Transform Compost Systems

Turning Waste Into An Opportunity

District of Kent Household Organic Waste Composting Project

Summary: *A pilot household organic composting project was conducted in the District to Kent to determine the best method for collecting and composting household organic waste. An average of 0.78 kg of organic waste per household per day was collected and transformed into pathogen-free compost by placing the material into aerated static compost bins. The households participating in the project enthusiastically embraced the project, and its continuation was repeatedly requested. The use of a kitchen catcher lined with a degradable bag and a green bin for storing the organic waste outdoors proved to be most appropriate for the collection. It was estimated that the collection and composting of residential waste will increase total residential garbage collection and disposal costs by 10% in the District of Kent, which compares favorably with an expected waste reduction of up to 34%. Residential organic waste collection and composting in in-vessel composting facilities is recommended for the FVRD, preferably with the inclusion of garden waste.*

1 Project Description

Within a few years, British Columbian legislation may ban organics from landfills. Organic waste amounts to up to 50% of all household waste, and many landfills are slated to be closed within the next decade.

The Fraser Valley Regional District and the District of Kent commissioned Transform Compost

Kitchen catcher and biodegradable bag donated by Biobag Canada Inc. (left), Ecosafe oxo-degradable bags donated by Plastics Solutions Canada Inc. (middle) and green bins purchased from Norseman Plastics Ltd. (right)

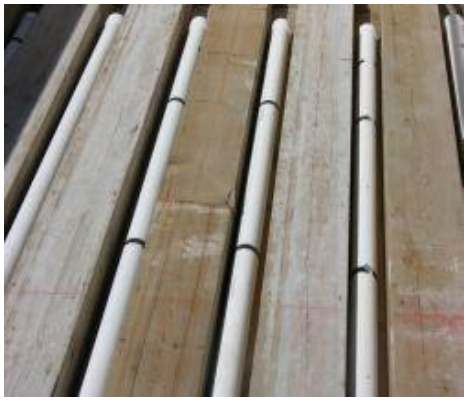
Systems, Abbotsford, BC, to conduct a small project to find the most appropriate collection systems, and the best method for composting household organic waste.

The project provided kitchen catchers for collecting organics in the kitchen and a green bin for storing organics. Two different bags to line the kitchen catcher were also tested: the certified bio-degradable *Biobag* bag, and the oxo-degradable *Ecosafe* bag.

Thirty-six volunteering households and five elementary school classes (with approximately 100 school children) participated in the project. A total number of 41 bins were distributed.

Organic waste was collected weekly and weighed to obtain data on waste quantities for future planning. The waste was then taken to the District of Kent wastewater treatment plant and mixed with bulking agent and biosolids, and composted in aerated bins. The aerated bins were specially built for this project.

The organic waste blended with other organics material.



The composting bins were located at the District of Kent wastewater treatment plant. They contained aeration pipes to optimize oxygen supply and temperature.

After placing the composting material in the bins, it was covered with a layer of screened compost overs that serve as odor barrier and with a frame and tarpaulin cover for protection.

2 Results from the Household Organic Waste Collection

2.1 Organic waste

Table 1 Statistical values from the organic waste collection. Waste per day and participant

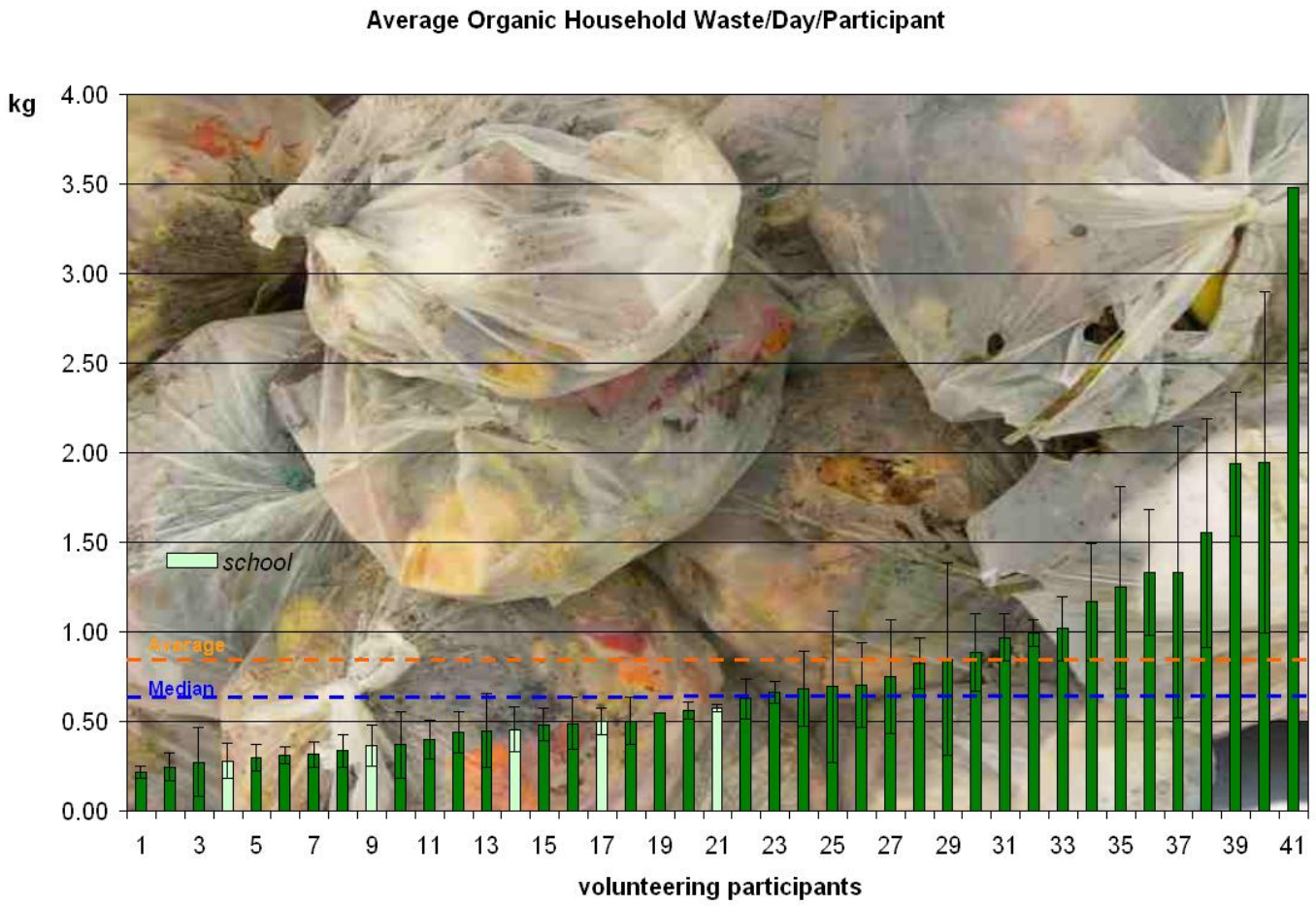
	Residential waste / day / participant (kg)
Average	0.78
Median	0.58
Coefficient of variation (CV)	78 %
5% percentile	0.27
95% percentile	1.94
lower 95% c.i.	0.59
upper 95% c.i.	0.98

On **average**, **0.78 kg** of organic household waste was collected per day per participant. This amounts to more than 280 kg per household per year. A few participants contributed much more to the amount of collected waste than the 'average' participant (see chart below) and therefore, the **median** amount, (the median better describes the typical situation than the average) was lower than the average amount, i.e. **0.58 kg**.

The **coefficient of variation** (CV) is a relative expression of how the numbers vary

around the average. The CV of the collection was 78%, which demonstrates that the amount of organic waste varied highly between the participants. Ninety percent of all participants in this project produced between 0.27 kg (the '5% percentile') and 1.94 kg (the '95% percentile') of organic waste per day.

While the median describes the typical situation better, the more important number for planning purposes on community level is the average. Based on the numbers found in our pilot project, we



predict that there is a 95% chance that the 'real' average (i.e. the average for the entire community) is not less than 0.59 kg ('lower 95% c.i.') and not more than 0.98 kg ('upper 95% c.i.') per household per day, and equivalent of **between 215 kg and 346 kg per household per year.**

2.2 Bags

On **average**, a total of **0.26 bags** were used per household per day, or approximately 1 bag every 4 days, or less than 2 bags per week. Again, the median number of bags used is lower than the average number indicating that the 'typical' household used less, but that some participants used many more bags than others. The variability (expressed by the CV) of the numbers of bags used was not as high as it is the case for the amount of organic waste. Ninety percent of participants in the project used between 0.11 and 0.45 bags per day, or less than 1 to more than 3 bags per week.

Table 2 Statistical values from the organic waste collection: Number of bags per day and participant

	Number of bags / day / participant
Average	0.26
Median	0.23
Coefficient of variation (CV)	51 %
5% percentile	0.11
95% percentile	0.45
lower 95% c.i.	0.22
upper 95% c.i.	0.30

Based on the numbers obtained in this study, the average consumption of bags of the entire community will be most likely (95%) **between 0.22 and 0.30 bags per household per day.**

3 Composting Method and Compost Quality

3.1 Composting material

The organic waste of the first collection was mixed with the nutrient-rich biosolids from the wastewater treatment plant, with wood shavings as carbon source and with overs from the screening process as bulk material to improve the porosity of the material. The material was

Table 3 Compost material mix and use of biodegradable bags

Collection week	*Wood shavings*	*Sludge*	*Screen overs*	*Chicken manure*	*Biobag*	*Ecosafe Bag*
First	X	X	X		X	
Second	X	X	X		X	
Third	X	X	X	X		X
Fourth	X	X	X	X		X
First composting batch (batch 1) = material of first week mixed with material of second week						
Second composting batch (batch 2) = material of third week mixed with material of fourth week						

then placed into an aerated bin and covered with additional screened overs and a frame and tarpaulin cover for odor control, insulation and protection from precipitation. The same method was used for the waste collected one week later. This time, however, the entire material of the first and second week were pooled and mixed to form one composite batch (batch 1) before placing it into an aerated bin.

The same treatment was applied to the organic waste collected in the third and fourth week with the exception that about 3 % of chicken manure was added to the material that was mixed with the organic waste. The waste collected in the third and fourth week were also pooled and mixed to form one composite batch (batch 2).

3.2 Temperature

The temperature in the center and on the surface layers were monitored at regular intervals using a thermocouple temperature probe. Temperature in the center of batch 1 reached 55° - 60° C, and 75° - 80° C in the center of batch 2.

3.3 Pathogens

One of the major public concerns and attributes of superior compost quality is that it is free of potential disease-causing organisms. A very important biological indicator of compost quality is the presence of bacteria called *coliforms*, in particular *Escherichia coli*. Most strains of *coliforms* are generally harmless, but they are hardy organisms and can be easily detected. Therefore, if no or few *coliforms* can be found in compost, it can be assumed that most other pathogens are also killed.

To investigate the potential pathogen kill, samples of the composting material were taken four weeks after placing batch 1 (two weeks in the case of batch 2) into the aerated bins, and sent to an accredited laboratory. Altogether, three samples per batch were taken. Two separate samples per batch were taken from the center of the compost inside the aerated bin, and one composite sample per batch consisting of four subsamples was taken close to the respective corners of each compost bin.

Table 4 Presence of pathogens in composted material

		Sample 1 (bin center)	*Sample 2 (bin center)*	*Sample 3 (composite sample of four subsamples from the corner)*
Batch 1 (without chicken manure)	Moisture (%)	43	41.5	47,3
	Total coliforms (MPN/g)	150,000	110,000	150,000
	Escherichia coli (MPN/g)	110,000	2,400	460
Batch 2 (with chicken manure)	Moisture (%)	37.2	35.7	37.2
	Total coliforms (MPN/g)	20	75	20,000
	Escherichia coli (MPN/g)	<3	<3	2,400

The supplementary nitrogen source provided with the chicken manure to batch 2 increased the microbial activity and resulted in a rise in temperature that was sufficient to kill most pathogens. Conditions as created in the center of batch 2 would suffice to comply with the BC requirement of highest compost quality. Lower temperatures in the peripheral parts of the compost pile 'the edge effect' is the primary reason for the higher pathogen content in the composite sample of batch 2. The small size of the aerated bin with the greater surface area to volume ratio also reduced the ability to the compost in the bins to retain heat. It is fully expected that poultry litter is not required for adequate pathogen kill during source separated foodwaste composting.

3.4 Decomposition of bags

Ecosafe bags were apparently less degradable than *Biobag* bags. Furthermore, *Ecosafe* bags were distributed after the *Biobag* bags and had less time to decompose. As a consequence, much more plastic material was present in batch 2 than in batch 1 where the *Biobag* bags were nearly entirely decomposed. Notwithstanding, it is however interesting to notice that the presence of plastic material in batch 2 did not impede the microbial activity.

3.5 Moisture Content

The initial moisture content of the mixed material before composting was approximately 65% moisture (wet weight). The moisture content in batch 2 was reduced to an average 36.7% (wet weight). This corresponds to 447 liter of water loss per metric tonne of material, or 68% of the total water content. Assuming an outside temperature of 20°C, this amounts to the energy equivalent of approximately 1.16 GJoule per metric tonne of composting material.

3.6 Odor

Odorous emissions from organic waste and during composting are often the greatest public concern with composting.

During the pilot project, no odors were reported by participating volunteers and by residents. We detected some unpleasant odors during collection when bags broke open and when the waste was unloaded at the composting site. The Ecosafe bags broke less easily which resulted in less odor, and easier handling.

There were no odors detected or reported by staff or residents after the mixing of the organic waste with the bulking agents, or emanating from the composting bins (the compost in the bins was covered with a layer of screened composted material as odor barrier and with a frame and tarpaulin for protection).

We highly recommend that separated household organic waste be received and processed indoors during the composting process. The greatest risk for odor emission is from the material received at the composting plant, and during the first two weeks of an aerated composting process.

4 Volunteer Feedback

Table 5 Number of participants

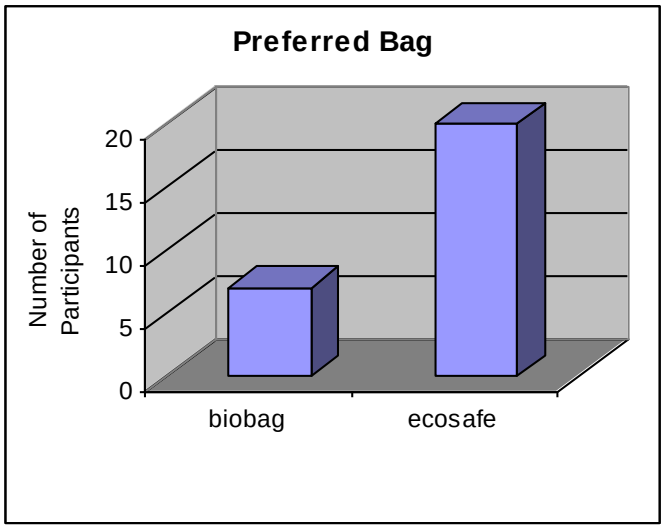
TOTAL VOLUNTEERS ENROLLED	43
School teachers	5
Participation withdrawn	2
Total without school	36
Interviewed	31 (86 % of total without school)

Simple, clean and odorless procedure
All participants found the explanation of the procedure, and the information (as to what belongs into the bin and what does not) sufficient and easy to understand. Many participants were surprised at how many items were included in the list that can be composted, such as meat, hair or cigarette butts.

None of the participants detected any odor from the small container; neither did the small kitchen collection container cause any other inconvenience. In fact, many mentioned that they liked the 'handy' size, which allowed them to put it easily under the kitchen sink. Only one participant did not like the idea of a small container on the kitchen counter and suggested to modify the container so that it can be mounted to a wall.

3 out of 4 favor the 'Ecosafe' bag

Twenty-seven of the interviewed participants tested both bags (four people received only the Ecosafe bag because they enrolled later in the program). Of these twenty-seven, twenty participants favored the '*Ecosafe*' bag (also called '2nd bag' or 'green bag'). All twenty-seven participants agreed that there was no difference between the bags in smell when full – because there was no smell at all.



The 'Ecosafe' bag was considered as sturdier and easier to close as it exceeds the size of the kitchen collection container. Several households reported that the Biobag broke or leached. Those who prefer the 'Biobag' said it fits better in the container and has a silky texture (better feel to it). Besides, it gives the impression that it is more degradable. One participant mentioned that a dark bag hides better the content and reduces the "yuck factor". One participant said it would be good if they could also have access to even smaller bags to take along when walking the dog.

The green bin works well for garage or outdoor storage

All participants were very satisfied with the green bin and said it was the perfect size. Most kept the bins under a shelter and did not encounter problems with wind or animals. Two participants mentioned that strong winds would occasionally blow the bin over; one of these two participants also offered an apparently proven (by experience with other bins) solution: to put a brick inside. One participant mentioned a slight odor after having had fish dinner. One participant reported that raccoons had repeatedly tried to open the bins – without success. An 86-year old participant, probably the most senior participant in this program, said it is a perfect size for her to handle and to take to the curb without help. Most participants did not use half of the capacity of the bin. Only one participant said the size is too small if the bins are not collected less than once a week.

Positive feedback from family and friends

All participants that had the opportunity to discuss the program with friends and family reported very positive feedback. Even initially reluctant family members participated voluntarily after they understood how easy and clean the organic waste separation is.

Possible improvements

All participants considered the program as efficient, well done and generally, could not think of ways to improve the program. Some participants, however, would like see a coordination of the organic waste collection with the collection of other garbage, i.e. to have all garbage collection on the same day. Other suggestions are: garbage bins with two compartments (based on an experience made by the participant in Europe), and to laminate and magnetize the list to place it on the refrigerator.

Encouraging the reluctant

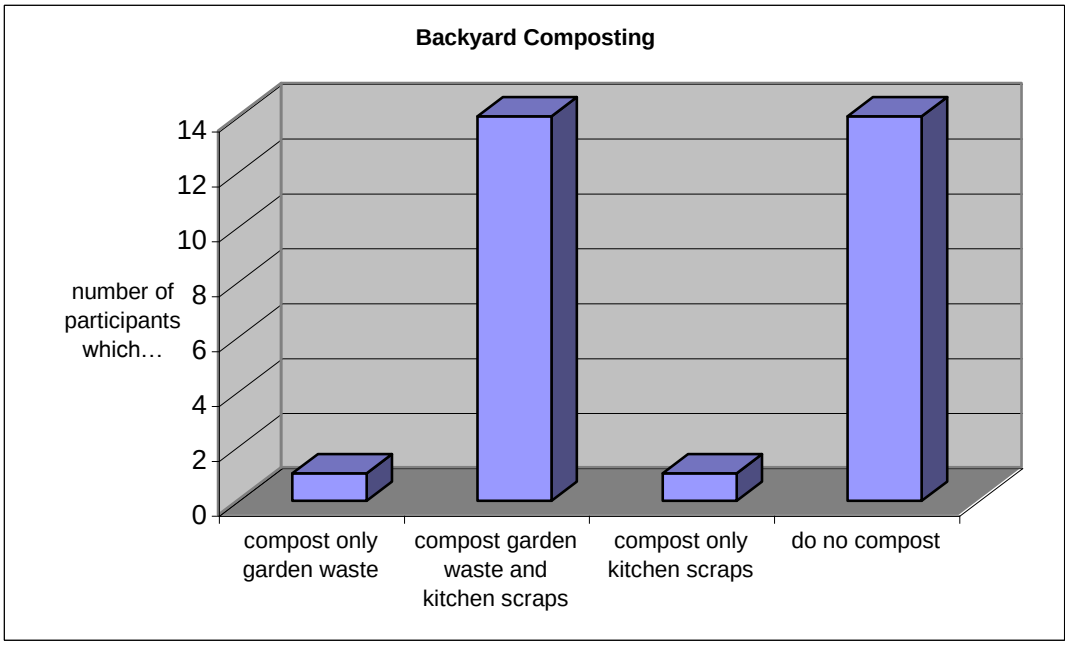
Most participants considered public education and publicity as important ways to encourage more reluctant community members to participate. When advertising, stress should be placed on showing how simple the procedure is. Word of mouth was also considered as an important part of an advertising strategy. Two participants had the idea to make waste collection 'trendy' by associating waste collection to 'success stories' with young couples as 'heroes'. One participant said that a flyer in the newspaper or in the mailbox is more efficient than an advertisement in the newspaper.

Many participants also believed that working with children and teenagers is very important to instill a natural awareness of our environment into our future generations, but also to indirectly address the parents. Several participants said that their children had actually made them participate in the program.

Cost was a repeatedly mentioned as a concern. Twenty percent of the participants mentioned that the cost of the collection plays a crucial role in convincing people and that the collection should be at no or less cost than existing programs. One participant believes that no cost will be also an incentive to avoid that some people dump garbage into the organic waste as a way of 'cheating' to save on garbage collection taxes.

Backyard composting

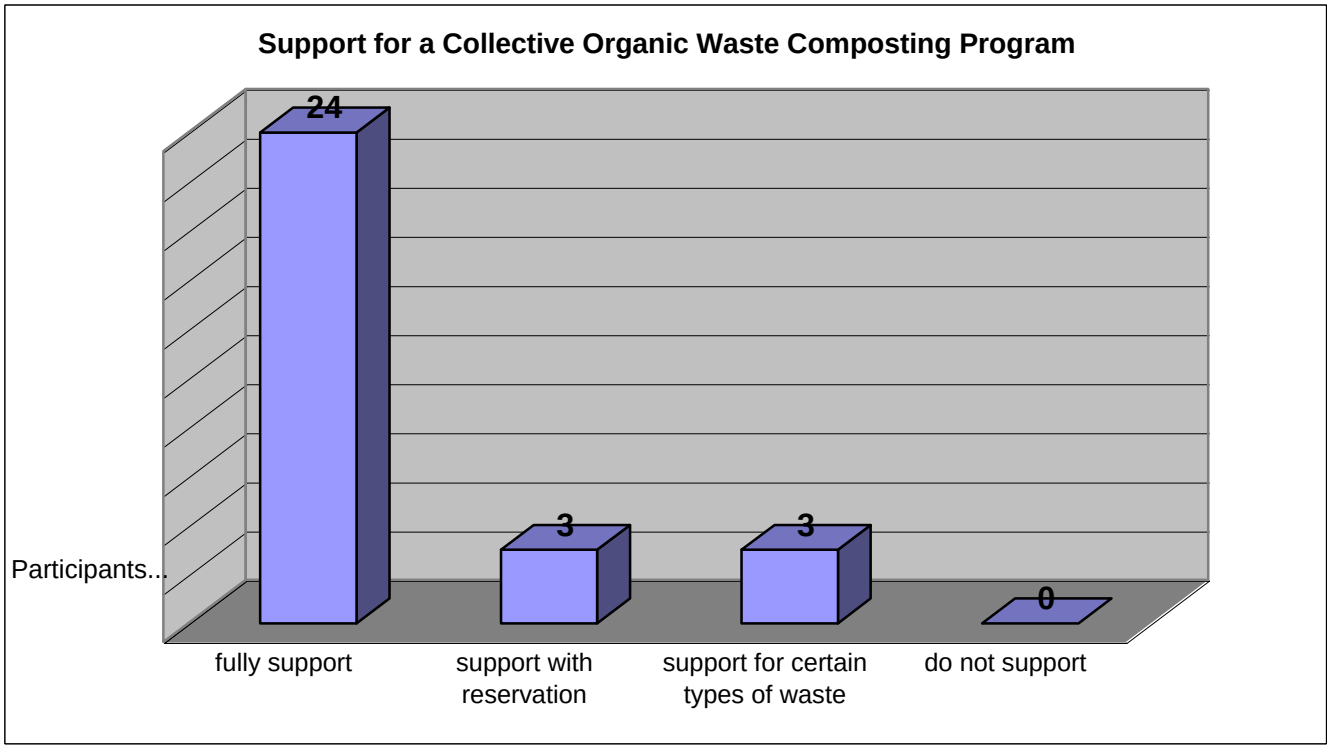
Fifteen participants, or half of the interviewed participants, have their own compost pile in the backyard. Most households with backyard composting also compost their kitchen scraps. One



participant composts only kitchen scraps in a black plastic bin. However, approximately half of the households that currently do not have a backyard composting pile possess previous composting experience.

Collective composting is supported

All participants prefer to have a collective organic composting facility because it is considered as cleaner and more efficient than a backyard composting pile. A collective organic composting facility can handle much more and different material than backyard compost piles (for hygienic reasons and to avoid the presence of rodents and scavengers). Some participants wished to have access to composted material, at least at a reasonable price (4 participants). A few participants mentioned that their support depends on the cost of the program (3 participants). Two participants said they would contribute only the material in excess of their own composting pile, and one participant said to contribute only organic waste from animal origin (meat, grease, etc).



Integrated garbage pick-up preferred

Twenty-six participants (87%) would like to have an integrated garbage pick-up (that includes separate collection of garbage, recyclable material and organic waste). Four households said their answer would depend on the cost of the program.

All participants thought that garden waste should be included in an organics collection program, except for two participants who said it depends on the cost. In particular elderly people consider the collection of garden waste as a very convenient service. According to one participant, this would also prevent illegal dumping.

Environmentally aware participants

Twenty-nine households rated themselves on a scale from 1 to 10 (where 1 is little and 10 is very environmentally aware). Three households rated themselves 5 (‘average environmentally aware’), four households rated themselves 10 (very environmentally aware). The average rating was 7.9, i.e. the participants are apparently more environmentally aware (based on their own appreciation) than the average community member supposedly is.

Experiences from other communities

Only two participants have lived in a community that collected organic waste (one lived in Guelph, one lived in the Netherlands). Both described the programs as being well received by the community (and as something ‘normal’ in the case of the Netherlands). Three participants reported indirect experience (relatives or friends living in communities with organic waste collection) with excellent results in two cases, but a less successful in one case where the population resented a relatively drastic enforcement and control of the waste collection program.

5 Tipping Cost and Waste Reduction

5.1 Household organic waste

Experience from communities with waste collection show that waste collection services have to be simple, convenient and affordable in order to achieve maximum support and participation by the residents.

Costs for curbside garbage collection are influenced by each municipality's program design and service level, its urban form, distance to transfer facilities, and the extent of the recycling program.

Based on personal communication, a short literature review and internet research on collection costs per tonne (without tipping fee, processing costs or transfer costs) for residential waste for several communities in Canada, numbers range from $50 to $160 per tonne of waste, with an estimated median approximately around $110 per tonne. These numbers include estimates from communities with and without recycling and/or organic waste curbside collection service.

Currently there are four companies providing curbside collection services for the District of Kent. The current collection cost for the District of Kent is approximately $121 per tonne. This does not include the tipping fee, but does include profit for the company.

To our knowledge, all communities with an established and functional residential recyclables collection service pick up the organic waste at the same day as either recyclables or garbage (or both). Costs associated with the collection of organic waste will therefore not translate into a considerable increase in fixed collection costs. The increase in labor costs will also be relatively small, as the extra container for organic waste will cause little additional handling. Furthermore, it may be assumed that there will be only a small increase in fuel expenses for the collection of the organic waste. Additional fuel costs will only occur for the hauling of the organic waste to a composting facility.

These assumptions are confirmed by estimations made in other communities. A study of different waste collection scenarios for the Region of Peel, ON, predicts an increase in collection costs of only 8.9% if organic waste is collected separately. Similarly, according to information from the Waste Resource Information Center of the City of Guelph, ON, the transition to a two-stream wet/dry waste collection service (wet: organic / dry: recycle and garbage) in 1995, and a few years later to a three-stream wet/dry waste collection program (recycle, garbage and organic waste) did not result in a considerable increase in collection costs, but exact numbers were not available.

Costs associated with our program as designed for the present District of Kent household organic waste collection and composting project include the one-time purchase of an outside organic waste container and a small inside container (kitchen catcher), which are approximately $27 and $3 including GST, respectively. The costs per household for the degradable bags will be approximately $8.04 for each household per year in the case of the *Biobag* bags and $7.42 in the case of the *Ecosafe* bags. This numbers are based on the daily consumption of 0.26 bags per day as found in our pilot study, and assuming a participation rate of 75% of all households.

In total, assuming a comparable relative collection cost increase as calculated for the Region of Peel and use of degradable bags would increase *collection costs* by approximately 19%, or an additional $15.20 per household and year compared to the current system.

Table 6 Estimations of current residential garbage collection costs and collection costs of residential garbage and separated organic waste.

Estimated current collection costs per tonne of garbage for Agassiz, BC†	$121.00
Estimated current collection costs per household per year	$80.40
Estimated cost increase for organic waste collection per household per year*	$7.20
Biodegradable bags per household per year	$8.00
Cost increase in *collection* costs per household per year	**$15.20 (19%)**
Plus one-time purchase (kitchen catcher and green bin)	$30

† Based on information of one private waste collection company servicing Agassiz, BC

* Based on a 8.9% increases as predicted for the Region of Peel

The *avoided costs* will include a reduction in tipping fees. For our project, the savings per household are estimated at $2.20 per household per year. This assumes a participation rate of 75% of all households, which is a conservative estimate because much higher participation rates are reported in other communities. At a 100% participation rate, the savings would be an estimated $3.20.

Table 7 Comparison of the estimated total costs (collection and disposal) of the current system with a service that includes the composting of organic waste (per household and per year).

Current program	$128.90
Organic waste separate collection program	$141.90
Total cost increase (*collection and disposal*)	**$13.00 (10%)**

The *total cost increase*, i.e. collection and disposal, has been estimated to be approximately $13.00 per household per year, which corresponds to 10% compared to the current costs. However, the numbers do not include potential revenue from compost sale (prices over $30 per tonne were achieved in the City of Guelph for high quality compost from source separated organic waste), which would contribute to a further reduction of costs.

How much can be achieved by $13 per household and year, or $1.1 per month? Under the same assumptions and with the same data used for above estimations for the District of Kent, the amount of residential garbage currently disposed in landfills is approximately 66.4 tonnes per 100 households per year. If only 75% of all households participated, the amount of garbage would be reduced by 17.1 tonnes per 100 households per year, or 26%. A 100% participation rate would result in a 34% reduction of landfilled residential garbage. Whatever scenario, the 10% increased cost is small relative to the long-term benefits.

5.2 Garden waste

The collection of yard waste was not part of the pilot project, therefore we do not possess reliable data on the relative amount of residential yard waste collectable in the District of Kent. Surrogate data from other communities suggest a yearly average of 8 – 10%. The amount is dependent on

season and location of community, with more yard waste in the summer months than in the winter months, and much more yard waste will be produced in rural residential areas (such as the District of Kent) than in urban areas.

Certainly, due to the considerable amount of yard waste between March and October, the collection of yard waste will increase collection costs, in particular during the summer months. On the other hand, the collection of yard waste at the same time as the organic household waste will attenuate the cost increase. Furthermore, garden waste usually contains much less impurities than other residential organic waste and has a beneficial effect on the composting process. Therefore, nearly 100% of the material can be composted, which will fully contribute to the avoided costs. As a conclusion, it can be safely assumed that, similarly to the household organic waste, the waste reduction achieved by including yard waste into an organic waste collection program will by far outweigh additional costs.

5.3 Other costs and savings

Many other costs or avoided costs associated with organic waste collection are not taken into account in this report because they are usually difficult to quantify and because of the lack of available data for the District of Kent. They are also beyond the scope of this report.

These costs or savings would include

- External costs or avoided external costs
    - Air emission reduction: greenhouse gases, air contaminants (CO, PM10, NOx, SOx, VOCs), and air toxics (dioxins)
    - Reduction of land remediation costs / and public health costs associated with the land and water emission of not stabilized heavy metal spills from landfills
    - Costs / savings: reduced housing values due to proximity to composting sites as compared to landfill. Value of saved landfill space.
    - Job creation by collection and composting
    - Energy savings and air, water, land emission reduction from compost use compared to the use of synthetic fertilizer
- Contingent costs or avoided contingent costs
    - insurance claims for potential spills
    - fines, violation of environmental regulations,
    - WCB claims

Studies conducted for locations in North America and Europe repeatedly show that composting is an environmentally preferred solution, as well as being economically sustainable. This is particularly true if composting is part of a comprehensive waste management program that also includes recycling.

6 Recommendations

1 Building the infrastructure

There are more than 85,000 residential properties in the FVRD. A significant population growth is predicted for the next 30 years while there will be no landfill capacity in 20 years. Although composting can be only part of an integrated waste management solution, it will contribute to a significant reduction of landfilled waste.

Today's modern composting technologies allow an environmentally friendly and economically sensible processing of several hundred tonnes of organic material per day, and there are many examples of successfully operational composting facilities of this capacity worldwide.

Considering

a) the amount and the composition of residential organic waste
b) environmental restrictions and precautionary measures
c) potential further uses of the composted product
d) economic aspects

we recommend the construction of one, or two, in-vessel composting facilities for the FVRD.

Composting facilities as shown on this picture can transform several hundreds of tonnes of organic waste into high-quality compost in a short period of time without negatively impacting the environment.

In 2000, 101,982 tonnes of waste were landfilled in FVRD, 32% of which was organics. Even if 95% of this waste can be collected (a feasible albeit unlikely high efficiency of the an organic waste collection program), it would require only one in-vessel composting facility containing 28 100-m long aerated continuous flow channels (see picture left) to transform the entire organic waste into high-quality compost.

However, in order to reduce hauling costs and to minimize the footprints of the facilities, we would recommend the construction of at least two smaller composting facilities, strategically located at different places in FVRD.

Another factor in favor of in-vessel composting facilities with flow-channels is their flexibility to adjust to changes in the annual waste volume to be processed. This type of plant can be designed, from the beginning, to allow the future addition of more channels and thus, to increase the capacity of the composting plant.

As odor management is crucial for the success or failure of a waste management project, we strongly recommend the use of closed composting facilities which allows control of odorous emissions.

It is important to note that the population in FVRD is projected to almost double in the next 25 years. Besides, the presence of a well performing organic waste composting plant in FVRD may

also encourage other communities - which hitherto exported waste - to participate in the organic waste composting program. Furthermore, other categories of organic waste such as biosolids from wastewater treatment or yard waste may also be included. It is therefore very likely, that the volume of organic waste will strongly increase in FRVD in the coming years.

2 Curbside organic waste collection

The design of the present project has convincingly proved to fulfill crucial requirements for a successful waste collection: simplicity and convenience.

Generally, it can be safely assumed that, due to its convenience, curbside collection catches more organic waste and thus, reduces total waste more than if organic waste is taken to composting facilities by the residents themselves.

As the organic waste constitutes between 30 – 50% of the total residential waste, this gives leeway in the frequency of garbage collection and consequently collection costs. It is recommended to collect organic waste on a weekly basis, while garbage and recyclables can be collected bi-weekly (the collection of garbage and recyclables can be alternated). Whatever scenario, it is important that communities decide on a single waste collection day per week, as it was suggested by participants in this project but also as experience from other communities demonstrates.

The collection in degradable bags proved to be a clean and odorless procedure. This approach should be maintained, also because its convenience will further augment the participation rate. The use of bags will also contribute to a considerable reduction of odorous emissions during the collection.

We recommend that communities decide on only one brand of degradable bag to avoid a mix of plastics with different decomposition characteristics, or worse, to avoid the presence of other plastics. If the bags are purchased and distributed through the community, a favorable rate may be obtained from the manufacturer. Residents may also have the option of not using any bag at all, although we believe that only few will take to this solution considering potential odors and the relatively modest cost of the bags.

We would also suggest the purchase of the green bins by the communities. This would reduce the cost per unit, encourage cost-oriented residents and warrant the uniformity of the product to avoid confusion during the collection of the organic waste.

To minimize odor emissions during collection, only closed collection trucks should be used.

3 Including yard waste

We also recommend including yard waste in the organic waste collection. Garden waste provides good and clean feedstock for composting, and its collection can further reduce landfilled waste. Besides, collecting yard waste will be a particularly helpful for elderly people.

We suggest the use of the green bins for garden waste of smaller size and amount (as it will be done anyways). For residents with large gardens the purchase of a second green bin should be suggested. Branches up to 3 cm diameter may be bundled or put in paper bags, and put beside the green bin on collection day. Bigger branches should be collected separately.

4 Engage the community

The introduction of a new waste management system, in particular when it comes along with extra costs, may be rejected by an ill-prepared public.

We recommend one-page supplements to local newspapers or mail-outs rather than newspaper advertisements. Small fliers supplemented to bills from public services such as BC Hydro may also be considered. Beside technical instructions, it is important to inform residents about the economic and ecological necessities of the program.

Other ways of public education include the consistent introduction of organic waste separation in all public buildings, including schools.

The public awareness campaign needs to be supported, at least in its beginnings, by a telephone hotline and/or online assistance on the community websites. The employment of a campaign manager with a background, both in public education and in waste diversion strategies, for at least the first few months may also be considered.

Community involvement has to be continuous and ongoing over a long period of time to avoid a ‘creeping sloppiness’ towards the waste separation over time.

Participation of businesses (groceries, restaurants, etc.) should be encouraged by incentives and/or stipulated in business permits.