potential of reducing the tonnes of material landfilled each year by implementing the office waste reduction project campus-wide:

Landfill and Recycling Cost Projections	
Cost per tonne Landfill Waste	$147.27
Cost per tonne PGM Recycling*	$-
Landfill Cost Savings for All-Campus implementation	**$(15,662.12)**
Recycling Cost Increases	**$-**

As shown above, reducing 106 tonnes of landfill waste per year would save approximately 15,000$ per year.

*Recycling costs incurred by the increase in collection of PGM is assumed to be negligible, since collection costs are calculated by trip and not by mass collected. The amount of additional recycling collected should not require additional trips, however this needs to be verified by examining the current volume of recycling contained in the bins collected by the recycling company.

Paper recycling costs and returns are not calculated since the change of 6 tonnes per year is not significant.

Costs associated with composting the additional organics collected will be calculated in the next section.

Compost Operational Costs

Carbon Costs

Given that 44% of the organics collected from office spaces (kitchenettes and washrooms) are carbon-rich (mostly paper towels), this material can be used to substitute the cost-incurring wood pellets currently used as a carbon source for the in-situ composter at Loyola.

It remains to be determined what the ideal percent of substitution of paper-towels for wood pellets is as a carbon-source. Wood pellets also serve the function of moisture absorption and providing aeration.

The following chart calculates the costs and savings using scenarios of 25% and 50% substitution of wood pellets by paper towels and other carbon sources collected from offices. The chart uses carbon collected per-capita during the pilot project to extrapolate the total tonnes of carbon that would be collected across all campus staff offices.

Compost Carbon Cost Estimates	
Percent of organics that are carbon rich paper napkins	44%
Organics collected per day pilot project (g)	11049
Carbon collected per day pilot project (g)	4862
Carbon collected per capita (g)	39
Extrapolated carbon collected yearly pilot project floors (kg)	1026
Extrapolated carbon collected yearly all campus offices (tonnes)	22
Extrapolated nitrogen collected yearly all campus offices	29
Percent carbon needed by mass of nitrogen	35%
Carbon needed for existing collected compost (tonnes)	21
Carbon needed for compost collected after office expansion to all campuses	31
Cost per kg of wood pellets	$ 0.25
Wood pellets cost current compost collected without paper napkins	$ 5,302
Wood pellets cost after office expansion without napkins	$ 7,821
Cost savings if 25% wood pellets replaced after office expansion	$ (1,955)
Cost savings if 50% of wood pellets replaced after office expansion	$ (3,910)
Wood pellets costs after expansion with 25% replaced	$ 5,865
Wood pellets costs after expansion with 50% replaced	**$ 3,910**

The amount of carbon needed per mass of nitrogen is calculated as 35% of nitrogen-rich materials input into the composter. The carbon needed in the scenario of expanding the project to all offices is calculated by assuming that the current 60 tonnes per year of mostly nitrogen-rich organics collected was supplemented by the 29 tonnes per year from offices.

35% of 89 tonnes of nitrogen-rich waste = 31 tonnes of carbon-rich material

The 22 tonnes of carbon-rich material collected from offices would be more than sufficient to replace 50% of the 31 tonnes of carbon-rich material required.

Using paper towels in place of 50% of wood pellets would yield a yearly saving of 3,900$ after expansion to all offices.

Compost Operator Salaries

The following chart estimates the additional hours and salary needed for operating the composter if the project is expanded to all offices.

It is assumed that fewer carbon-rich organics (paper towels) can be composted per hour than nitrogen-rich organics since the material is less dense; more bin-loads would be required for an equivalent mass input into the composter.

Composter Operation Needs	
Kg nitrogen composted/hr	800
Additional nitrogen to compost/yr	29
Kg carbo-rich (paper) composted/hr	200
Additional carbon to compost/yr	22
Hrs required for additional composting/yr	148
Hrs required for additional composting/day	1.0
Compost operator wage	$19
Additional cost for compost operation/yr	**$2,841**

To compost the additional 29 tonnes of nitrogen-rich waste and 22 tonnes of carbon-rich waste per year would require 148 hours per year. **The additional compost operation would require around one additional hour per day and 2,841$ per year.**

The cost of manipulations needed for maturing the additional compost are not included here, since it is assumed the additional mass will not significantly extend the process of re-locating compost to the maturation pile.

Collection Service Costs

The cost of service collection will change significantly with the implementation of this project campus-wide; cleaning staff will no longer need to visit so many offices and instead will only be visiting kitchenettes and washrooms for collection.

Service Cost Projections	
Collection salary per hour	$26.00
Minutes required to collect each office trash bin	1
Office bins removed on 3 pilot project floors*	150

Daily minutes reduced over 3 pilot project floors	-150
Daily hours reduced over 3 pilot project floors	-2.5
Daily hours reduced per FTE occupant	-0.020
Yearly service hours reduced for expansion to all university	-3387
Service cost savings per year for expansion to all university offices	**$(88,064.52)**
Compost bins required per FTE occupant	0.1
Additional minutes required to collect PGM recycling and Compost	0.5
Additional hours to collect PGM recycling & Compost for all university offices	775
Yearly service cost to collect PGM & compost for all university offices	**$20,137.42**

*The pilot project scenario had slightly more trash bins removed than users (150 bins for 124 users), due to unneeded bins found in hallways and photocopy and meeting rooms.

The amount of time required for collection of office trash per capita was multiplied by the number of listed staff members (3360) and the 50 collection days per year (one per week) to yield 3387 reduced hours per year. **This yields approximately 88,000$ in trash collection service savings per year.**

It is assumed that one minute is required to enter an office with one trash bin and to change the trash bag. No changes were accounted for with washrooms, since the collection of paper towels for compost is no different than collecting them for trash.

There were approximately 10 users per compost bin added during the pilot project, so this figure was used to extrapolate the compost collection service needs for the entire campus. It was assumed that compost and PGM recycling collection would only require an additional 30 seconds to collect, since cleaners were already entering kitchenettes to collect trash. These figures were discussed with the custodial supervisor.

An additional 20,000$ will be required for PGM recycling and compost collection.

Trash and Compost Bag Costs

Although there are some cost savings to be had by removing the need for the small trash bags used in the office trash bins, the cost of compost bags are much higher and vastly offset those savings, as shown in the chart below:

Trash and Compost Bag Cost Estimations	
Cost per small trash bag	$ (0.02)
Cost per compost bag	$ 0.75
Number of trash bins removed during pilot	150
Frequency of trash collection per year	50
Number of trash bins removed per capita during pilot project	1.2
Number of compost bins used during pilot project	14
Number of compost bins used per capita	0.1
Trash bins in all offices at the university	4065

Compost bags needed daily for all offices at the university*	379
Trash bags reduced per year for all offices at the university	203226
Trash bag yearly cost savings for all offices at university	**$ (4,065)**
Compost bags needed for all offices at the university, daily collection	94839
Compost bag yearly cost for all offices at the university, daily collection	**$ 71,129**
Compost bags needed for all offices at the university, 3x/wk collection	56903
Compost bag yearly cost for all offices at the university, 3x/wk collection	**$ 42,677**

An additional 71,000$ would be required yearly for compost bags changed daily at all office kitchenettes at Concordia, and at the current price per bag paid, while 4,000$ would be saved on trash bags.

It is recommended to investigate reducing the pick-up frequency to three times per week, yielding a yearly cost of 42,677$. This would be feasible if the closing, ventilated lids were used in place of the open lids. The additional cost of these lids is already factored into the capital costs listed in the next section.

The supplier was able to offer a maximum reduction of price at .40$ per bag for a bulk purchase of bags.

Discounted Compost Bag Cost Scenario	
Discounted Compost Bag Price	$ 0.40
Compost bag yearly cost for all offices at the university, daily collection	$ 37,935
Compost bag yearly cost for all offices at the university, 3x/wk collection	$ 22,761

At this price, the yearly cost would be 37,935$ for daily collection and 22,761$ for collection 3 times per week.

Expansion Capital Costs

Equipment Costs

Expanding this project to all campus staff and faculty offices will require new compost bins, lids, posters, and desktop sorting bins. It will also require additional 240L bins for transporting compost and PGM recycling. The additional organic waste generated will also require increased composting capacity. These costs are estimated and tallied below:

Compost and Recycling Expansion Capital Costs	
Max kg capacity for paper towels per 240L bin	5
240L bins needed for paper towels - office expansion all campuses	21
Max kg capacity for nitrogen waste per 240L bin	100
240L bins needed for nitrogen waste - office expansion all campuses	25
Cost per 240L bin	$75
Total cost 240L compost bins (incl. tax, no shipping)	$ 3,952
Compost slim bins needed for all offices at the university	379
Cost per compost collection slim bin	$ 38.50
Cost per compost collection lid	$ 45.00
Total cost for new slim compost collection bins and lids (all university)	$ 31,676
Max kg capacity for PGM recycling per 240L bin	25
240L bins for PGM recycling - office expansion all university	4
Total cost for new 240L PGM recycling bins	$ 313
Color poster printing per poster	$ 0.20
Posters cost for expansion all university (4 posters per kitchen/washroom combo)	$ 303
Desktop waste sorting receptacles (Mini Bins) Cost/Unit	$ 4.75
Desktop waste sorting receptacles total cost – all university	$ 15,960
Compost Capacity Expansion (18 tonne per year composter for Grey Nuns)	$ 39,000
Total Compost and Recycling Expansion Infrastructure Capital Cost	**$ 91,205**

The total initial infrastructure investment for expanding the project is 49,170$.

The trash bins removed from office spaces will likely be sold for a very low amount (estimated at 50 cents per bin). **This would yield around 2000$ in recovered costs:**

Trash Bin Cost Recovery	
Sale value per trash can	$0.50

Total trash cans to sell	4065
Potential recovered costs	**$(2,032)**

Project Coordination Costs

A project coordinator will be required to bottom-line the expansion of the office waste reduction project. They would play the following roles, conducted over 30 hrs per week in phases targeting approximately 200 occupants at a time from multiple office spaces:

Week 1 – Preliminary Work:
- Site visits to verify current bin configurations
- Collect DA contact info, preliminary meetings, provide memo and waste info posters
- Review plan with cleaning manager and cleaning team

Week 2 – Initial Waste Audit and Educational Presentation:
- 3 day simplified audit
- Data processing
- Educational presentation on key waste practices at staff meetings

Week 3 – Project Roll-out and Site Visits:
- Roll-out of mini bins and desktop memos
- Removal of trash bins
- Site visits and informal

Week 4 – Follow-up Waste Audit: (two weeks later)
- 3 day simplified audit (small team, no need for volunteers)
- Data processing
- Distribution of survey

Week 5 – Announcement of Results:
- Analysis of results
- Follow-up email memos and posters

Project Expansion Coordination Costs	
Coordinator wage	$ 21.00
Staff members on both campuses	3360
Occupants per phase	200
Phases required	17
Weeks per phase	5
Hours per week	30
Employee benefit rate	25.7%
Total project coordination salary required	**$ 66,520**
Weeks per phase w/out waste audits	$ 3

Total project coordination salary required w/out audits	**$ 39,912**

The **5-week phase** expansion would require 2 years to reach all staff offices and, as shown in the chart above, would **cost 66,500$ in project coordination costs**. A **3-week phase** expansion that does not include waste auditing would require 1 year and **cost 39,900$ in project coordination costs.**

Waste auditing would be beneficial for the following reasons:

- It allows data to be collected that can be used for tracking Concordia's overall performance
- It will identify any particular waste issues at each office space
- The awareness by staff members of the auditing encourages extra care for proper sorting
- Most importantly, it immediately validates the success of each expansion, rather than waiting to see if yearly figures have changed, which may be difficult to detect if other activities offset the changes by generating more waste than the previous year within a building.

If auditing consistently shows similar waste reduction results in the initial audits, it may be decided to discontinue auditing for the sake of efficiency.

Summary of Costs and Savings for Expansion to All University Offices

The scenarios below demonstrate that compostable bag prices and frequency of compost collection will have the highest impact on reduction of the payback period. They also demonstrate that increasing the capital costs by lengthening the expansion period and paying more coordination salaries (which allows for waste-auditing to be conducted, verifying the impact of the expansion after each phase) has a minimal impact on payback period.

Scenario 1: 1 year expansion, daily collection of compost bags, discounted compost bag price

Yearly Operating Costs		
Compost and PGM Collection Salaries	$	20,137
Compost Bag Costs	$	37,935
Additional Composter Operation Costs	$	2,841
Total Operating Costs	**$**	**60,914**

Yearly Operating Cost Savings		
Trash Collection Salaries	$	(88,065)
Trash Bag Savings	$	(4,065)
Landfill Cost Savings	$	(15,662)
Wood Pellet Savings	$	(3,910)
Total Operating Cost Savings	**$**	**(111,701)**

Capital Investments		
240L Compost Bins	$	3,952
240L Recycling Bins	$	313
Compost Slim Bins and Lids	$	31,676
Slim Bin and Washroom Posters	$	303
Desktop Waste Receptacles	$	15,960
Composter for Grey Nuns	$	39,000
Project Coordination Salary (1 year)	$	39,912
Total Capital Investments	**$**	**131,117**

Payback Period		
Total Yearly Operating Cost	$	60,914
Total Yearly Operating Savings	$	(111,701)
Total Yearly Net Savings	$	(50,787)
Total Capital Investment	$	131,117
Payback Period (years)		**2.6**

Scenario 2: 1 year expansion, 3x/wk collection of compost, discounted compost bag price

The changes from scenario 1 are highlighted in blue.

Yearly Operating Costs		
Compost and PGM Collection Salaries	$	20,137
Compost Bag Costs	$	22,761
Additional Composter Operation Costs	$	2,841
Total Operating Costs	**$**	**45,740**

Payback Period		
Total Yearly Operating Cost	$	45,740
Total Yearly Operating Savings	$	(111,701)
Total Yearly Net Savings	$	(65,962)
Total Capital Investment	$	131,117
Payback Period (years)		**2.0**

Scenario 3: 2 year expansion, 3x/wk collection of compost, discounted compost bag price

The changes from scenario 2 are highlighted in blue.

Capital Investments		
240L Compost Bins	$	3,952
240L Recycling Bins	$	313
Compost Slim Bins and Lids	$	31,676
Slim Bin and Washroom Posters	$	303
Desktop Waste Receptacles	$	15,960
Project Coordination Salary (2 years)	$	66,520
Total Capital Investments	**$**	**118,725**

Payback Period		
Total Yearly Operating Cost	$	45,740
Total Yearly Operating Savings	$	(111,701)
Total Yearly Net Savings	$	(65,962)
Total Capital Investment	$	118,725
Payback Period (years)		**1.8**

Scenario 4: 2 year expansion, 3x/wk collection of compost, current compost bag price

Yearly Operating Costs		
Compost and PGM Collection Salaries	$	20,137
Compost Bag Costs	$	42,677
Additional Composter Operation Costs	$	2,841
Total Operating Costs	**$**	**65,656**

Payback Period		
Total Yearly Operating Cost	$	65,656
Total Yearly Operating Savings	$	(111,701)
Total Yearly Net Savings	$	(46,046)
Total Capital Investment	$	118,725
Payback Period (years)		**2.6**

Scenario 5: 2 year expansion, daily collection of compost, current compost bag price

Yearly Operating Costs		
Compost and PGM Collection Salaries	$	20,137
Compost Bag Costs	$	71,129
Additional Composter Operation Costs	$	2,841
Total Operating Costs	**$**	**94,108**

Payback Period		
Total Yearly Operating Cost	$	94,108
Total Yearly Operating Savings	$	(111,701)
Total Yearly Net Savings	$	(17,594)
Total Capital Investment	$	118,725
Payback Period (years)		**6.7**