

City of Cambridge – Department of Public Works

Curbside Organics Collection from Residents Phase 1 Report



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Acronyms

AD	Anaerobic Digestion
ASTM	American Society for Testing and Materials
BEF	Brick Ends Farm
CA	California
CalRecycle	California Department of Resources, Recycling and Recovery
Cy	Cubic Yards
DCR	Massachusetts Department of Conservation & Recreation
DON	Determination of Need
DPW	Cambridge Department of Public Works
EOW	Every Other Week Collection
EPA	United States Environmental Protection Agency
FPZ	Franklin Park Zoo
FWD	Food Waste Disposer
FY11	Fiscal Year 2011 (July 1, 2010 – June 30, 2011)
GHG	Greenhouse Gases
HH	Household
IVC	In-Vessel Compost System
Lbs	Pounds
LE	Landscape Express
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
M.G.L.	Massachusetts General Law
Mi	Miles
MSW	Municipal Solid Waste
MTCO ₂ E	Metric Tons Carbon Dioxide Equivalent
MWRA	Massachusetts Water Resources Authority
NFP	Non-For-Profit Hauler
NH	New Hampshire
PAYT	Pay-As-You-Throw
PHA	Polyhydroxyalkanoates
OT	Overtime
RFP	Request For Proposals
RHF	Rocky Hill Farm
SF	Seacoast Farms
SSO	Source Separated Organics
STS	Save That Stuff
TPD	Tons Per Day
Wk	Week
WARM	Waste Reduction Model
WM	Waste Management
Yr	Year
YW	Yard Waste

I. Executive Summary

Purpose of Study

The Massachusetts Department of Environmental Protection (MassDEP) awarded the City a 2 ½ year grant for up to \$67,000 through the Sustainable Materials Recovery Program to research, plan and possibly implement a pilot curbside food scraps collection program (“Program”) for residents. The City is motivated to implement a Program for several reasons: to reduce greenhouse gas emissions and further climate protection efforts; to control trash disposal costs; to achieve the City’s goals to reduce tons disposed by 30% by 2020 from 2008 levels, and 80% less by 2050, to respond to public support as demonstrated by a March 2011 City Council resolution in support of curbside composting; to help meet state goals to increase food scraps diverted from the waste stream; and to respond to MassDEP’s encouragement of a Program based on the new regulation changes that facilitate the siting and operation of composting facilities.

To achieve the City’s waste reduction goals, Department of Public Works (DPW) recognizes that food scraps is one of several materials to target in the waste stream. We need to take a broad look at how we manage the waste stream and put it in a larger context. As the City begins on the path towards zero waste, we recognize that certain programs and strategies complement one another.

More processing capacity is needed in the Boston area to accommodate increased diversion of food scraps. To achieve this, there are different approaches to curbside collection, including trucking it to regional compost facilities (p. 17-25), sending all municipal solid waste to a regional facility that can compost it (p.38-39), encouraging increased home composting, and neighborhood-scale composting with in-vessel technology (p. 10). Trucking food scraps to a regional composting facility is likely the main strategy.

Methodology

DPW gathered information for this report from MassDEP resources and conversations, facility visits, interviews with many people including processors, haulers, developers, other communities, and compostable product companies. We reviewed research and findings by other organizations and developed a cost calculator (p. 32) to analyze the costs of implementing a pilot or citywide Program. The calculator allows the user to choose different options to run different scenarios. DPW staff met several times to review costs and discuss logistics related to the possibility of collection by city crews or private haulers (p. 32-35).

DPW met with MassDEP in early September to discuss the report and criteria for determining whether to implement a possible pilot Program (p. 9). These considerations include proximity of potential composting facilities to Cambridge, status of whether these facilities are currently accepting food scraps or will expand with the new MassDEP regulation changes, what organic materials will be accepted by each facility, how food scraps can be delivered (separate or combined with yard waste), tip fees at these facilities, and the economics of collection by city crews or a private hauler.

Findings

Possible Compost Facilities

We identified 10 possible compost facilities that could take loads of food and/or combined food and yard waste (p.17-25). Tip fees range from \$40-\$80/ton. Currently operating sites that could accept loads include Rocky Hill Farm in Saugus, Brick Ends Farm in Hamilton, and WeCare Environmental in Marlborough. Potential sites waiting that intend to add food to their operations under the new MassDEP regulation changes include Wellesley Town Compost Site and Landscape Express in

Woburn. Additional sites that are not yet built or fully operational include the Department of Conservation and Recreation Compost Site in Mattapan, Franklin Park Zoo in Boston, and Waste Management. Waste Management plans are uncertain but may involve its transfer station in Melrose or an alternative location within 25 miles of Cambridge.

Projected Tons for Pilot Collection and Citywide Program (p. 27)

If implemented, the pilot will run one day a week for one year. We estimate 2 TPD of food and 124 tons per year (TPY). This assumes 800 households generating 10 pounds of food scraps per week with an 85% participation rate and 70% setout rate. To ensure an efficient pilot route, we will choose a neighborhood within one collection day. We would target a range of housing types including single-family homes and residential buildings with up to 12 units.

Eligible households will be notified through various neighborhood outreach efforts that will include email, mail, posters, announcements, etc. (p. 44-46) Households participating in the pilot will receive a kitchen scrap container and a year's supply of 3-gallon compostable bags to line the container. Once full, participants would place the bag in a sturdy plastic curbside bin with a locking lid. Curbside organics bins will be available in different sizes.

If the pilot is successful, a voluntary citywide program would be phased in by collection day to get enough participation among households to achieve minimum route density. It is important to note that the tonnage estimates below would not be realized on the first week of a citywide program. If implemented, a citywide program is likely to see a 35% participation rate and 70% setout rate. Applying these rates of participation and set out to 31,500 eligible households with City trash service and households generating 10 pounds of food scraps per week, we estimate 8 TPD and 2,007 TPY.

If we collect food and yard waste together in the same truck, we estimate 14-33 TPD and 3,911 TPY. The TPD range is due to seasonal fluctuations (p. 26). We would need to choose a facility that accepts all yard waste currently accepted in the City's program, including brush up to 1 inch in diameter and up to 3 feet long. It is important to note that combined collection of food + yard may not make sense if tip fees for mixed loads cost more than for separate yard waste. In addition, several facilities have limitations on brush due to concerns about damaging grinding equipment, or because they do not have a grinder. However, compost operators in other parts of the country are grinding food and yard waste including brush without issue (p. 15-16).

Costs for Pilot (p. 32-35)

If the pilot is implemented as food only, a side loader truck is recommended. Since DPW does not have a side loader, a private hauler would be needed for the pilot. Costs for the different pilot scenarios with a private hauler have a net cost of \$5,600-\$41,700 after the MassDEP reimbursement (up to \$24,230 for collection costs and compost tip fees). All pilot scenarios (food only or food and yard) using City crews are fully reimbursable with grant funds. Some scenarios even show a net savings to the City before reimbursement. In addition to cost, however, distance and accessibility of the compost facility is ultimately going to determine if the pilot is feasible for city crews.

Should a citywide program be implemented, different scenarios are discussed in the full report. All citywide food and yard scenarios with City crews have a net savings of \$158,300-\$340,300, driven by the elimination of the yard waste contract, using existing Solid Waste Division staff, and reduction of trash disposal fees. Citywide food-only scenarios show a range of impacts, from a net cost of \$52,800 to a net savings of \$27,500, driven by the wide range of compost tip fees.

Background - MassDEP Regulation Changes (p. 7)

MassDEP promulgated the proposed regulations in late November 2012 making it easier for existing compost facilities to expand and new facilities to be developed. These changes to MassDEP regulations are a significant development and remove barriers to siting composting and anaerobic digester operations, allow small compost operations to accept 15-30 tons per day (TPD) of food and other organics and aerobic or anaerobic digestion facilities to accept up to 60 TPD. The timeframe for this process depends on the size of the facility.

II. Background

Description of MassDEP Grant

The City of Cambridge (City), Department of Public Works (DPW) received a Sustainable Materials Recovery Program Municipal Grant in October 2011 from the Massachusetts Department of Environmental Protection (MassDEP) for up to \$67,000 to conduct a feasibility study for a curbside residential organics program for food scraps and possibly to implement a one year pilot as early as September 2013-September 2014 or as late as April 2014-April 2015. Work on this grant began in January 2012 and will conclude no later than June 2015.

From recent residential trash sorts, the City estimates that food and soiled paper constitute 25% of the trash. With the implementation of a composting program, about 2,000 tons of food waste could be diverted from the municipal waste stream every year, depending on the number of participating households and the extent of their participation. The City is motivated to implement a curbside residential organics program to reduce waste and greenhouse gas emissions, control trash costs, clean up the trash, and meet public demand for compost services. DPW recently adopted goals to reduce waste 30% by 2020 and 80% by 2050 over 2008 levels, aligning with the goals in the MA Solid Waste Master Plan. In March 2011, Cambridge City Council passed a resolution in support of curbside composting and held a public meeting on this in April 2011.

Currently, Cambridge residents have several composting options: backyard bin, indoor bin with red worms, drop-off at the Recycling Center or the Whole Foods Prospect Street store, bicycle pickup by Metro Pedal Power or Bootstrap Compost, or food waste disposers used properly. Each option has its own barriers and is not feasible, convenient, and/or cost-effective for most households. MassDEP has noted that this is a comprehensive array of options, more than most MA municipalities offer.

Cambridge businesses have had access to compost collection services since 2006. Participants have food waste collected by Save That Stuff (STS) and other private haulers which deliver the material to regional compost facilities. DPW and the School Department are introducing lunchroom composting programs in the public schools, and DPW offers food scraps drop-off for residents at the Recycling Center. Residents continue to ask when curbside collection will be offered.

Figure 1. Tons of Trash, Yard Waste, and Food Scraps

Curbside Material Collected	Current Citywide Program (Actual Figures)	With Compost Program (Projected Figures)	
		Pilot (Collection 1 day per week)	Citywide (Collection 5 days per week)
Food Scraps	57 TPY*	124 TPY (2 TPD)	2,007 TPY (8 TPD)
Yard Waste (39 weeks, April to mid December)	1,904 TPY (10 TPD)	34 TPY (1 TPD)	1,904 TPY (6-25 TPD)
Trash	16,066 TPY (62 TPD)	15,942 TPY (61 TPD)	14,059 TPY (54 TPD)
* Current (FY12) food scraps tons come from the following sources: 32 TPY Schools, 18 TPY Drop-off, 7 TPY Bike Pickup			

TPY = Tons per year
 TPD = Tons per day

Context of Waste Ban and Composting Regulation Changes in Massachusetts

The MA Draft Solid Waste Master Plan includes a goal for the commercial waste stream, to divert 35% of food from disposal by 2020, or 350,000 additional tons per year. To achieve this, MassDEP is planning a commercial and institutional waste ban on food scraps effective July 2014. Under a ban, large generators, including hotels, convention centers, supermarkets, food waste processors, and other large institutions would be required to divert source separated organics (SSO).

With the impending waste ban for large generators, compost facility operators and other developers are planning to build additional compost facilities or expand materials accepted at existing yard waste facilities to include food. When selecting technology for their future facilities, many developers are focused on the relatively clean organics stream from these large commercial and institutional generators. As a result, these facilities may not be considering the needs of the residential stream, such as the ability to accept food and yard waste together (for collection efficiency), processing compostable bags (to maintain clean collection containers and minimize the yuck factor), or even questions about other organics such as kitty litter and diapers. With the exception of Hamilton-Wenham in MA (3700 households), no east coast US cities offer curbside compost collection, and it is important for facilities to consider the needs of municipalities for MA to divert organics from the municipal waste stream (MSW) as well.

MassDEP Regulations

The Task Force on Building Organics Capacity has noted that composting technologies have improved significantly in the past 20 years, but MA regulations have not kept pace. Further, the regulations were designed for landfills and transfer stations; not for anaerobic digestion and composting operations. Existing regulations limit exemptions to small composting operations, less than 15 tons per day (TPD), and anaerobic digesters are not addressed.

To support the development of additional compost processing capacity, the state has modified the solid waste siting regulations to remove barriers to composting and anaerobic digester operations.

Now that these regulation changes have been approved, facilities handling SSO for composting are not be considered “solid waste management facilities”, and therefore exempt from the Site Assignment process; levels of review and oversight for these facilities; and clear permitting pathways for facilities.

The new regulations:

- Allow small windrow composting operations to accept 15-30 TPD of food and other organics, not to exceed 105 tons per week, with a maximum capacity of 10,000 tons of organics on site at any time, including food and the bulking agent.
- Allow aerobic or anaerobic digestion facilities to accept up to 60 TPD, where organics are pumped directly into the digester unit or storage tank.
- Allow an existing yard waste facility planning to add food, under the Permit by Rule category.
- Allow a transfer station to add a food scraps transfer operation to their site with a permit modification.

Different Approaches for City to Consider to Divert Food from the Trash

There is more than one approach to divert food from the trash, to discuss and consider:

1. Haul food (SSO or with yard waste) by truck to a composting site.
 - a. Options for hauling: City crews, private hauler, or nonprofit hauler.
 - b. Options for paying for program: part of taxes, participating households pay for service.
 - c. Options for collection frequency: weekly organics on the same schedule as recyclables, yard waste and trash, or weekly organics and trash every other week (EOW).
2. Send all MSW to a facility that can compost it (i.e. WeCare). Reduce non-compostable trash so trucks can make one trip to the facility. This can be accomplished by:
 - a. Recycling/reuse programs for bulky items (furniture, mattresses, carpet, etc.)
 - b. Reduce plastic waste through bans on Styrofoam, plastic bags, producer take-back requirements, and extended producer responsibility.
3. Food waste disposers. Pipe materials to waste water treatment plant. See discussion on this under the Deer Island Sewage Treatment Plant (i.e. Philadelphia)
4. Neighborhood-scale composting, possibly in-vessel technology.
5. Municipal Composting Facility. If the City decides that co-collection of food and yard is most viable, it is worth considering siting a municipal facility (in Cambridge or nearby municipality with more available land) to handle this mix. Lexington and Bourne are pursuing privately owned and operated facilities on leased municipal land. High solids digesters are ideal for municipalities since they can process a food and yard mix. These require 6 acres vs. 2.5 acres for low solids digester.¹

Neighborhood Based Composting with In-Vessel Compost (IVC) Systems

Another solution would be to place in-vessel composting systems at sites Citywide to generate compost for use in urban agriculture. The California Department of Resources Recycling and Recovery (CalRecycle) maintains a good list of technology vendors that sell IVC systems at

¹ Molly Bales at Harvest Power, June 12, 2012.

www.calrecycle.ca.gov/Organics/Food/Compost/InVessel.htm. Some systems convert solid food waste to liquid and some are vermicompost systems.

As described by the EPA, with IVC, food scraps, meat, animal manure, and biosolids are fed into a drum, silo, concrete-lined trench, or similar equipment where temperature, moisture, and aeration are closely controlled while producing very little odor and minimal leachate. There is usually a mechanism to turn or agitate the material for proper aeration. IVC systems vary in size and capacity. They can process large amounts year-round while taking up less space and requiring less manual labor than windrows. Some IVC can fit into a school or restaurant kitchen while others can be as large as a school bus to accommodate large food processing plants. IVC can be used in extremely cold weather if the equipment is insulated or the processing takes place indoors. IVC are expensive and might require technical assistance to operate properly. Conversion of organics to compost can take as little as a few weeks. Once the compost comes out of the vessel, however, it still requires a few more weeks or months for the microbial activity to stabilize and the pile to cool.

This neighborhood-based approach was the basis for the City's original grant proposal to MassDEP, and we received support from the Harvard Divinity School, Volpe Transportation Center, and McMath Community Garden. These sites were interested in learning more and possibly being a host site, open to the public. In Boston, City Growers², a for-profit enterprise, is working to transform vacant lots into small-scale intensive urban farms that are economically and environmentally sustainable. They are talking with MA Department of Agricultural Resources regarding best practices, and the City of Boston about the need to rezone for urban agriculture. City Growers is looking to identify an appropriate IVC system.

While this type of system would not be able handle all residential food scraps in Cambridge, it would be relatively inexpensive, create jobs, and offer an alternative that results in significantly fewer greenhouse emissions by reducing truck transportation. Bicycle collection could supplement this system to offer the convenience of curbside pickup for households that choose not to drop off organic waste at a neighborhood compost site themselves. Ultimately, this system may have significantly less participation, but it is certainly worth exploring further from a sustainability perspective.

Criteria for Determining Whether to Implement Pilot

1. Identify facility within 15 miles or 90 minutes roundtrip, or location and/or travel time is acceptable to City crews or private hauler. Distance to a facility may affect overall collection logistics more for City crews than for private haulers.
2. Facility can accept the pilot volume of mixed or separate loads of food and yard. City should renegotiate yard waste contract with Russell to account for about 34 fewer tons per year of yard waste, which would be included in the pilot tons. If Russell pays about \$40/ton this is \$1,360.
3. Ideally, the facility can scale up from pilot to citywide program. However, these additional factors will determine if the pilot is worthwhile:
 - If other facilities would be appropriate for scale up (volume, cost, distance, timeframe)
 - To work through any other collection issues, independent of the end site.
 - To provide City crews with organics collection experience.
 - To gain experience implementing organics collection in multifamily buildings.

² <http://citygrowers.wordpress.com>

- To educate residents about composting.
4. For City collection, a good truck is available and possible retrofits are cost-effective, union incentive costs are acceptable, and reliable staff are identified to be assigned on organics truck.
 5. For Russell, STS, or another private hauler: the grant or City can cover the collection costs. Vehicle and reliable staff are identified to be assigned on organics truck.
 6. Compost tip fees are equal to or lower than trash tip fees. Facility takes separate yard waste only at a competitive cost if the combined food + yard tip fee is higher for yard waste normally.
 7. Compostable bags are tested and approved for use by the end facility.
 8. Minimize disruptions to trash collection with pilot route.

Considerations for a Citywide Program

The City can consider the following strategies if a pilot is implemented and successful:

- Expand service to more households neighborhood by neighborhood within the pilot collection day. Then introduce another collection day and grow from there. This would involve no breaks in service for the pilot households and could start seamlessly soon after the pilot ends.
- Continue the pilot for another year, or other length of time deemed appropriate if the City or partner facility is not yet ready to expand. This would avoid a stop in service for the pilot households.
- Stop service after 1 year pilot, evaluate and plan citywide service for a later date. This would stop service for the pilot households, possibly leading to confusion and discontentment, and more anticipation among other households.
- Delay decision on pilot until more facilities have taken the necessary steps to accept food under the new MassDEP regulations, giving the City clearer options. If needed, MassDEP has agreed to extend the grant timeframe and allow the City to implement the one-year pilot as late as April 2014, completing it by April 2015.

Motivating Households (HH) to Participate in an Organics Program

Maximizing participation in a citywide organics program is in the City's best interest. Doing so will result in reduced disposal tip fees costs, collection efficiencies, and GHG emissions reductions, helping the City meet its goals related to climate protection and reducing waste. Participants in the pilot will be motivated due to environmental awareness and commitment.

For a Citywide program, for HH that are not already motivated by environmental reasons, there are three main ways to motivate the average HH: convenience, financial, and enforcement.

- **Convenience**

Change collection strategies to make composting more convenient. Offering weekly organics collection with every-other-week (EOW) trash pickup would motivate residents to put food in the bin collected weekly. It would also provide significant collection efficiencies and cost savings on fuel, maintenance, and tip fees. Portland, OR, and Toronto have EOW trash and weekly organics, as well as the rural town of Hamilton, MA, with a PAYT option during off weeks.

In 2010, Portland started weekly organics and EOW trash during a pilot for 2,000 HH in four neighborhoods. Residents could continue weekly trash at double the monthly rate, but very few chose this. The City reported, "*While the pilot customers loved weekly yard and food collection, some were not as enthusiastic about EOW trash. About 20% of the initial customer phone calls and emails related to EOW trash. After a year, the vast majority of pilot HH had adjusted and was satisfied. City staff learned that acknowledging the magnitude of the change to people's expectations and habits and helping them through the transition was very important.*"³ In 2011, Portland expanded services citywide for 150,000 single family and multifamily (with 4 or fewer units) HH with EOW trash and weekly recycling and compost. There is no option to for weekly trash at a higher rate. Portland reports, "*EOW trash has increased participation in food scrap collection, food diverted, and reduced*

³ <http://www.portlandoregon.gov/bps/article/380681>

*trash significantly. The program's success can be credited to the move to EOW trash, a big transition for many residents. Any change to our daily habits takes time and now that the program has been going for awhile the majority of HH are figuring out how to make it work."*⁴

In Toronto, buildings up to 7 units get EOW trash. Multifamily buildings are on a case-specific schedule, with trash service up to twice weekly. The city reports that residents love EOW trash, and there is great participation in the organics program. Since residents pay for trash, they are more cognizant of the waste they produce. Buildings pay more for additional collections, so there is an incentive to reduce the number of pickups. The city used savings from switching to EOW trash to fund their compost program.⁵

In Cambridge, EOW trash might be an idea for smaller buildings while charging buildings for additional pickups. If the City offered EOW trash to buildings with fewer than 7 units this would include 66% of City-served HHs. There are 460 8+ unit buildings with city trash service. Or, 31% of City-served HH if EOW was offered to buildings with 4 units or fewer.

- Financial

Give households a financial incentive so that wasting is more expensive and composting is cheaper. This is tricky in Cambridge since trash is paid for through property taxes. Residents do not pay for it as an itemized service like water or electricity. Charging for trash or introducing a volume based fee would allow the City to provide HH a direct financial incentive to trash less and compost/recycle more.

San Francisco charges HHs for weekly trash: \$27.55/month for a 32-gallon container. 23% discount if HHs downsize to 20-gal. Recycling and composting is free. Seattle charges HHs for trash and composting: \$28.05/month for a 32-gal trash container vs. \$6.95/month for a 32-gal compost bin, with different rates available for larger and smaller bins. Portland charges HHs for trash, from \$23.15/month for a 35-gal collected once per month to \$43.80/month for a 90-gal collected every other week. Weekly composting and recycling are included with trash fees, and opting out is not permitted. HHs can choose only recycling and composting for \$18.35/month. Toronto charges single family homes based on the size of the garbage cart and charges multifamily buildings based on the volume and frequency. The trash fee includes recycling and composting. Financial incentives motivate residents to recycle and compost more by making trash more expensive.

- Enforcement

Make it mandatory and enforce participation. Typically, composting programs start as voluntary and do not become mandatory until years later. In San Francisco voluntary service began in 1999 and was made mandatory in 2009. Seattle started in 2009 as voluntary 2009 and went mandatory in 2011. While not currently proposed, the organics waste ban in MA could apply to the residential sector at some point in the future. The City would then need to revise the Mandatory Recycling Ordinance and take steps to ensure trash loads are in compliance with the state waste ban.

⁴ Arianne Sperry at the City of Portland, July 25, 2012.

⁵ Rob Orpin at the City of Toronto, August 7, 2012.

III. Existing and Planned Organics Processing Facilities

Composting technologies

Composting is either **aerobic** (oxygen is present) or **anaerobic** (oxygen is absent). The technology used largely drives what material is accepted and tip fees.

For aerobic composting there are three basic types: windrows, aerated static piles, and in-vessel composting. These methods differ in terms of how oxygen is introduced. Windrows are long piles and periodically turned manually or mechanically to aerate the materials. Aerated static piles introduce oxygen via forced aeration. With in-vessel composting materials are placed in an enclosed vessel which is mechanically turned to aerate the materials.

For anaerobic digesters (AD) there are two basic types: low solids and high solids. Low solids digesters are common at waste water treatment plants and require a low proportion of solids to moisture in the material slurry. High solids digesters are less common, but potentially could accept a food and yard waste mix as their moisture requirements are lower.

From our conversations with various facilities and players in the industry, it seems that most existing local composting operations are farm-based windrow sites and that most facilities under development will be low solids AD facilities. It is important to note that low solid digesters do not want yard waste, and aerobic compost facilities do not want to grind food.

Potential Facilities Identified for Cambridge Organics

To identify potential end sites, we began with the MassDEP list of food residuals processors,⁶ and added to it after conversations with processors, haulers, developers, municipalities, and others. The new MassDEP regulatory changes for organics will affect current market conditions. The information below reflects the best available from April-August 2012 will likely change as the organics market in MA evolves in the months and years ahead. The figures quoted are not binding; rather they are based on preliminary conversations and included to consider the possibilities. If the City implements a pilot, further conversations and negotiations about costs and logistics are necessary.

For each facility identified, we posed the following questions:

- ✓ What materials are accepted? (This includes yard waste, food waste, soiled paper, meat/dairy, compostable bags, plastic bags, kitty litter, and diapers.)
- ✓ Can yard waste and food scraps be delivered together in one truck?
- ✓ What technology do you use? Will this change in the coming year?
- ✓ How many tons per day (TPD) can you accept? Will this change in the coming year?
- ✓ Hours of operation, including Saturdays?
- ✓ Tip fee (actual, best guess or range)?
- ✓ What is the final output/product(s)? Is the material sold, and to whom?

⁶ <http://www.mass.gov/MassDEP/recycle/reduce/fcdcmpst.pdf>

Choosing a Compost Facility

The main factor for the City when choosing a facility is whether it has an updated Site Assignment from MassDEP to accept food. If not, it may be best for them to wait until the new regulations take effect. Other factors include who does collection, distance from City, ease of route, type of loads accepted, load restrictions, and tip fees.

Types of Organics Loads Accepted

The end site ultimately dictates accepted materials and therefore collection methodology. Although collecting mixed food and yard is preferable from a service standpoint, not all sites will take brush. And, tip fees for yard waste alone can be cheaper than when mixed with food. AD facilities under development are low solids digesters not capable of taking yard waste. These facilities seem to be focused on a clean stream of food from commercial and institutional generators affected by the 2014 waste ban. Several windrow facilities that accept food and yard, want brush separate to grind it first. They fear that grinding the mix could damage equipment. Sites without a grinder do not want brush.

Landscape Express, which has taken the City's yard waste from Russell, believes that spring loads are 50% brush, but close to 0% brush in the fall. With this in mind, we estimate that Cambridge generates about 350 tons of brush annually, but mostly in the spring. It is preferable that a potential facility accepts and composts brush to avoid any regression of the current yard waste program, which accepts branches up to 1 inch in diameter and 3 feet long.

Other Cities Collect and Grind Mixed Food and Yard

In Portland, compost facilities are grinding mixed food and yard. The City accepts branches up to 4 inches thick and 3 feet long. They estimate that food is a small percentage of the total (7-20% by weight, varying seasonally) and is "almost invisible".⁷ Likewise, in Denver, the processor considers the City's organics stream as "dirty yard waste" because less than 10% is food. This mixed stream is ground using a large tub grinder.⁸ Seattle accepts branches up to 4 inches thick and 4 feet long and is also grinding its mixed food and yard waste stream.⁹

Brian Mathews at StopWaste.org, Alameda County, reports: *"Various methods are employed in CA for yard collected with food. Most facilities do screen first to remove fines prior to grinding. Trommel screens are typically used, but star and deck screens used as well, though less efficient. Screening removes fines which do not need to be size reduced, and reduces wear and tear on the hammers and cutting surfaces. Grass is actually very abrasive and can wear down grinder parts. I have seen various grinders used for food and yard mixed. The equipment includes Peterson grinders (horizontal hammer mills) and MorBark (tub grinders). At a facility I ran we ground up cannery waste mixed with green waste to blend the material. It was very wet, but there were no equipment problems."*¹⁰

In San Francisco, the City accepts branches less than 6 inches thick and 4 feet long. Bob Besso from Recology reports: *"All inbound food and yard, goes through a high torque low speed shredder, then a 2" trommel screen. Everything over 2" goes across a sort line for inspection and contamination removal, then through an all electric, 200 HP vertical grinder (www.westsalem.com/index.htm) then*

⁷ Arianne Sperry at the City of Portland, July 26, 2012.

⁸ Charlotte Pitt at the City of Denver, July 27, 2012.

⁹ Marcia Rutan at the City of Seattle, August 8, 2012.

¹⁰ Brian Mathews at StopWaste.org, July 26, 2012.

*the 2" minus food is blended in with grindings for composting. There is also post composting standard trommel screenings down to 3/8" for the finished product."*¹¹

Other Cities Collect Food and Yard Separately

In Hamilton/Wenham, there is year-round yard waste drop-off and curbside collection three times a year. Yard waste is collected separately, so there is no need to grind a mixed stream.

In Toronto, there is EOW separate yard waste collection from mid-March into December. No tree limbs, trunks or stumps. Leaves, plant/tree trimmings, weeds, brush, and bundles of branches up to 3 inches thick are accepted. Yard waste is collected separately, so there is no need to grind a mixed stream. Toronto explains two reasons why yard waste is collected separately. 1) Yard waste can be processed through simple aerobic methods such as windrowing with generally low technology requirements and minimal odour issues. Kitchen and household organics are processed through an AD process. These facilities are harder to site and can have odor issues. Generally they have had a lack of kitchen organics processing capacity and thus would not want to almost double the quantity of organics going through such a facility by adding yard waste which can be handled by simpler technology. 2) Related to collection containers, kitchen food scraps need to be stored in a plastic, rodent and pest resistant container. Yard waste is generated in such large quantities that providing an adequate container would be a challenge especially since yard waste is very seasonal here.

Possible Strategies to Address Issue with Brush

There are a few strategies to consider further for a citywide compost program, given possible brush limits posed by potential facilities:

- Encourage MassDEP to offer assistance to compost facilities regarding grinding concerns given that west coast facilities are accepting and processing mixed loads of food and yard waste.
- If there are two organics trucks, collect mixed loads of food and yard from July-March and collect the material streams separately from April-June.
- Require branches cut to 2' long to meet limits posed by Brick Ends Farm. Also consider that long branches may break into smaller lengths after compacted in the collection truck.
- Since most brush is only generated during the spring, be flexible as needed, with where organics loads are taken to haul mixed loads or separated loads to facilities that will accommodate them.
- Consider just accepting brush at the Recycling Center, or possibly in designated locations throughout the City to be consolidated with materials generated from tree pruning operations.

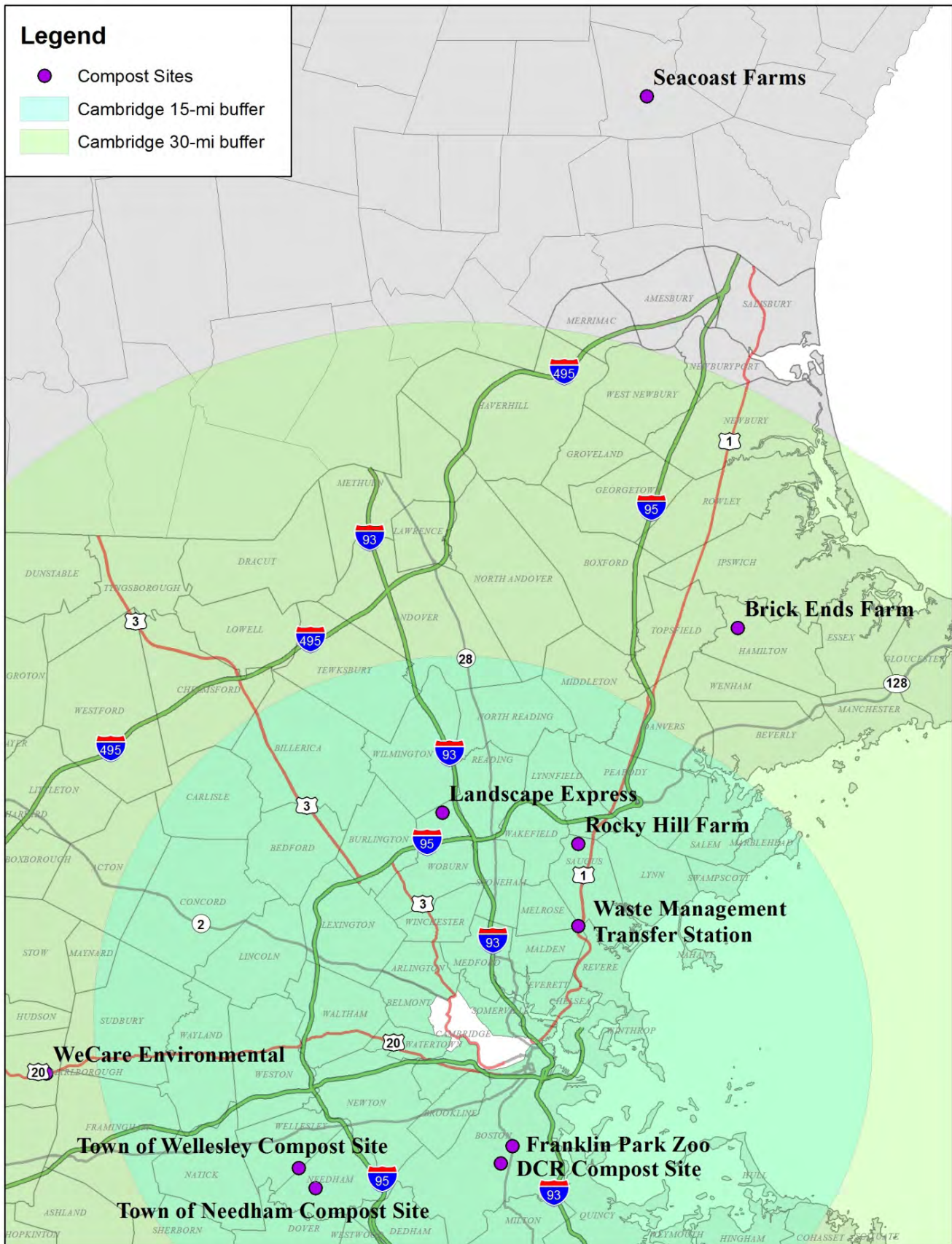
¹¹ Bob Besso at Recology, August 1, 2012.

The facilities below are a subset identified in our review, roughly ranked by which we feel would be the most feasible partner. This is based on consideration of a combination of factors including materials accepted, distance from Cambridge, and tip fees. They could be end sites for residential loads from Cambridge, either immediately or in the near future, either for a pilot or citywide program.

Figure 2. Short List of Possible Compost Facilities

Facility *accepts food now	Location, Distance 1 Way	Tip Fee	Status	Accepted Loads
Town Compost Site	Wellesley 15 mi	\$40/ton yard, maybe less for food	Windrows. Brush ground 2x/yr. Not yet permitted for food. Needs MassDEP site assignment changed.	food + yard (brush maybe separate) (OK: meat & biobags)
Franklin Park Zoo	Boston 6 mi	\$45-60 Depends on quality	Not yet permitted for food, working with City Soil to fund enclosed compost facility. Needs DON from MassDEP, Summer 2013.	food only, yard at nearby site (OK: meat & biobags)
*Rocky Hill Farm	Saugus 15 mi	\$55, maybe less if yard separate	Accepting food now, In-vessel digester.	food + yard, brush separate (OK: meat & biobags)
Waste Management	Melrose, 7.5 mi (or alt site within 25 mi)	\$45-50/ton if processing on site, \$60-\$125/ton if materials taken off site	Not yet built, would require MassDEP permit modification. May site a compost facility or use site as transfer.	food only (OK: meat, plastic & biobags)
DCR Compost Site	Mattapan 8 mi	\$??	Not yet permitted for food. Issuing RFP by early fall for new operator to resume operation. Interested to add food in RFP.	food + yard (OK: meat, biobags?)
Landscape Express	Woburn 15 mi	\$80 food only, maybe lower ~\$40 yard only	Compost yard waste. Needs MassDEP to change site assignment for food. Loads premixed onsite and transferred offsite for final composting.	food & yard, brush separate
Town Compost Site	Needham 15 mi	\$?? Town review of financials fall 2012.	Windrows. Taking food loads from Agresource, YW from residents.	food + yard, Currently no mixed loads, no meat, but maybe
*Brick Ends Farm	Hamilton 28 mi	\$50	Accepting food now, low tolerance for contamination.	food + yard, brush up to 2" diameter & up to 2' long (OK: meat, biobags, maybe kitty litter. No pet waste or diapers)
*WeCare Environmental	Marlborough, 25 mi	\$65-75 food only \$85 compost unsorted MSW	Accepting food now, 100 TPD. 2 large rotating drums. High tolerance for contamination.	Food + yard, brush disposed (OK: meat, plastic & biobags)
*Seacoast Farms	Exeter NH, 54 mi	\$17.50 food + yard \$57.50 food only	Accepting food now.	Food only, or food + yard. Brush up to 1" diameter & 10% of load by volume. OK: meat & bio bags

Figure 3. Map of Possible Compost Facilities



1. Town Compost Site, Wellesley

169 Great Plain Ave, Wellesley, MA 02482

Route: 15 miles, estimated 1 hour round trip, I-90 to I-95S, Exit 21B for MA-16W.

Hours: Monday- Saturday 7am-2pm, Mon-Wed, driver must open / close gate.

Pros: Easily accessible, possibly low tip fee.

Cons: Not permitted, needs to change MassDEP site assignment, brush may need to be separate.

Wellesley is a drop-off community. Composts 6-7,000 tons of yard waste per year, from Wellesley residents and businesses. Leaves and grass are screened and sold after composting. Brush is ground 2x/year and composted separately. Landscapers are charged a tip fee. City will likely accept food and yard waste together, but brush may need to be separate.

Although they do not currently accept food, they are very interested in possibly collaborating with Cambridge. They will contact MassDEP to modify their Site Assignment. Meat, dairy, and compostable bags would be accepted. Currently charging landscapers \$40/ton for yard waste, \$20 minimum. They will consider how costs might change if they begin accepting food, but they say that the food tip fee could be lower since it adds value to their final product.

2. Franklin Park Zoo (FPZ), Boston

1 Franklin Park Road (food) and 450 Canterbury St (yard), Boston, MA 02121

Route: 6 miles, estimated 40-50 minutes round trip

Hours: Unknown

Pros: Easily accessible, low tip fees

Cons: No yet built, separate yard waste, project timeline may be Summer 2013.

FPZ is interested in composting as best environmental practices align with their mission. They want to be a research and development facility on best practices for zoos, regarding manure management and urban waste sheds. City Soil & Greenhouse is working with FPZ to seek funding and help with an enclosed composting operation. They could compost animal manure with residential food scraps, including compostable bags and meat. Yard waste will not be accepted at the primary site, but may be accepted on another zoo property at 450 Canterbury Street. The Zoo is familiar with managing food after pilot trials with Harvard and Stop & Shop.

Manageable volume could be 10-20 TPD, possibly closer to 10. The operation would involve heat recovery for the kangaroo and emu house, and the tropical plant greenhouse. Volume and quality standards will dictate whether they sell finished product. Tip fee may be \$45-\$60/ton, depending on quality. The zoo needs a DON from MassDEP.

3. Rocky Hill Farm (RHF), Saugus

34 Butterfield Road, Saugus, MA 01906

Route: 15 miles, estimated 1 hour round trip, Route 1/129W

Hours: Mon-Thurs 7am-3pm, Fri 7am-2:30pm. Closed on Saturdays. Closed on 5 holidays (New Years, 4th of July, Labor Day, Thanksgiving, Christmas).

Pros: Existing site accepts food (including Recycling Center), low tip fees, can take 10 TPD of Citywide volume

Cons: Brush must be separate, need alternative site for 5 Saturday holiday collections; capacity is limited unless additional digester(s) added

Formerly a livestock farm, today RHF accepts grass, leaves, and food. They produce compost using an in-vessel digester. After 3 days in the digester, the material is completely broken down, then cured in windrows 4 more weeks, and then passed through a Trommel screen.

RHF could accept food and yard combined, but no brush that is larger than a pencil in width/length because it would get tangled in the digester and block the door. RHF could grind brush if it was delivered separately, but does not want to grind a food/yard waste mix due to equipment limitations. Compostable bags are OK, especially BioBags and EcNow Tech bags.

Tip fee is likely \$55/ton for yard and food, possibly less for yard separately. The site is capable of handling pilot tons, and 10 TPD for citywide program.

4. Waste Management (WM) Transfer Station, Melrose

740 Broadway, Melrose, MA 01906

Route: 7.5 miles from Cambridge, estimated 1 hour round trip, Broadway and Route 99

Hours: Monday-Friday 7am-3pm

Pros: Close to the City, food scraps accepted in plastic bags, low tip fee.

Cons: Transfer station not yet permitted, compost facility not built yet, food only.

Plans for Melrose are not yet certain, and WM is also exploring alternative locations within 25 miles of Cambridge for a potential organics facility. WM is exploring two possible modifications to their transfer station: 1) an organics facility that would accept residential food, or 2) a food transfer station, and transfer to their Fitchburg Compost Site or another location. If modified, the site would cease operation as a MSW transfer station.

WM plans to only accept food, including meat. No kitty litter or diapers. Compostable and/or plastic bags could potentially be accepted, but removed as contamination. Leaves and grass clippings potentially could be included, but no brush. Tip fees for food loads would be \$45-\$50/ton if composted onsite. If transferred, tip fees could be \$60-\$125/ton depending on the added transportation costs and how frequently materials must be moved off site.

5. Department of Conservation & Recreation (DCR) Compost Site, Mattapan

395 American Legion Highway, Mattapan, MA 02124

Route: 8 miles from Cambridge, estimated 40 min – 1 hour round trip

Hours: Unknown

Pros: close to city

DCR operates a compost site across the street from the Boston Nature Center, close to FPZ. Compost was used in DCR park properties and made available to the public. Both sites had the same private operator, but the contract was recently terminated due to poor management causing rodent and quality problems. DCR expects to issue an RFP by early fall for another operator to resume operations in the fall or winter. City Soil & Greenhouse is a potential bidder to be an operator.

DCR is interested in partnering with Cambridge for the pilot and can add language in the RFP for food. They may need technical assistance to ensure best practices to manage food including meat and dairy. MassDEP says that it is unlikely that food composting could occur at this site unless an in-vessel system is built, due to the urban surroundings and site history. Tip fee would be up to the operator, unknown at this time.

6. Landscape Express (LE), Woburn

218 New Boston Street, Woburn, MA 01801

Route: 15 miles, estimated 1 hour round trip, I-93, Exit 36. (Easily accessed via Route 93/95, and the state plans to build a new bridge to I-93 at Exit 37C making even quicker access to the highway.)

Hours: Monday-Friday 7am-4pm (5pm in spring), Saturday 7am-3pm in spring/fall (until noon in summer, closed Saturdays in winter). Hours may change due to weather.

Pros: Existing facility, accessible, quick tip times, can handle pilot and citywide volumes, MassDEP supports their expansion to food.

Cons: Higher fee than other facilities (includes transfer costs), brush must be separate.

LE composts yard waste and sells mulch and soil products. Some material is composted onsite; some is mixed, consolidated, and transferred to Agresource in Ipswich or Brick Ends Farm for composting. They prefer to receive food and yard separately. Grass and leaves could be combined with food, but brush must be separate to grind prior to composting. Cambridge loads would be premixed onsite, using a controlled ratio of food and yard, and transferred daily to the end site.

Before moving forward, LE needs a MassDEP permit modification to accept food. MassDEP said they may want to wait for the new regulations. LE is very interested in working with us and said that this may be the “nudge” needed to move ahead. Tip fees for food would be around \$80/ton, potentially lower once the operation gets going. Yard waste would be priced by the cubic yard, at \$10.50/cy, with 3.5-4 cy/ton.

7. Town Compost Site, Needham

1421 Central Ave, Needham, MA 02492

Route: 15 miles, estimated 1 hour round trip, I-90 to I-95, Exit 19B

Hours: Tuesday-Saturday 7:30am-3:30pm

Pros: Easily accessible, possibly low tip fee

Cons: Not taking mixed loads of food and yard. No meat. Brush must be separate.

Needham is strictly a drop-off community, and the compost site is part of the town dump where residents drop off trash, recyclables, and yard waste. Brush is kept separate from grass/leaves. Yard and food are composted in windrows turned with a front loader. Brush is chipped and mixed with grass, leaves, and food in a controlled manner. Mixed loads of food and yard are not currently accepted but they are open to the possibility. The site does not accept meat per board of health concerns, but this could be revisited.

Agresource collects food from supermarkets and has a contract with Needham to tip food, and buy and market the finished compost. Needham accepts leaves from Natick, Framingham and Westwood for a nominal fee to help with peak volumes. Needham is not currently accepting any other food loads, but is open to being a partner for food and yard loads from Cambridge. Town officials doing a full financial review of the operation and can discuss more with Cambridge in Fall 2012. Needham cannot commit to anything at this time.

8. Brick Ends Farm (BEF), Hamilton

464 Highland Street, South Hamilton, MA 01982

Route: 28 miles, estimated almost 2 hour round trip, Route 1 to I-95, Exit 20A, or 31 miles via I-93 to I-95, Exit 20A

Hours: Monday-Friday 7am-4pm, Saturday 8am-12 noon
Pros: Existing facility accepts food, low tip fees, takes food from Recycling Center, could take Citywide volume
Cons: Far away, low tolerance for contamination

BEF is accepts organics from cafeterias, curbside collection from Hamilton-Wenham, and supermarkets. Materials are composted in windrows and passed through a Trommel screen. The process takes about 6 months. They can accept a food and yard mix, including compostable bags, meat, grass, leaves, and branches up to 2" in diameter by 2 feet in length. Kitty litter might be accepted, but some customers of the finished product are pushing back on this material. Due to plastic contamination, no compostable diapers and no dog waste is accepted. Zero tolerance for contamination; dirty loads will be refused.

Tip fee is likely \$50/ton. BEF is open to expansion beyond the pilot once Cambridge has more details about the number of households participating and projected citywide tonnages.

9. WeCare Environmental, Marlborough

856 Boston Post Road East, Marlborough, MA 01752

Route: 25 miles, estimated 2 hours round trip, Route 2 to I-95 to Route 20, or 26 miles via I-90 to I-95 to Route 20

Hours: Monday-Friday 7am-5pm, Saturday 8am-12 noon

Pros: Existing facility accepting food + yard, high tolerance for contamination, will accept food in plastic bags.

Cons: Far away, high fees, brush and compostable bags would be screened out and not composted.

WeCare is a co-composting facility that processes about 55,000 tons annually. About 40% is SSO from supermarkets. 22-25% is bio-solids from Marlborough's wastewater treatment plants. Interestingly, 40% is unsorted curbside municipal solid waste from the City of Marlborough. Materials are mixed together and processed in two rotating drums, each 185 feet long and 12 feet in diameter, maintained at a high temperature to be a suitable environment for bacteria to break down the organic materials. Materials exit the rotating drum after about 3 days, screened and then the compost is then cured in aerated windrows for an additional 45-60 days and sold to farmers. Screened materials are transported offsite for disposal.

They accept all food, including meat, bones, and dairy and yard combined together. But anything that does not break down during the initial 3-day process, such as brush and compostable bags, is screened out for disposal. WeCare has a high capacity to handle contaminants.

Tip fees for food loads would be \$65-75/ton. Alternatively, WeCare would charge around \$85/ton for unsorted curbside MSW. Like the MSW from Marlborough, WeCare estimates that 40% of the MSW would be composted.

10. Seacoast Farms (SF), Exeter NH

59 Columbus Avenue, Exeter, NH 03833

Route: 54 miles via I-95 or 58 miles via I-93, estimated 2.5 hours round trip

Hours: Monday-Friday 7am-4:30pm, Saturday 9am-2pm (call first)

- Pros:** Existing facility accepts food, tolerant of contamination, low tip fees, Casella partner.
- Cons:** Russell and STS won't haul here (either no interstate permits and/or too far), Does not want straight food loads in winter and tough to supply YW in winter

SF is a partner of Casella Recycling. SF produces compost from leaves, yard trimmings, food, seafood wastes, and animal manures. This site has experience processing post-consumer food and has worked with other small generators to start up similar composting programs. The site is equipped to address contamination issues.

Compostable bags will be accepted, pending further discussion regarding specifications. No biodegradable plastic including cups, straws, silverware, etc. YW can include leaves and grass, but no more than 10% brush by volume to avoid the need to grind materials. Brush would need to be 1" diameter or less. Loads with more than 25% brush by volume or brush larger than 1" in diameter would be unmanageable. The site would prefer not to receive straight food loads in the winter. As residents will likely not be producing yard waste in the winter, we would have to explore getting materials from the Parks Division or other sources.

Tip fees for unscaled material is \$115/load for mix of food and yard (assuming a 5-10 ton packer truck load), \$575/load for SSO only (assuming a 5-10 ton packer truck load). Tip fees for scaled material is \$17.50/ton for mix of food and yard, and \$57.50/ton for SSO only. SF is open to variable pricing, if more than 3% of a load by volume is brush. Pricing will remain firm for 3 years, subject to an annual inflation adjustment. SF has no scale, so Casella has agreed to allow the City to first weigh loads at the Charlestown location.

Figure 4. Possible Organics Loads and Facility Destinations

Possible Loads	Existing Facilities
Food + Yard (mixed loads)	Brick Ends Farm* (brush 2" thick, 2' long) DCR Compost Site** WeCare (but brush disposed) Seacoast Farms
Food + Yard (mixed loads but no brush)	Rocky Hill Farm* (brush separate) Needham* (no meat now) Wellesley**
Food + Yard (separate)	Landscape Express**
Food (only)	Waste Management*** (transfer or full facility) MWRA Deer Island Plant
*Facilities that are currently composting food **Existing facilities that under the proposed regulations would need to certify to MassDEP that their operation meets certain criteria before adding food.	

We also identified some sites that should be revisited in the future:

- **Town of Lexington**

In development phase for an AD facility, on top of closed uncapped landfill. Planning to finalize RFP and put it out for bid in Fall 2012, put before town meeting in April 2013, and break ground in early FY14. Requires a major modification of current landfill Site Assignment. Technology options include: 1) Pre-processing with grinding, separation of contaminants, placement in covered aerated windrows; 2) Multi-stage anaerobic digestion creating biogas and composting of digestate with yard waste in covered aerated piles; 3) AD of SSO to produce a biogas that is used to generate electricity; and 4) Pyrolysis (gasification) of incoming organic materials to generate a biogas used to generate electricity.

- **Harvest Power**

Harvest owns and operates 25+ organics processing facilities throughout North America, in British Columbia, Ontario, CA and in Mid-Atlantic and Northeastern US. Two AD facilities will be coming online by the end of 2012. They are working on siting multiple AD facilities in MA.

Harvest responded to an RFP from the Town of Bourne to site an AD facility on municipal land that would accept food only. This is expected to be a 3-year process, including time for development work (6 months), permitting (1.5 years), and construction (12 months).

- **Pig Farms**

MassDEP suggests possibly bringing food only loads directly to pig farms. However, most locations reviewed are at least 40 miles far from Cambridge. There may be one option about 20 miles away and could be cost effective if the tip fee is very low.

- **MA Water Resources Authority, Deer Island Sewage Treatment Plant**

Bio-solids from waste water are digested in 12 distinctive egg-shaped anaerobic digesters, each 90 feet in diameter and 130 feet tall. Not operating at full capacity and could process residential food scraps. The byproduct of digestion is 70% methane gas, which is captured and piped to boilers that generate heat to warm the buildings and used for heat-dependent treatment processes. Boiler steam is sent through a turbine generator producing 3 megawatts of electricity. Digested sludge leaves Deer Island is transported through the Inter-Island Tunnel to MWRA's pelletizing facility at Fore River, where it is further processed into fertilizer.

Most of the fertilizer is marketed in bulk by New England Fertilizer Company, and some is packaged and sold as Bay State Fertilizer. The product meets all government standards for bio-solids (sludge-derived) fertilizer, including strict limits on metals. Like compost, this fertilizer adds organic matter to the soil, helping to improve its texture and moisture-holding capacity. Unlike compost, however, this fertilizer is a significant source of nutrients and can be easily applied to lawns using conventional spreaders. It is purchased wholesale by golf courses and landscapers and has been available locally through garden centers and nurseries since 1995. Many MWRA communities use it in parks, athletic fields, and municipal landscaping.

Increasing solids content in waste water could increase wastewater treatment costs for the City. Transporting material to this site by truck through the nearby neighborhood is not practical. Some players have suggested collecting material, slurring it and piping it or shipping it by barge. Long term possibility.

InSinkEerator, a Wisconsin-based manufacturer of food waste disposers (FWD), is an active participant in the MA Organics Subcommittee and advocates that municipalities promote FWD to residents, as an alternative to landfilling organics, backyard composting, or separate curbside collection. They state that their FWD turn food scraps, which average 70% water, into a liquid slurry, no different than the output from a toilet. This slurry is then conveyed by gravity in pipes, rather than trucks running on fossil fuels.

The City of Philadelphia's Clean Kitchen, Green Community initiative will provide and install 200 FWD in homes and \$20 rebates to more residents for installing InSinkEerator's "Evolution" FWD that use 1 ½ gallons of water a day and cost less than 50 cents/year in electricity.

DPW staff estimate that roughly 30% of households in Cambridge have FWD. However, the DPW Engineering Department is concerned about the physical limitations of the Cambridge sewer system, including that many City pipes are flat rather than steeply sloped, which slows down the cleansing velocity and leads to greater possibility of buildup; and undetected backups put the City at liability for damages and possible MassDEP fines for reoccurrence.

The City has ½" limits on particle size for the sewer system. These limits do not appear to pose any problem for FWD made by InSinkEerator, which states that *"the industry standard requires that all particles pass through a 1/2" sieve. Beyond that minimum, disposers vary a bit depending on model, grinding features, etc. The better-model being offered in Philadelphia probably results in a) all particles pass through a 1/2" sieve; b) most pass through a 1/4" sieve; and, c) most are collected on a 1/8" sieve."*

- **NeoEnergy, Fall River**
Facility in development phase, focus on supermarkets, including food still in plastic packaging.
- **Three State Properties:** MassDEP is working with other state agencies to identify potential state-owned properties for a large regional composting facility. State prisons are one possibility, but only a few have enough land to site a facility. No timeline for project yet. Once suitable property has been identified, state planning to issue RFP to developers.
- **Town of Hamilton Former Landfill:** CDM Smith compiled a feasibility study to site an AD facility.
- **Commonwealth Resource Management, Dartmouth:** Landfill/gas operation, may pursue AD.
- **Brockton Wastewater Treatment Plant:** Considering AD.
- **Worcester/Upper Blackstone Wastewater Treatment Plant:** Considering AD.
- **Greater Lawrence Wastewater Treatment Plant:** Might add second digester and accept outside organics.
- **Atlantic Gelatin, Peabody:** AD may be a pre-treatment before effluent sent to wastewater treatment plant.
- **Town of Concord Compost Site:** Seasonal with limited staffing, budget, and site capacity. Composts 1,800-2,000 TPY. No food. Not a likely option.

IV. Operational and Economic Analysis

Current Trash, Recycling, and Yard Waste Collection Operations

Curbside **trash** is collected weekly by City crews 5 days a week. There are 7 trucks, each has 1 driver and 2 laborers. Trash is collected from City buildings, schools and residences that meet these criteria: barrels up to 50 gallons, tolerate once per week collection, and barrels do not block the sidewalk when set out for collection. The City does not provide dumpster service to multi-family buildings. About 31,500 HHs receive City trash service, and almost 40% live in multi-family buildings with 6 or more units. In FY11, the City collected 16,000 tons of trash.

City trash crews operate under a union labor agreement that specifies the number of trucks (7) and stipulates that wage premiums to be paid to employees if 6 trash trucks are used to allow for the 7th truck to be used for organics. Currently, the City brings trash to the WM transfer station in Somerville. WM then brings it their incinerator in Saugus. The current trash tip fee that the City pays WM is \$89.11/ton for FY12, escalating at an annual rate of 3%, or \$91.78 for FY13. The Somerville transfer station is 1 mile from Cambridge, but is expected to close in July 2014, and the City is working to identify a new facility to take its trash, possibly directly to the Saugus incinerator or to Allied Waste in Roxbury. The Somerville transfer station is 1 mile from Cambridge

Single-stream **recycling** is collected weekly by the City's contractor, F.W. Russell using 5 trucks, each has 1 employee who drives and collects. The supervisor drives alone in a small packer truck. The new trucks compact recyclables in one compartment. The City provides HHs with 95- and 65-gallon toters. A small number of HHs still use the old 14- or 18-gallon bins, or a 32-gallon barrel with a sticker. Russell brings recycling to Casella, 2.5 miles away in Charlestown, where it is weighed, sorted, baled, and marketed.

Yard waste is collected weekly April-December by F.W. Russell using 1 truck with 1 driver and 1 thrower. In November, typically peak volume, sometimes there is a 2nd laborer, or 2nd truck added with a driver and 1-2 throwers. Residents use a 32-gallon barrel with a sticker, or paper lawn refuse bags. Once collected, Russell owns the yard waste brings it to a permitted compost facility including Landscape Express, Town of Lexington, and JRM in Peabody. In FY12, 1904 tons were collected and 1974 tons in FY11. There is great variation in tonnages. Over the past 5 years, 2007-2011, the average low was 6 TPD in September 2007 and an average high was 25 TPD in November 2009.

Figure 5. Highest / Lowest Yard Waste Tons Observed by Month, 2007-2011

Month	Highest Tons Observed Each Month			Lowest Tons Observed Each Month		
	Year Observed	Monthly Tons	Avg TPD	Year Observed	Monthly Tons	Avg TPD
April	2007	264	12	2012	175	8
May	2007	225	10	2012	183	9
June	2011	232	11	2009	173	8
July	2008	205	10	2007	145	7
August	2008	192	9	2007	138	6
September	2011	232	11	2007	120	6
October	2008	199	9	2007	155	7
November	2009	542	25	2007	347	16
December	2010	159	7	2008	130	6

Compost Tonnage

To estimate the costs of a pilot or citywide compost program, the first step is to estimate the expected weight of the diverted materials. The underlying assumptions in the model are listed below:

Figure 6. Underlying Assumptions in Cost Model

Item	Pilot	Citywide
Number of eligible households	800	31,500
Compost program participation rate	85%	35%
Set out rate for participants	70%	70%
Pounds of food produced per participating HH/week	10*	10*
Total weekly collection days for compost	1	5

* We estimate that participating households would generate 10 lbs/HH/wk of food for both the pilot and voluntary citywide tons because these participants will be a self-selected, motivated group. To estimate tons for a mandatory Citywide program, we would instead use 5 lbs/HH/wk. This figure is demonstrated by recent residential trash sorts, in which we have found that 25% of the trash is food, or about 5 lbs/HH/wk across all households Citywide.

Our estimate of 10 lbs/HH/wk is consistent with the national average for participating households in communities with compost programs: 7-9 lbs/HH/wk for food alone, with up to 12 lbs/HH/wk for more established programs.¹² Volume produced will vary due to household size and lifestyle choices. Plus, participating households may generate more than the average household. Households in the pilot may have more if food scraps are brought home from the workplace or from neighbors. Volumes will also vary seasonally, with more around holidays such as Thanksgiving, Christmas, or July 4th.

Actual observed tonnage information from other sample communities is shown below. Note that some municipalities present their tonnage data across all households, and some report data across participating households. Also note that some programs are voluntary and others are mandatory, all of which influence the total amount collected.

Figure 7. Compost Tonnage from Other Communities

City	Tonnage Observed
Portland, OR	90,000 tons/year from 150,000 HH, about 23 lbs/HH/wk. Food scraps are 7-20% by weight depending on season, and Portland estimates an annual average of 12%, or 2.76 lbs/HH/wk averaged across all households.
Denver, CO	31 pounds per week per cart during the growing season, and 12 pounds per week per cart during the winter months.
Hamilton/Wenham, MA	Hauler seeing 8 lbs/HH/wk across 3,700 HH. During the pilot, 12-17 lbs/HH/wk. Yard waste is separate, but some is placed in the compost bins.
San Francisco, CA	Estimate 8 lbs/HH/wk of food/soiled paper, or 400 lbs/HH/yr
Toronto, Canada	128,000 tons of food annually. The City estimates a total capture rate of 72% of

¹² Best Management Practices in Food Scraps Programs, page 21.

	organic discards. 8.8 lbs/HH/wk for single family HH and 2.2 lbs/HH/wk for apartment building HHs. Waste sorts show that about 25% of the total organics that could be captured from these buildings.
Seattle, WA	For multi-families: Estimate 1 ton/year for every 35 units based on results from 46-building pilot. Seeing less volume citywide than expected from the pilot.

If the City implements a Citywide composting program, the figure used to report pounds collected per household should be considered carefully. Dividing total tons by the total number of eligible households (31,500 city-served trash) may give an unrealistically low picture of pounds collected in the early years when the program is small and fewer households are participating. Dividing total tons by the participating households may show a downward trend, as the pounds collected per household may decline as less motivated households join the program, as these households may generate less.

For the pilot, DPW would recruit 500-800 HHs concentrated within one collection day, to participate in the pilot. The pilot would run once per week for one year, starting as early as September 2013 or as late as April 2014.

For the pilot, we assume a high participation rate of 85% because the HHs will be self-selected. Although all units in multifamily buildings that sign up would be counted towards the total number of participating HHs, not all HHs will participate and participants may not set out an organics bin every week. Using observations on subscriber set-out rates from Denver,¹³ we estimate a 70% weekly set-out rate.

For a citywide program, about 31,500 HHs that receive City trash service would be eligible. 35-40%¹⁴ participation rates have been observed nationwide (including in San Francisco) when their program was voluntary.¹⁵ We also estimate the same 70% weekly set-out rate assumed for the pilot. Using the figures estimated above and FY11 trash tons, we estimate compost tons for the pilot (1 day/week for 1 year) and a citywide program (5 days/week) using the following equations:

Pilot: Eligible households (800) x Percent participation (85%) x Set-out rate (70%) x Pounds produced per household per week (10) x Weeks per year (52) x Tons per pound (1/2000) = 124 tons per year

Citywide: Eligible households (31,500) x Percent participation (35%) x Set-out rate (70%) x Pounds produced per household per week (10) x Weeks per year (52) x Tons per pound (1/2000) = 2,007 tons per year

¹³ Increasing Residential and Commercial Organics Waste Diversion in the City and County of Denver, 2009.

¹⁴ Best Management Practices in Food Scraps Programs, page 2.

¹⁵ Beyond Recycling, page 33.

Figure 8. Baseline and future trash and compost tonnages

Status quo without compost program		
Baseline TRASH Tonnages (FY11)		
Tons per year	16,066	
Tons per week	309.0	
Tons per collection day	61.8	
Number of trash collection vehicles	7	
Trash tons per truck per day (generally split over two loads)	8.8	
Future status with compost program		
Projected FOOD WASTE Tonnages	Pilot	Citywide
Tons per year	124	2,007
Tons per week	2.4	38.6
Tons per collection day	2.4	7.7
Number of compost collection vehicles	1	1
Compost tons per truck per day	2.4	7.7
Projected TRASH Tonnages (Baseline trash – projected food waste)	Pilot	Citywide
Tons per year	15,942	14,059
Tons per week	306.6	270.4
Tons per collection day	<i>n/a</i>	54.1
Number of trash collection vehicles	<i>n/a</i>	6
Trash tons per truck per day (generally split over two loads)	<i>n/a</i>	9.0

Collection Scenarios:

1. DPW collects:

- a. Option A: 7 trash trucks with 21 Sanitation Division employees in addition to 1 organics truck with 2 Street Cleaning Division employees.
- b. Option B: 6 trash trucks with 18 Sanitation Division employees in addition to 1 organics truck with 2 Sanitation Division employees. The remaining Sanitation Division employee would be reassigned to the street cleaning division.

2. Private Contractor:

- a. F.W. Russell, the City’s current yard waste contractor
- b. Save That Stuff, the City’s current business and school compost hauler
- c. Other hauler – quote from Casella (Seacoast partner) expected. City could ask other haulers with organics experience (Hiltz Disposal, C.B. Trucking, and Troiano Trucking).

3. Not-For-Profit Hauler (NFP)

One stakeholder suggested a need in the marketplace for more organics hauling and transportation capacity due to the extremely thin profit margins. Unfortunately, for-profit haulers will not add capacity unless the profitability is at least as high as their other lines of business or will help their business mix.

This leads to the idea that a nonprofit organics hauler is a possible solution for several reasons: The profitability hurdle to start and build the business is considerably lower; Cambridge could have a dedicated organics hauler that grows with the program as it expands; the NFP model could use Cambridge as a core account in order to garner low-interest financing; the accounting approach

would be transparent / pass-through; and the hauler and the City could work together to lower cost solutions for processing and locations.

A NFP and Cambridge could be partners in a more evolved and engaged business relationship than is typically maintained. This could be pursued if the City expressed interest, provided some level of contractual commitment to move forward and could encourage the NFP to explore funding options. Examples of NFPs include EcoCycle in Colorado (www.ecocycle.org) and Eureka Recycling in Minnesota (www.eurekarecycling.org). These nonprofits were formed under unique circumstances.

Eureka Recycling was created in 2001, formerly the Saint Paul Neighborhood Energy Consortium (NEC) in 1985. NEC started Saint Paul's recycling program in 1986, and after significant changes in the local recycling landscape (the sale of a local independent recycler and elimination of the only independent processing option for small haulers), the NEC was concerned that the lack of competition would lead decrease quality and increase price. NEC decided to create a new organization Eureka Recycling, which has a 10-year contract with the City of Saint Paul, a fleet of recycling trucks (2003) and a recycling facility (2004). They will soon collect organic materials.

EcoCycle's nonprofit was formed in 1976 when no other recycling options were available, hence no competitors. We asked EcoCycle if they thought a nonprofit was worthwhile for Cambridge to pursue. They advised that given the significant outlay to purchase trucks, initial funding assistance and a long-term contract with the City would be critical for a viable nonprofit. Having a nonprofit would allow the City to align more closely with the operator. However, a nonprofit would face the same questions about where to haul organics. Focusing efforts on siting a local compost facility may be more productive in the long term since other we do have hauling options, city or private crews. Having a nearby site would give the City greater flexibility with hauling decisions.

Vehicles

If the City collects food and yard waste for the pilot, we recommend using an existing single packer rear loading truck from the trash fleet, installing new seals to prevent leaks. New single packer or split-bodied trucks cost about \$165,000-\$300,000 respectively. Rentals would cost about \$1,500/week, and to use a rental truck only one day a week is not cost effective.

Another consideration is the possible need to add bulking, absorbent materials into a load of food scraps, especially for a rear loader. Save That Stuff (STS) reported difficulty collecting food alone in a rear packer truck due to the high moisture content and were able to work around the issue by strategically picking up materials such as animal bedding at various points along the route, to absorb the moisture and stabilize the load. This issue warrants further exploration to see whether other cities such as Toronto and Hamilton are experiencing similar issues with their food-only loads.

Ultimately, STS recommends using a side loading truck for food-only loads. If this is necessary, and since the City does not any side loaders, and grant funds would not cover rental costs, then the City may need to choose a private hauler if we move forward with a food only pilot.

For a citywide program, a split-bodied truck could be considered, in terms of material requirements by the end site, collection efficiencies, costs, and environmental impacts. Split-bodied trucks can be a 50/50 split, 60/40, or even 70/30. Organics would be in one compartment, and either trash, recycling, or yard waste in the other. This may result in collection efficiencies if one truck could collect two

streams, possibly decreasing the number of trucks, GHG emissions, and vehicle congestion. Other cities use split trucks successfully and are not experiencing issues due to unbalanced loads.

In Hamilton and Wenham, MA, Hiltz Disposal bought a new Heil 25-yard 60/40 split-body truck from CN Wood for \$305,000, including modifications to make it more watertight and suitable for organics. Hiltz serves 3,700 HH over five days, averaging 2.5-3 TPD of organics (8 lbs/HH/wk). The truck was intended for dual stream recycling. Organics is put in the small side and single-stream recycling in the large side. Organics are taken to Brick Ends Farm in Hamilton and recycling to Charlestown, almost 24 miles apart. When the recycling side fills up mid-route, the driver continues the route but collects only organics, then empties the truck and returns to collect the remaining recycling. The organics side never fills completely. Hiltz reports no issues with driving lopsided and believes it to be a non issue.

Toronto uses split packers in some neighborhoods. The truck split is 70/30. The small side is used for organics, the larger side for trash or recycling, on alternating weeks. Both loads are dumped at the same transfer station. The City reports no issues with trucks being unbalanced during driving.

Regardless of whether food and yard are collected together or separately in a citywide scenario, it is likely that two organics trucks will be needed if there is 15 TPD averaged over the year, which is not feasible for one truck. Given the seasonality of yard waste, the City may need one extra truck to handle peak volumes, but may only need one truck in the winter when there is little to no yard waste. For our analysis, we assume even distribution of yard waste throughout the year.

Given that two trucks will likely be necessary, two single packer trucks (one for food and one for yard waste) may be better than two split packer trucks (each carrying a mixed load). Drawbacks to split trucks include the added expense for new vehicles, less fleet flexibility, complicated logistics such as decreased efficiencies when one side fills faster, and increased emissions from heavier trucks.

Costs

We built a cost calculator model in Excel to run different scenarios and compare the costs of a pilot or a citywide program under various assumptions. This calculator estimates the total cost of labor, trucks, and tip fees, taking into account the distance and specific tip fee of each site, as well as assumptions about the source of the collection labor, choice of collection day, number of participating households, pounds of compost produced per household per week, etc.

Figure 9. Screenshot of Compost Calculator with Options to Choose Collection Scenario

Collection	Monday
Compost facility	Rocky Hill Farm, Saugus
Pilot Collection	DPW: Use street cleaning crew for pilot (keep 7 trash trucks)
Citywide Collection	DPW: 6 trash trucks, 1 or 2 organics trucks
Buildings to include	All multi-family homes
Materials	Food scraps and yard waste, mixed
Trucks to use	Use old DPW trucks
Monetize street cleaning impact	No
Trash location	Somerville Transfer Station

At our request, Russell and STS provided estimate costs for the pilot, 1 day/week for 1 year, to several possible compost sites. We also estimated costs for collection using City crews. MassDEP will reimburse the City up to \$24,230 for collection costs and tip fees, combined. Compost tip fees range from \$40-\$80/ton depending on the facility. For 124 tons of food during the pilot, compost tip fees will cost \$5,000-\$10,000. With 158 tons of food + yard waste, compost tip fees would cost \$6,200-\$12,600. At \$91.79/ton for trash, avoided tip fees for food are \$11,400.

The cost summary charts to all locations under consideration show a range of total costs. These reflect all costs associated with the compost program, and reductions in trash costs, including personnel, collection, and disposal costs, net of the MassDEP reimbursement. These costs do not include purchasing new bins or designing and producing educational materials. These figures demonstrate the cost to add a compost program to the existing DPW operation. The findings are summarized below.

- All pilot scenarios (food only or food and yard) using DPW crews are fully reimbursable with MassDEP grant funds. Some scenarios that keep 7 trash trucks and do not require the City to pay the organics premium even show a net savings to the City, up to \$3,800.
- Pilot scenarios using a private hauler have a net cost of \$5,600-\$41,700.
- Citywide food only scenarios show a range of impacts, from a net cost of \$52,800 to a net savings of \$27,500.
- All citywide food and yard scenarios have a net savings, ranging from \$158,300-\$340,300. This savings is driven by the elimination of the yard waste collection contract and using existing Solid Waste staff to pick up yard waste/organics.

Russell Costs

Russell gave estimated collection costs ranging from \$63,000-\$67,600 to haul food only to a few sites for the pilot, using 1 truck with 2 employees. The City would pay tip fees. Since Russell does not have interstate permits, they did not provide an estimate for Seacoast in Exeter, NH. At this time, they only have an extra truck and employees available to do the pilot on a Friday, but this is not ideal since 12 collection days will shift to Saturday due to holidays. Note limits on Saturday hours: Landscape Express closes at 3pm, Brick Ends and WeCare close at noon, and Rocky Hill is closed.

The figures below are the net costs to the City for Russell to do the pilot taking into account compost tip fees, trash savings, and the MassDEP reimbursement.

	<u>Food Only</u>	<u>Food + Yard</u>
Landscape Express, Woburn:	\$37,300	\$38,700
Rocky Hill Farm, Saugus:	\$34,200	\$34,800
Brick Ends Farm, South Hamilton:	\$37,200	\$37,600
WeCare, Marlborough:	\$40,700	\$41,700

STS Costs

STS collects organics from many Cambridge businesses and several public schools. STS would charge \$110/hour for a driver and a helper. Projected hours and costs for pilot collection range from \$34,320-\$45,760 depending on the end site, assuming about 45 seconds per stop and 350 unique stops. The City would pay the associated tip fees. STS suggests using variable pricing the first 3 months to ascertain how long the route takes and adjust the fees accordingly, or to charge on an hourly basis with a not-to-exceed budget. They did not provide a price for Seacoast in Exeter, NH.

The figures below are the net costs to the City for STS compost collection during the pilot taking into account compost tip fees, trash savings, and the MassDEP reimbursement.

	<u>Food Only</u>	<u>Food + Yard</u>
Landscape Express, Woburn:	\$8,700	\$10,000
Rocky Hill Farm, Saugus:	\$5,600	\$6,100
Brick Ends Farm, South Hamilton:	\$16,400	\$16,700
WeCare, Marlborough:	\$18,900	\$19,900

At the City's request, STS provided a high estimate of \$935,202 for year-round citywide collection of food only from households that receive city trash service. This estimate was based on 35% participation and a 70% setout rate, a total of about 8 TPD. This includes hauling costs to WeCare in Marlborough, which STS believes is a preferable facility since they can handle higher levels of contamination. STS felt that a farm-based compost operation would be less tolerant of contamination, but is willing to work with us to try different facilities.

Citywide service would likely be gradually introduced by neighborhood within a collection day to ensure route density of at least 500 participating households, and expanded to additional collection days as households commit to participating and route density is established. STS quoted \$1.1 million for collection of food and yard waste together. Ultimately, since the number of participating households in a citywide program is unknown, STS suggested working in partnership with the City to ramp up the collection operation as participation grows while maintaining "open book accounting". This would reduce costs by not deploying more trucks or employees than actually needed.

DPW Costs

The figures below are the net costs or savings to the City for DPW crews for the pilot taking into account compost tip fees (\$5,000-\$12,600), trash tip fee savings (\$11,400), and the MassDEP reimbursement (\$24,230). The costs for DPW crews to haul to Brick Ends Farm in Hamilton, WeCare in Marlborough, or Seacoast Farms in Exeter, NH, are not included here because they are too far to consider. Note that the higher the figure in parentheses, the bigger the savings to the City. \$0 means no cost and no savings to the City. Costs are for FY13.

<u>Using DPW Street cleaning crew (7 trash trucks)</u>	<u>Food Only</u>	<u>Food + Yard</u>
Landscape Express, Woburn:	\$0	\$0
Rocky Hill Farm, Saugus:	(\$1,700)	(\$1,100)
Town Compost Site, Wellesley:	(\$3,500)	(\$3,500)
Waste Management, Melrose	(\$3,800)	Not Applicable

<u>Using DPW Trash crew (6 trash trucks)</u>		
Landscape Express, Woburn:	\$0	\$0
Rocky Hill Farm, Saugus:	\$0	\$0
Town Compost Site, Wellesley:	\$0	\$0
Waste Management, Melrose	\$0	Not Applicable

Our cost calculator allows for either 6 or 7 trash trucks during the pilot, with either 1 or 2 organics trucks depending on total volume collected. If DPW crews collect organics using fewer than 7 trash trucks, there are union agreement hourly wage premiums that take effect in addition to other union costs. Costs are calculated assuming that the contract could be in force for 52 collection days/year during the pilot¹⁶ (and daily for a citywide program).

The decision about the number of trash trucks to deploy affects staffing options. In a pilot scenario with 7 trash trucks, 2 staff from Street Cleaning are needed for the organics truck. With 6 trash trucks, the organics truck would be staffed by 2 Sanitation employees and the third Sanitation employee (each trash truck has 3 employees) would be reassigned to Street Cleaning.

In a citywide scenario with 6 trash trucks and 1 organics truck, the organics truck would be staffed by 2 Sanitation employees and the third Sanitation employee (each trash truck has 3 employees) would be reassigned to Street Cleaning. With 6 trash trucks and 2 organics trucks, the organics trucks would be staffed by 3 Sanitation employees and 1 Street Cleaning employee.

The City could also explore consolidating second loads¹⁷ and keeping workers longer on a rotating basis, but this cost is not analyzed here.

None of these DPW costs include the cost/benefit to street cleaning resulting from staffing choices. If we reassign street cleaning staff to the organics truck, or reassign sanitation workers to street cleaning, the City will not incur any costs or savings from this internal reassignment; however, the

¹⁶ As currently written, the union contract only allows for 50 days of such a schedule. The contract would need to be renegotiated for 60 days/year for a pilot (10 days of Christmas trees, plus 50 days of organics year-round) and for 260 days/year for a citywide program. Street cleaning staff do not normally get holiday OT, so is an added cost if pilot is done on Fridays and collection is bumped to Saturday. Sanitation workers receive holiday OT on these days regardless of pilot, so no additional cost if they staff the organics truck. This analysis assumes that for the organics pilot, all workers will be done by 3pm, so there will be no additional OT for longer days.

¹⁷ Currently, trash trucks generally make two trips to the dump: one large load in the morning (7-9 tons) and a small load (1-2 tons) in the afternoon. The average load is 5 tons.

level of street cleaning services provided will change. These changes to street cleaning are not incorporated into the final costs for the City since they do not represent actual costs/savings incurred.

However, impacts to street cleaning from organics collection are monetized here, for consideration since they do affect service levels. For the pilot, if the City deployed 6 trash trucks and 1 organics truck, the City would realize an increase of \$5,300 worth of Street Cleaning services. If 7 trash trucks and 1 organics truck were used, the City would realize a decrease of \$7,500 of Street Cleaning Services. For a citywide program, if the City deployed 6 trash trucks and 1 organics truck the City would realize an increase of \$26,400 worth of Street Cleaning services. If 6 trash trucks and 2 organics trucks were used, the City would realize a decrease of \$8,900 of Street Cleaning Services.

If the end site accepts a food and yard mix, for a citywide program we expect 14-20 TPD, but up to 24-33 TPD during the heavy leaf season in November. In this case, two compost trucks will likely be needed, so the City may need to reassign or hire additional staff. This would increase labor, fuel, and maintenance costs for a food-only scenario. However, the City could eliminate the current yard waste contract (\$381,900 in FY13).

In the Citywide scenario, regardless of whether food and yard are collected together or separately, two trucks are likely needed because we estimate 15 TPD averaged over the year, which probably is not feasible for one truck.

Figure 10. Summary of Costs to All Locations, Food Only, Monday Pilot

	Pilot	Citywide
Assumptions		
Number of eligible households	800	31,500
Compost program participation rate	85%	35%
Set out rate for participants	70%	70%
Pounds of food produced per participating HH/week	10	10
Total collection days (compost)	1	5
Holidays impacted	0	12
Trash collection vehicles	7	6
Compost collection vehicles	1	1
Tonnage of Materials		
Compost Tons	124	2,007
Yard Waste Tons	n/a	n/a
Trash Tons	15,942	14,059

	Town of Wellesley	Franklin Park Zoo	Rocky Hill Farm	Melrose	Landscape Express	Brick Ends Farm	WeCare	Seacoast Farms
Distance in miles (one way)	15	6	15	7.5	15	28	25	54
Tip Fee per ton	\$40	\$52.50	\$55	\$47.50	\$80	\$50	\$70	\$57.50
Pilot Costs (Including MassDEP reimbursement up to \$24,230)								
DPW Street cleaning crew (7 trash trucks)	(\$3,500)	(\$3,400)	(\$1,700)	(\$3,800)	\$0	(\$200)	\$0	\$0
DPW Trash crew (6 trash trucks)	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Private Hauler: Russell	n/a	n/a	\$34,200	n/a	\$37,300	\$37,200	\$40,700	n/a
Private Hauler: STS	n/a	n/a	\$5,600	n/a	\$8,700	\$16,400	\$18,900	n/a
Citywide Totals								
DPW Trash crew (6 trash trucks)	(\$27,500)	(\$9,600)	\$2,600	(\$18,500)	\$52,800	\$3,000	\$40,700	\$38,800

No tip fees for DCR or Needham. Russell and STS did not provide hauling estimates for all sites. Scenarios with negative costs resulted in a savings prior to MassDEP reimbursement; no MassDEP reimbursement would be applied in these scenarios. Scenarios that show a total net cost of zero had a total cost prior to reimbursement of \$24,230 or less; MassDEP reimbursement will be up to \$24,230. Scenarios that show a total net cost greater than zero received the full MassDEP reimbursement.

Figure 11. Summary of Costs to All Locations, Yard & Food, Mixed or Separate, Monday Pilot

	Pilot	Citywide
Assumptions		
Number of eligible households	800	31,500
Compost program participation rate	85%	35%
Set out rate for participants	70%	70%
Pounds of food scraps produced per participating HH/wk	10	10
Total collection days (compost)	1	5
Holidays impacted	0	12
Trash collection vehicles	7	6
Compost collection vehicles	1	2
Tonnage of Materials		
Compost Tons	124	2,007
Yard Waste Tons	34	1,904
Trash Tons	15,942	14,059

We have calculated the tip fees assuming that yard waste will be charged at the same rate as food; however, some sites would charge a lower rate for yard waste.

As we assume that we will run one truck during the pilot and two trucks Citywide regardless of whether food and yard are collected separately or mixed, tip fees would be the only difference between these scenarios.

	Town of Wellesley	Franklin Park Zoo	Rocky Hill Farm	Landscape Express	Brick Ends Farm	WeCare	Seacoast Farms
Distance in miles (one way)	15	6	15	15	28	25	54
Tip Fee per ton	\$40	\$52.50	\$55	\$80	\$50	\$70	\$17.50
Pilot Costs (Including MassDEP reimbursement up to \$24,230)							
DPW Street cleaning crew (7 trash trucks)	(\$3,500)	(\$3,000)	(\$1,100)	\$0	\$0	\$0	(\$800)
DPW Trash crew for pilot (6 trash trucks)	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Private Hauler: Russell	n/a	n/a	\$34,800	\$38,700	\$37,600	\$41,700	n/a
Private Hauler: STS	n/a	n/a	\$6,100	\$10,000	\$16,700	\$19,900	n/a
Citywide Totals							
DPW: Use trash crew (6 trash trucks)	(\$314,700)	(\$280,200)	(\$256,100)	(\$158,300)	(\$254,800)	(\$181,400)	(\$340,300)

No estimates for DCR or Needham because we do not yet have tip fees. Russell and STS did not provide hauling estimates for all sites. Melrose will not accept yard waste at its facility, so this scenario is not applicable there. Scenarios with negative costs resulted in a savings prior to MassDEP reimbursement; no MassDEP reimbursement would be applied in these scenarios. Scenarios that show a total net cost of zero had a total cost prior to reimbursement of \$24,230 or less; MassDEP reimbursement will be up to \$24,230. Scenarios that show a total net cost greater than zero received the full MassDEP reimbursement.

Charge Fee for Service

The City could consider charging a fee to participants in the curbside organics program in order to pay for the program. This option has been built into the cost calculator to be explored more fully if necessary. There is precedent for charging a fee to participate in compost collection in Cambridge, as Metro Pedal Power and Bootstrap Compost, the two private bicycle haulers, charge their customers a minimum of \$8/week, or \$416/year. Dozens of Cambridge households are paying for this service.

If the City did charge, more households would participate if the service were cheaper. Other municipalities have also charged for organics collection. When the program began in **Hamilton** and **Wenham**, it was voluntary and households were charged \$75/year to participate, which covered the program costs. The program is now free since being rolled out town-wide. Eligible **Denver** households can sign up for weekly compost collection for an additional \$9.75/month or \$117/year, with trash and recycling services included in property taxes. These fees cover the costs of the compost program.

Alternative to Separate Compost Site: WeCare Option for All Trash

Another option is to take all City trash to WeCare in Marlborough. This facility actually processes MSW from the City of Marlborough, and they say that 40% of it is compostable and composted. This option is worth considering because:

- There would be no need for a separate curbside organics collection, completely avoiding collection costs, and capital costs for kitchen containers, curbside bins, educational materials and possibly compostable bags.
- The City would not need to factor in a 35% participation rate or consider a voluntary vs. mandatory program now or in the future, because everything compostable in the trash would be automatically be composted.
- Compostable bags would not be required for use by residents.
- Potentially fewer GHG emissions by avoiding a separate organics collection vehicles.

This would increase trash hauling costs as Marlborough (25 mi) is further than the City's current trash facility in Somerville (1 mi) and potential facilities in Saugus (12 mi) or Roxbury (9 mi). Due to the distance, there may be union issues if trash workers need to work longer hours.

For now, we assume that the trucks make one trip per day to Marlborough (trash trucks currently make two tips to Somerville) and workers will be done by 3pm to avoid OT. So, the only changes from the new program will be in tip fees and hauling expenses. FY13 tip fees in Somerville will be \$91.78/ton compared to \$85/ton for MSW at WeCare, a net savings of \$6.78/ton. Assuming 16,066 tons of trash, this is a total decrease of \$110,000 for tip fees. Hauling expenses increase significantly by driving to Marlborough instead of to Somerville. Assuming 7 trucks make one trip daily to the facility, annual fuel costs could rise by \$55,000 and annual maintenance could rise by \$79,000.

Taking additional tip fees, fuel costs, and maintenance into account, the net cost of bringing all trash to WeCare instead of to Somerville is **\$25,000** if 7 trucks make one trip daily. If 7 trucks need to make two trips daily, the total cost would be \$160,000 annually. One daily trip per truck is much more realistic considering the distance to Marlborough, but the City would need to make significant changes to reduce waste to get to one load per day with the same number of trucks. At 16,066 tons/year or 60 tons per collection day, that is 8.8 tons per truck per day. FY12 WM trash weight slips show the average payload was 4.9 tons, yet individual trash loads exceeded 8, even 9 tons.

Reducing Trash Tonnage to WeCare

Let us assume that each truck collected and delivered 7 tons per day to WeCare, or 12,789 tons/year. That would require **3,377 tons less annually**, or a 20% reduction. To significantly reduce trash, there are several courses the City can take, including active recycling enforcement, separate collection of bulky materials, and enforcing trash limits.

In 2011 City staff conducted several household trash audits. For 1-6 unit buildings, 13% was recyclables accepted in the existing curbside recycling program. Annualized for 10,169 HHs in these buildings, this is at least 300 more lbs/HH/year of recycling, or about **1,525 more tons/year**. Also, 20% of trash from 7+ unit buildings with a "C" recycling grade was recyclable. Annualized for 11,479 HH in "C" buildings, this is 100 more lbs/HH/year of recycling, or at least **570 more tons/year**. DPW staff defines "C" buildings as recycling less than 10 lbs/HH/wk or less than 30% of all discards.

Regarding bulky materials, the 2011 waste characterization studies completed for MassDEP¹⁸ at the 6 waste combustors in MA included the Waste Composition of a Rear Loader at WM's facility in Saugus during the spring and fall. Bulky materials comprised 3.2% of the average load (defined as products made from multiple materials and large in size, which are meant for extended use, including mattresses, furniture (non-plastic). Carpet and carpet padding comprised 2.9% of the average load and, sinks, toilets, and other non-metal items) and treated wood is 2.9%. DPW staff has observed that during move out season, particularly in May/June and August/September, particle board furniture including shelving, desks, dressers and coffee tables is a significant material in the trash. MassDEP says that this material is included in both "bulky materials" if it is still recognizable furniture, and "treated wood", if it is detached pieces of particle board.

If we apply these percentages to the 16,066 trash tons collected by the City annually, this is 514 tons of bulky materials, 466 tons of carpet and carpet padding, and 466 tons of treated wood, or **1,446 tons total**. Let us assume that on average the density of these materials are 200 pounds per cubic yard (compared to 300 lbs/cy for white goods per MassDEP), 1,446 tons would translate to 14,460 cy annually, or 55 cy per collection day. Recycling furniture and carpet or even sending these materials for disposal to a closer facility would help normalize packer loads and reduce excessive trips to WeCare. Further study may be needed for the volume of bulky materials generated throughout a year, noting increases in May/June and August/September during the heavy move-out season.

¹⁸ <http://www.mass.gov/MassDEP/recycle/solid/wcssaug.pdf>

IV. Greenhouse Gas (GHG) Emissions Analysis

Using EPA’s WARM model for GHG emissions, we investigated the impacts of incinerating food vs. composting. The emissions are shown below. For comparison, landfill emissions are also shown, but this is not relevant to Cambridge because WM currently sends all trash for incineration.

Figure 12. Post-Consumer GHG Emissions Associated with Processing Food

	Composting	Incinerating	Landfilling
Emissions	<ul style="list-style-type: none"> *Transport to facility * Compost machinery <i>0.04 MTCO₂E/Short Ton</i> * Small but measurable emissions of CH₄ and N₂O produced during composting are not included here. * N₂O emissions from volatilization of nitrogen in compost are not included here. 	<ul style="list-style-type: none"> * Transport to facility <i>0.03 MTCO₂E/Short Ton</i> * Combustion-related nitrous oxide <i>0.04 MTCO₂E/Short Ton</i> 	<ul style="list-style-type: none"> * Transport to facility * Landfilling machinery <i>0.04 MTCO₂E/Short Ton</i> * Landfill methane <i>0.77 MTCO₂E/Short Ton</i>
Offsets	<ul style="list-style-type: none"> * Increase in soil carbon storage <i>-0.24 MTCO₂E/Short Ton</i> 	<ul style="list-style-type: none"> * Avoided utility emissions <i>-0.18 MTCO₂E/Short Ton</i> 	<ul style="list-style-type: none"> * Avoided utility emissions due to landfill gas combustion <i>-0.04 MTCO₂E/Short Ton</i> * Landfill carbon storage <i>-0.08MTCO₂E/Short Ton</i>
Net Emissions	<i>-0.20 MTCO₂E/Short Ton</i>	<i>-0.12 MTCO₂E/Short Ton</i>	<i>0.69 MTCO₂E/Short Ton</i>
Source: Organics chapter from EPA’s WARM model. Numbers may not sum due to rounding.			

Negative GHG figures correspond to emissions reductions or carbon storage. As such, the negative 0.20 MTCO₂E/Short Ton associated with composting is the most beneficial; incinerating is slightly less beneficial, and landfilling will increase emissions. By composting food instead of incineration, the City can expect a net benefit of 0.08 MTCO₂E/Short Ton, for a total of 163 MTCO₂E annually, assuming 2,007 tons of food per year, calculated previously.

The emissions figures presented here do not factor in hauling distance to the combustion site vs. various composting sites. The nationwide average presented above is 0.04 MTCO₂E/Short Ton for diesel fuel to transport and turn the compost piles. However, this figure may be different for Cambridge’s specific scenario, and this is not something the EPA model takes into account.

If we consider that one trash load is currently taken in one truck to one site, if we add an organics truck, emissions will increase with 2 trucks making 2 separate trips to 2 separate sites. Emissions increase the further away the compost facility is and since these two trucks will duplicate collection from households. Given this, it is unclear whether there is net benefit or loss if we move from incinerating to composting. Nationwide figures do suggest that this switch will yield a net benefit. If Cambridge trash was landfilled instead incinerated, reduced emissions would be more certain.

V. Curbside Containers, Kitchen Containers, and Compostable Bags

Compostable plastic bags

We recommend that the City encourage residents to bag organics in compostable plastic or paper bags to keep bins clean and to minimize the “yuck” factor by containing odors and mess. For the pilot, the City will supply participating households with compostable bags. BioBag and Novamont (resin manufacturer) are able to donate bags for the pilot. BioBag products meet ASTM D6400 specifications and are sold by local retailers. BioBag are made from the material, Mater-Bi which consists of starches derived from plants, vegetable oils, and compostable polymers from both renewable raw materials and fossil raw materials. No polyethylene is used in the production process.

Bags provided by the Cambridge-based company Metabolix may also be included in the pilot. Metabolix makes bags from PHAs (Polyhydroxyalkanoates), a material extracted from bacteria after they undergo a biological fermentation process. PHAs meet the ASTM standard D6400 for composting in a professionally managed composting facility are biodegradable in aquatic environments, soil, home composting, and industrial facilities. Tests of Metabolix’s bags are needed with possible compost facilities.

For Citywide expansion, compostable bags should be easily accessible to residents. We do not recommend providing them for free; unless a case could be made that free bags would boost participation enough to cover the cost with tip fee savings. This should be analyzed since as organics participation increases, overall program costs decrease under most scenarios, due to tip fee savings

Ideally, chain groceries and pharmacies could be required to provide compostable bags at checkout. This could be incorporated into a plastic bag ban. Alternatively, residents could purchase compostable bags if the City encouraged local businesses to sell them. We have requested a wholesale cost comparison of compostable vs. conventional plastic bags from Harvest Coop and Whole Foods to help understand the impact of a possible requirement.

Bins

BioBag will donate 800 MaxAir kitchen scrap buckets for households participating in the pilot and Sure Close also said they would consider donating 300 containers. In recent years, DPW staff tried 4 different kitchen bins. They believe the MaxAir with a BioBag and the Sure Close are superior to Busch Systems’ KC2000 (with or without the optional carbon filter for the list) and the Norseman Kitchen Collector. Sure-Close is a good size and has minimal odors since the lid is perforated. MaxAir has a small footprint and is ventilated on all sides, allowing the bag to breathe naturally, and heat and moisture to escape or evaporate. This allows food to dry, reducing bacterial build-up which causes odor. The Busch and Norseman bin led to odors, excess moisture, which makes collection messy.



MaxAir Bucket (BioBag)



Sure Close



Kitchen Collector (Norseman)



KC2000 (Busch)

The City may purchase curbside bins from Norseman Plastics. Previous quotes based on pilot quantities were \$20 for 13-gal bin and \$28 for 21-gal bin. In FY12, 65-gal totes purchased from Cascade Engineering were \$46 each.

Multifamily considerations

Implementing a compost program in multifamily buildings will be more complicated than for single family homes. We will require all households in a given building to sign a program acknowledgement form, regardless of their intent to participate. Although this requirement will take more time for multi-family buildings to sign up, it will help ensure that these residents understand the pilot and hopefully will minimize contamination.

In **Portland**, Private haulers provide garbage and recycling services to buildings with 5+ units. The City of Portland does not set rates for commercial or multi-family collection. Haulers are required to offer collection of standard source-separated materials for recycling, including yard debris. Food is not on the required list, but about 100 multi-family communities have signed up for food collection.

In **Denver**, the City services buildings up to seven units. Buildings are eligible if they are in the areas served by the program.

In **San Francisco**, all buildings (including multi-families) are covered by the mandatory composting ordinance of 2009. There was a big push to include multi-families in the program starting in 2007, when staff signed buildings up one by one and volunteers were trained to go hand out bins, talk to residents, and post signage. San Francisco has found that only one 64-gallon tote is needed for buildings up to 50 units, so securing adequate outdoor space for curbside bins at multi-family buildings may not be a significant issue. The average building gets weekly service. However, depending on the size of the building they can get more frequent service, noting that the hauler does not want to make multiple trips a week to an account if the bin is not full.

In **Seattle**, more than 40 multifamily buildings (5+ units) participated in a pilot from 2007-2009. The City has 6,000 5+ buildings, ranging from 5-550 units, averaging 35 units. Composting is now mandatory for all buildings, although there is no waste ban on food. City sent mailings to buildings not yet subscribed to the organics program. If buildings did not respond, the City signed them up for standard service and let them change to a different service level if desired. Property managers can choose among several bin sizes: 32 (recommended for 5-20 units), 64 (20-40 units), or 96 gallons (20-150 units). Buildings can choose weekly service (\$6.95-\$8.95 depending on bin size) or "on-site" service (\$25.91-\$59.48 depending on bin size, may be indoors). City provides compostable bags in curbside carts, due to the perception of a mess without it. Properties can order more curbside bins if needed. If storage space is an issue, the City's consultant visits the property to help. Though uncommon, a building can get an exemption from the compost requirement if space is really an issue. Some buildings with trash chutes get multiple 13-gallon bins, one per floor, and property managers empty these into the larger curbside bin. From the pilot, Seattle estimated that they would recover 1 ton/year for every 35 units. However, current citywide volumes are lower than expected. Food and yard waste service will be required for all households of 1-4 units by September 15, 2012.

In **Toronto**, the city provides trash and recycling collection to about 4,400 multifamily (8+ units) buildings with about 425,000 units. Toronto reports, "Some of our largest buildings are around 500 units. Over 3000 of our multi-res customers are collected using front end bulk collection containers (4 to 6 cubic yards). For these customers, we are also recommending bulk organics collection wherever

possible. We provide the buildings with the specifications, and they must purchase the bins themselves. We provide in-unit kitchen containers for all the units in a building. For the smaller buildings that do not have the room to use bulk containers, we provide curbside service using 95 gallon bins (totes). For these customers, we are using 35 gallon green carts for source separated organics. At present we have over 600 of the large buildings on the organics collection service and all of the large buildings have been invited to participate in the organics collection. This year, we have started to invite the smaller buildings onto the program. We have had some limitations due to processing capacity. Waste sorts of multifamily buildings show that the stream had minimal contamination.” Households in multi-family buildings in Toronto are generating 2.2 lbs/HH/week of food compared to 8.8lbs/HH/week for single family homes.

Experience shows that recycling and trash bins must be side by side to ensure convenient and fair access for residents. This must be true for compost collection bins as well. In May 2010, Toronto issued a report on maximizing residential waste diversion with a focus on multi-family building strategies (www.toronto.ca/city_manager/pdf/tr_waste_diversion.pdf).

In buildings with trash chutes, this can be more challenging. Toronto and San Francisco have experimented with:

- ✓ Implementing a levy system to charge for trash. In Toronto, property owners of multifamily buildings pay a fee based on how much trash the building generates during the billing period and the number of units. The levy system is discussed in detail in the report cited above.
- ✓ Retrofitting trash chutes. Either converting the inside chute or installing an exterior chute. This is costly, but can reduce use of elevators to move bins. This has not been very successful. Link to Toronto presentation on trash chute conversion options (www.acmo.org/pdf/PM_EXPO_DK.pdf) and tri-sorter technology (www.wastesolutions.ca/faqs/docs/WSG%20TriSorter%20retrofit.pdf).
- ✓ Changing local ordinances so construction of new buildings with trash chutes must accommodate compost and recycling as well.
- ✓ Recommending that property managers close the trash chutes altogether to ensure recycling and compost collection are equally convenient to residents.
- ✓ Installing outdoor bins partially located underground (requires significant infrastructure investments).

VI. Pilot Program

Selecting Eligible Neighborhood & Households

To select the eligible neighborhood for a possible pilot route, we first calculated an estimate of the number of stops an organics truck could reasonably make in a day. Assuming an 8-hour day with a ½ hour break and a conservative 2-hour round-trip time to the compost facility, we assume 5.5 hours of collection. Using a conservative estimate of 1 minute per truck stop, the truck can make 330 unique stops on route. Note that STS estimates 30-60 seconds per stop including travel time between stops. With our target of 500-800 HHs, this is feasible if we choose a mix of single and multifamily buildings.

We recommend that only residential buildings with 12 or fewer units be eligible to participate in the pilot. There is precedent for this when Cambridge introduced curbside recycling in 1991, the program started with buildings of 12 or fewer units; 13+ unit buildings were added later. As other cities have introduced curbside composting, most start with single family homes. The necessary lessons for multi-family buildings to participate in a curbside compost program can be learned from buildings with 12 or fewer units.

Given this limit on building size, we recommend targeting about 150 single-family buildings (150 HHs), 120 two-three-unit buildings (about 300 HHs), 60 four-six-unit buildings (about 300 HHs), and 5 seven-twelve-unit buildings (about 50 HHs). In total, this will give us about 335 stops and 800 HHs.

To see which days would yield a suitable density of buildings of various sizes, we looked at the distribution of buildings throughout the City's five collection days. This table was prepared using the DPW's recycling toter database, excluding non-residential buildings and residences with private trash collection. Buildings were assigned to a particular collection day based on the nearest collection route using GIS. There could be some error in this assignment, but it is likely not biased in either direction.

Figure 13. Total Buildings By Size and Collection Day

Number of Units	Recommended distribution of households for pilot		Total Buildings By Size and Collection Day				
	Buildings	Households	Monday	Tuesday	Wednesday	Thursday	Friday
Single-family	150	150	936	1129	465	547	407
2-3 units	120	300	1,301	1190	814	955	1,030
4-6 units	60	300	131	62	157	315	274
7-12 units	5	50	44	18	74	61	71
TOTAL	335	800	2,412	2,399	1,510	1,878	1,782

It is important to remember that only a certain subset of these buildings will volunteer to participate in the pilot. Furthermore, these buildings may be distributed widely throughout the collection day, and we are interested in keeping the pilot to a defined area within a specific collection day.

We also overlaid demographic data provided by the Community Development Department on the collection routes. This included: Youths by Census Tract, Population 65 and Older, Ratio of Persons Living Alone to Households with Related Children, Neighborhood Diversity, Hispanic Population, Haitian Population 2006-2010, Ethiopian Population 2006-2010, Portuguese Language Group Population 2006-2010, Children Living in Poverty 2006-2010, and Owner Occupied.

Figure 14. Recommendations for Pilot Area

Preferred:	
Monday (first)	Neighborhood underserved by current food scrap drop off program. Good distribution of building sizes. Diverse population. May require more 2-3 unit buildings if not enough participation from 4-6 unit buildings.
Wednesday (second)	Good distribution of building sizes. Diverse population. May require more 2-3 unit buildings if not enough participation from 4-6 unit and single-families. Shorter work day for City trash crews could be easier to incorporate pilot.
Thursday (third)	Good distribution of building sizes. Diverse population. Options for drop-off are convenient for this neighborhood.
Not preferred:	
Tuesday	Not many buildings above 3 units. Population less diverse.
Friday	Good distribution of building sizes. May require more 2-3 unit buildings if not enough participation from single-families. Diverse population. City will pay overtime on 12 days for holiday weeks where Friday shifts to Saturday. Note limited Saturday hours for facilities: LE closed on Saturdays in winter, Brick Ends and WeCare close at noon, Seacoast open until 2pm, Needham open until 3:30pm.

Further analysis is needed to identify a subset of the selected collection day (perhaps half of the collection area) and targeting those households as the eligible pilot neighborhood. It will be more efficient to limit the geographic area the truck must cover for collection. Participating HHs will be selected first-come, first-serve until the target number of HHs for each building size is reached.

Acknowledgement Form for Participating Households

The City should require that all participating households complete a signup/acknowledgment form to participate in the pilot program. All participating households must provide an email address so the City can quickly communicate and disseminate information to program participants. The form would describe how to participate in the program and the City’s goals and the acknowledgement would state something to the effect of:

“I, _____, represent my household in the City of Cambridge. I understand that my residential building is eligible to participate in the City’s organics pilot program for residents. I have read the instructions on what is accepted, including all food scraps. I understand that plastic, metal and glass items are not accepted. I understand that the success of this program is contingent on my informed participation and other participating households. I understand that my participation is voluntary; however, I agree to not place unaccepted materials in the organics containers.

If I have any questions about the program, I understand that information about the program will be available at www.cambridgema.gov/recycle. My email address is _____

and I understand the City will send out regular updates on the program to participants. If I have questions, I can also contact the City at recycle@cambridgema.gov or call 617-349-4800.”

Collection Procedure

It will be very important to train all collection employees of correct procedures. This includes putting the right materials in the right truck, or truck compartment. For example, if using a split packer for yard and food, making sure that food is not placed in the yard waste compartment, and vice versa. Also, collection workers must reject curbside organics containers contaminated with trash, plastic or other unaccepted materials, and understand the need to minimize contamination and be willing to quickly remove contamination and place in the trash bin if it is right on top. Driver consistency is key. We recommend avoiding the use of temporary workers for the pilot to ensure that all employees receive the proper training of correct procedures before being involved in collection.

VII. Next Steps

City staff will continue to correspond with possible facilities, coordinate testing of Metabolix bags, and select the target neighborhood within the recommended collection days. City and/or MassDEP may determine and discuss if more work is needed with the GHG analysis.

Once the City decides whether to move forward on a pilot, a part-time staff person is needed for 18 months and will be hired to work with the City for Phase 2 tasks in the grant scope including:

1. Hire part-time employee for 18 months to help DPW develop and implement program, analyze and summarize results.
2. Develop and implement a recruitment plan for eligible households.
3. Develop, design and produce educational content for outreach materials and website.
4. Recruit 500-800 participants; provide educational materials, organize information sessions, ensure ongoing education.
5. Order and distribute curbside and kitchen collection containers and compostable bags to participating households.
6. Conduct household surveys before, during and after the pilot. Document and analyze results.
7. Conduct field observations of curbside collection and collect participation data.
8. Summarize and present findings in final report (pilot results, survey response, best practices, lessons learned).
9. Based on the pilot results, determine whether to recommend expansion of the residential curbside food scraps program citywide, to continue it for targeted neighborhoods or to discontinue it. Describe the rational for the decision.

VIII. Links of Interest

- a. Massachusetts Department of Environmental Protection
 - Site Assignment Regulations for Solid Waste Facilities: www.mass.gov/dep/recycle/laws/310cmr16.htm
 - Building Capacity for Managing Organic Materials in MA: Proposed Regulation Amendments: www.mass.gov/MassDEP/service/regulations/proposed/adtsd.doc
 - Solid Waste Forms/Timeline: www.mass.gov/MassDEP/recycle/approvals/swforms.htm, www.mass.gov/MassDEP/service/approvals/fy10fees.pdf
 - List of Food Residual Processors: www.mass.gov/MassDEP/recycle/reduce/fcdcmpst.pdf
- b. Other Communities
 - Denver: www.denvergov.org/trashrecycling/TrashandRecycling/CompostingOrganics/CompostCollectionPilotProgram/tabid/438328/Default.aspx
 - Portland: www.portlandoregon.gov/bps/article/402972
 - Seattle: www.seattle.gov/util/Services/Yard/Yard_Waste_Collection/index.asp
 - San Francisco: www.sunsetscavenger.com/residentialCompost.htm, 200 HP vertical grinders used by Recology: www.westsalem.com/index.htm
 - Toronto: www.toronto.ca/greenbin/index.htm
 - Hamilton-Wenham: www.wenhamma.gov/public_docs/organicwasteflyer.pdf
 - Philadelphia: www.philadelphiastreet.com/ckqc-overview.aspx
 - California – List of Technology Vendors that Sell In-Vessel Compost Systems: www.calrecycle.ca.gov/Organics/Food/Compost/InVessel.htm
 - Boston City Growers: <http://citygrowers.wordpress.com>
 - Ecocycle (nonprofit hauler in Colorado) www.ecocycle.org
 - Eureka Recycling (nonprofit hauler in Minnesota) www.eurekarecycling.org
- c. Waste Composition of Rear Loader at Saugus Incinerator www.mass.gov/MassDEP/recycle/solid/wcssaug.pdf
- d. Vendor Approaches for Treating Source Separated Organic Waste at Hartwell Avenue Landfill Site, Lexington, MA <http://ci.lexington.ma.us/dpw/Lexington-Preliminary%20Evaluation%20of%20Source%20Separated%20Organics.pdf>
- e. Other published reports
 - Center for a Competitive Waste Industry, “Beyond Recycling – Composting Food Scraps and Soiled Paper”, 2010. http://beyondrecycling.org/pdf_files/FinalReport.pdf
 - Econservation Institute, “Best Management Practices in Food Scraps Programs”, Prepared for US EPA Region 5. http://www4.uwm.edu/shWeCare/publications/cabinet/composting/EPA_FoodWasteReport_EI_Region5_v11_final.pdf

Figure 15: Lessons from other communities with curbside organics collection programs. Information below reflects information available to us at this time through municipal websites, published reports, and conversations with city contact persons.

Category	Portland, OR	Denver, CO	Hamilton / Wenham, MA	San Francisco, CA	Toronto, Ontario	Seattle
Program Status	Pilot: 2,000 HHs in 4 neighborhoods, started May 2010. Citywide to 150,000 HHs started Oct 2011.	2,300 homes subscribed in pilot areas. 3,200 max eligible to sign up for this paid service.	4-neighborhood pilot, 75 homes in 2009 in Hamilton. Expanded to 675 homes in 2010-11 and townwide to 3,700 HHs in April 2012.	Pilot in 1999. Expanded Citywide as voluntary in 2001. Big push in 2007 to include more multi-res before program became mandatory for all bldgs in 2009.	Mandatory organics program since 2002, spurred by skyrocketing trash disposal fees due to the closing of the local landfill. Program expanded citywide in 2005.	Weekly curbside pickup was introduced to single family buildings in March 2009. Subscription to compost service is now mandatory for all residential buildings as of September 2011. Although subscription is required and yard waste is banned from the trash, food waste is not banned from the trash.
Source	Portland website (www.portlandoregon.gov/bps/article/402972) and conversation with Arianne Sperry.	Denver website (www.denvergov.org/trashrecycling/TrashandRecycling/CompostingOrganics/CompostCollectionPilotProgram/tabid/438328/Default.aspx), composting report, and conversation with Charlotte Pitt.	Conversations with Sue Patrolia and John Tognazzi.	EPA "Beyond Recycling" Report and conversation with Alexa Kielty.	EPA "Beyond Recycling" Report, Appendix E of Toronto's Pilot Report, and conversations with Renee Dello and Rob Orpin.	Seattle website and conversation with Marcia Rutan.
Brief description of City (# HHs, city layout, density, demographics, HH size, etc.)	245,000 HHs. 150,000 HHs are <5 units and subscribe for City trash, recycling, compost service (80-90% subscription rate).	173,000 HHs (single family homes & multi-res with 7 or fewer units) get City waste service. Avg HH is 2.1 people. 620,000 residents.	3,700 HHs serviced in two rural towns.	812,000 residents, dense, small lots. 350,000 HHs. 60% lives in apartment buildings.	The City of Toronto provides garbage and recycling collection to approximately 4,400 multiresidential (8 units +) buildings with approximately 425,000 units. 460,000 single buildings (7 units and fewer). All buildings (regardless of size) are eligible for City service. Approximately 10% of multifamily buildings choose to pay for private service.	6,000 5+ buildings, ranging from 5-550 units, with an average of 35 units.
Households covered	150,000 HHs, with a combo of single family and multi-res (with 4 or fewer units) HHs	17,200 homes in service areas. 2300 homes subscribed, 3200 homes max	3,700 HHs in Hamilton & Wenham	All HHs.	All 460,000 single-family homes (up to 7 units) are part of the program, and the program is being expanded to apartment buildings.	All households.

Category	Portland, OR	Denver, CO	Hamilton / Wenham, MA	San Francisco, CA	Toronto, Ontario	Seattle
Tonnage estimate	90,000 tons/year from 150,000 HHs. Average 23 lbs/HH/week. Food scraps about 7-20% by weight depending on the season. City estimates an annual average of 12%, or 2.76 lbs/HH.	31 lbs/week during growing season. 12 lbs/week in winter.	Hauler has observed approximately 8 lbs/HH/week across the 3,700 households in the service area now that program has been expanded townwide. During the 75-family pilot, the town observed approximately 12-13 lbs/HH/week of food waste. During the 675-family pilot, the town observed approximately 17 lbs/HH/week, with a small amount of that being yard waste included in the bins. (In general, yard waste is being collected separately, but some ends up in the compost bins.)	Estimate approximately 8 pounds of food/soiled paper per participating household per week. (Or 400 pounds per participating household per year.)	In total, 128,000 tons of Green Bin organics are diverted annually. The City estimates a total capture rate of 72% of organic discards. Average weekly capture rates for single family households have been observed at 4 kg (8.8 lbs) per household per week. The observed capture rate at apartment buildings is lower, around 1 kg (2.2 lbs) per unit per week. Waste sorts indicate that this represents approximately 25% of the total organics that could be captured from these buildings.	For multifamilies: Estimated 1 ton for every 35 units per year based on results from 46-building pilot program. Currently seeing less volume citywide than expected from the pilot.
Lessons/advice on how to recruit/select pilot route and participants	Identify areas with demographics to test program messaging and represent different neighborhood types. Got some criticism that pilot areas did not represent Citywide demographics.	Pilot: Residents can subscribe for free, 1 st come 1 st served til max participants. Eligible areas have diverse recycling participation levels, trash receptacles, neighborhood variety. Tip: Get emails from participants.	Started as 4-neighborhood pilot of 75 homes in 2009.	Voluntary pilot program began in 1999.	Pilot done in 2000, rolled out to single family homes in 2002-2006. In 2008, started bringing multi-res buildings into the program.	For multifamily (5+) pilot: got info from recycling drivers about which properties were already recycling well, targeted successful ones for organics pilot.

Category	Portland, OR	Denver, CO	Hamilton / Wenham, MA	San Francisco, CA	Toronto, Ontario	Seattle
<p>Multi-res bldgs (What size? Participation rates? Volumes? Included from the start? Lessons learned?)</p>	<p>Private haulers provide garbage and recycling services to bldgs with 5+ units. The City doesn't set rates for commercial or multi-res collection. Haulers must offer collection of standard source-separated materials for recycling, including yard debris. Food scraps not required, but ~100 multi-res bldgs are participating.</p>	<p>The City services buildings up to seven units. Buildings are eligible if they are in the areas served by the program.</p>	<p>Approximately 90% of households are single family homes.</p>	<p>All bldgs (including multi-res) covered by 2009 mandatory compost ordinance. 2007 push to include multi-res in program. Staff signed up bldgs. Volunteers gave out bins, talked to residents, posted signs. Easier to waste with trash chutes since residents must walk compost down. New City ordinance requires new bldgs to provide 3 separate chutes or a 3-way chute diverter. Chute retrofits not always reliable. Urging property managers to close chutes, but they're reluctant to for fear of "decreasing services".</p>	<p>Our definition of multi-res is 9 units and up and some of our largest buildings are around 500 units. Over 3000 of our multi-res customers are collected using front end bulk collection containers (4 to 6 cubic yards). For these customers, we are also recommending bulk organics collection wherever possible. We provide the buildings with the specifications, and they must purchase the bins themselves. We provide in-unit kitchen containers for all the units in a building.</p> <p>For the smaller buildings that do not have the room to use bulk containers, we provide curbside service using 95 gallon bins (totes). For these customers, we are using 35 gallon green carts for source separated organics.</p> <p>At present we have over 600 of the large buildings on the organics collection service and all of the large buildings have been invited to participate in the organics collection. This year, we have started to invite the smaller buildings onto the program. We have had</p>	<p>Multifamilies have been deliberately targeted since 2011. City sent targeted mailings to those buildings that were not yet subscribed. If buildings did not respond, the City signed them up for standard service and allowed them to change to a different level of service if desired. One person has done phone outreach to property managers.</p> <p>City provides compostable bag liners in curbside carts at multifamily buildings, because of building managers' perception of mess without a bag.</p> <p>Properties can order multiple curbside bins if needed. A large building complex (450 units) has 3 96-gallon carts, one for each of the buildings.</p> <p>A major issue with large properties is where to put the carts. Composting consultant is sent to go help them find space. If there is really no space, the building can receive an exemption from the compost requirement, but this is not common.</p>
<p>Participation rates</p>	<p>Unknown citywide. In pilot, over 75% of survey respondents said they put food scraps in the toter. (Nearly 20% response rate among pilot participants.)</p>	<p>60%-70% of pilot participants put organics cart at curb in any given week.</p>	<p>The hauler has observed near total participation among all residents.</p>	<p>Voluntary participation rates observed of 35-40%.</p>	<p>90% of single family homes participate.</p>	<p>Subscription for compost service is mandatory for all buildings.</p>

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Types of indoor/outdoor bins/bags provided	60-gal organics toters and kitchen bins provided to all residents.	Participants got one 65-gal organics toter, one 2-gal kitchen pail, and educational materials. Some Friday participants got 2 boxes of BioBags.	Town bought 35-gal toters and white/tan oval kitchen bins for all residents when launched townwide. Curbside bins lock down so no rodent issues.	Curbside: one 32-gal toter for bldgs with >15 units, one 64-gal toter (serviced with semi-automatic high loading truck) for up to 50 units, and multiple 64-gal toters for >50 units. Kitchen: City 1st gave out 2.5-gal closed pail, then tried the Max Air pail, which requires a liner. Many people stopped using bags after sample bags ran out. Then City switched to SureClose pail (partly vented).	Households provided with a kitchen catcher and a 16-gallon latched and wheeled green cart.	For single-family homes: 13-gallon (\$4.65/week), 32-gallon (\$6.95/week), or 96-gallon (\$8.95/week) For multifamily homes: 32 (recommended for 5-20 units), 64 (20-40 units), or 96 gallons (20-150 units). Buildings can elect for weekly curbside service (\$6.95 to \$8.95 depending on bin size) or "on-site" service (bins can be indoors) (\$25.91 to \$59.48 depending on bin size).
Compostable bags required, allowed, etc?	5 approved compostable allowed: BioBag Certified Compostable, Ecnow Tech Compost Me, EcoSafe 6400 Line, Glad Compostable Kitchen, & Natur-Tec Natur-Bag Compostable.	Compostable bags allowed but not required. Bags must carry the official BPI logo (Biodegradable Products Institute) and be green in color.	Compostable bags are allowed.	City tells residents that they can use compostable liners, paper bags, or newspaper to contain their food scraps. Compostable liner bags are widely available at retail outlets in the city, thanks to recycling staff efforts.	Any plastic bag is permitted to line the container.	Can dump materials lose in the cart. Can use newspapers, paper bags. Haven't heard of any issues. Bags not required.
Brush in compost? (If so, is it ground?)	Facilities grind mixed yard & food. Food is only 7-20% by weight of the total yard debris (depending on the season). Almost invisible when you look at big pile.	Processor grinds everything before composting using large tub grinder. Vendor classifies material as "dirty yard waste" because it is less than 10% food waste.	Yard waste is collected curbside 3 times per year, plus there is a drop off program the rest of the year. Yard waste is collected separately, so there is no need to grind a mixed stream.	Materials are ground prior to composting.	Leaf and yard waste collection is picked up separately, every other week, on garbage collection day, from mid-March into December. Tree limbs, trunks and stumps are not accepted. Leaves, plant/tree trimmings, weeds, brush, and bundles of branches up to a diameter of 3 inches are accepted. Yard waste is collected separately, so there is no need to grind a mixed stream.	Materials are ground prior to composting.

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Collection system and Truck Information	Various.	Autocar right hand drive with 28yd McNeilus ZR body	Heil 25 yard split body truck purchased new from CN Wood in Woburn for \$305K, including all modifications to make truck more watertight. Organics and single stream recycling collected together.	Organics collected in a separate specialized organics packer truck; trash and single stream recycling co-collected in split packer.	In some sections of the city, organics collected weekly in split compacting collection vehicle; other compartment is used for trash/single-stream recyclables in alternating weeks. Both streams are dumped at the same transfer station. Have not experienced any issues with trucks being unbalanced while driving. Split is 70/30, with 70 for garbage/recycling, and 30 for organics.	[No information provided.]
Collection & Frequency	Private haulers collect. Mixed yard and food collected weekly. Single stream recycling weekly, same day. Trash is EOW. 30% reduction in trash due to compost program.	City collects. Pilot: Weekly during growing season, EOW in winter. Same day as trash & recycling. Now: Weekly year round, even in winter.	Hiltz Disposal, private hauler collects. Weekly compost and recycling pick-up for both towns. Weekly trash in Wenham, and EOW in Hamilton. PAYT available to Hamilton residents on off weeks.	Recology, private hauler collects. Organics weekly year-round. Trash and single-stream recycling weekly.	Collection largely done through private franchise agreements. Organics collected weekly, trash and recyclables collected alternating weeks. Yard waste separately collected on variable schedule that depends on time of year.	City has contract with two solid waste firms; each services different sections of the City. Residents can choose to get service from Cedar Grove Compost directly and opt out of City service. Food and yard waste collected weekly on the same day as garbage.
End site? Processing technology? Transfer involved?	Hauled to transfer stations then shipped to compost facilities: Allied Waste's Pacific Region Compost facility in Benton County, or Recology's Nature's Needs facility in Washington County.	Pilot: Consolidated at Cherry Creek Transfer Station then delivered to AI Organics in Keenesburg CO. AI composts and markets finished product. Now: Hauled to A1 Organics Denver for pre-processing, grinding using industrial grinder to reduce volume and increase efficiency. Then brought to Keenesburg compost facility.	Hauled to Brick Ends Farm. Hamilton is exploring AD facility on former landfill, CMD Smith report..	Hauled to Recology Transfer Station in southern end of SF. There, organics top-loaded into possum-belly" long-haul trailers and taken to Recology's Jepson Prairie Compost Facility in Solano County, 70 mi from SF. There compost is in covered, aerated windrows, then open-air windrows, then cured before screening and marketed to landscapers and farmers.	Yard trimmings composted at windrow facilities separate from the source separated organics because processing costs are much lower for yard waste only. City is focusing on digesters because organic materials can be contaminated with plastic -- plastic is screened out in pre-processing step using a hydro pulper. As of 2010, City moving to two 55K TPD facilities that will produce methane anaerobically and then compost the remaining digestate. Processing is done at city owned and operated facilities.	Processed locally at Cedar Grove, which processes materials using aerated static piles (similar to windrows, except on concrete floor with forced aeration and covered with Gore-Tex). 10% max contamination.
Free or Fee	Residents signed up for trash service get recycling & composting for "free." You can't opt out of either service if you have curbside trash.	Post-pilot: \$9.75/month in Aug 2010 (with 2,300 participating homes). Discount offered if resident pays for the whole year. Yearly cost = \$107	Pilot: \$75-\$100/year. In April 2012, program made free, part of trash service.	Recycling/composting provided at no additional cost, fee for trash.	User pay system. Single buildings pay based on size of garbage cart. (\$220/year - \$420/year.) All recycling is "free" as part of garbage fee. Multi-residential buildings charged according to volume.	Fees based on size of cart. Subscription to compost service is mandatory for all buildings.

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Per Ton Tip Fees	\$51 for organics, \$90 for trash	\$26.50 for organics, \$20.28 for trash (year to date average)	\$42 for organics, \$72 for trash	[No information provided.]	[No information provided.]	[No information provided.]
Materials Collected	Yard + food. All food allowed including meat and dairy, as well as paper napkins, paper towels, coffee filters, tea bags, pizza boxes. Yard includes weeds, leaves, vines, grass, small branches and pumpkins.	Yard + food in 1 container. All food, compostable paper products, and other organics (flowers, houseplants, dryer lint). Branches up to 4' long and up to 4" diameter.	All food including meat, dairy, coffee grinds, paper towels, plants, grass and soil. Yard is collected 3x/yr plus year-round drop-off.	All food + yard in 1 container. Food includes meat, dairy, soiled paper. Yard includes brush up to 4' long and up to 6" in diameter. Compostable bags, cutlery, wax paper and small pieces of lumber accepted. No kitty litter, animal waste, diapers, dirt, rocks, or plywood.	All organics (beyond yard trimmings), including: all food scraps, coffee grounds, filters, tea bags, soiled paper, paper packaging, household plants, soil, diapers, sanitary products, animal waste, bedding. No dimensional wood. Leaf and yard waste collection is picked up separately, every other week, on garbage collection day, from mid-March into December. Tree limbs, trunks and stumps are not accepted. Leaves, plant/tree trimmings, weeds, brush, and bundles of branches up to a diameter of 3 inches are accepted.	Food waste and other compostables collected together. All food waste, including meat, dairy and cheese, and yard waste, including grass, leaves, weeds, houseplants, and branches up to 4 inches thick and 4 feet long permitted.
Contamination Rate	Minimal—around 3%	Contaminants included Styrofoam products, contaminated wood, and foil-lined packaging, and plastic bags.	Brick Ends Farm reports that the material stream has been very clean due to education efforts.	City continues to get lots of plastic bags, even though residents are discouraged from using them. Sorting at the front end of the compost facility pulls off the bags. Facility has 5% tolerance for contamination.	Plastic bags and other materials containing plastic (e.g. diapers) allowed because these are screened out by a hydro pulper.	Facility has 10% tolerance for contamination.

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<p>Other Details and Issues Encountered (e.g. issues with moving to EOW trash)</p>	<p>EOW trash increased compost participation & food diverted. Reduced trash significantly. EOW is big transition for many. Any change to daily habits takes time and now that the program has been going for awhile most HH figuring out how to make it work.</p>	<p>Operationally, City and residents pleased with service. Huge demand to expand but City's budget is limited. Pilot was instrumental to the City in developing its 2010 Master Plan.</p>	<p>Program started as volunteer citizen-led project. Hamilton saw \$80-\$100K in savings through the first year of the program, prior to townwide expansion.</p>	<p>[No information provided.]</p>	<p>Strong financial incentive to begin program after the local landfill closed and trash disposal fees increased by more than 300%. Found that collecting rubbish bi-weekly has a significant impact in increasing capture rates. Have experienced odor problems at AD facilities. City reports that processing is complex and may be better performed by the private sector.</p> <p>Make participation as easy as possible. Plastic bags makes things easy and keeps yuck factor to a minimum.</p> <p>Used savings from switching to EOW trash to fund compost program. Residents love the EOW trash, and there is great participation in the green bin program. Raccoons are the biggest issue. Since residents have to pay for trash, they are more cognizant of the waste they produce.</p> <p>Buildings up to 7 units are on EOW trash schedule. Multifamily buildings are on building-dependent</p>	<p>[No information provided.]</p>