



Appendix C:

Phase 2: Enhancements to the Current Waste Management System and Additional ZWMP Options

Draft Zero Waste Master Plan

City of Cambridge, MA
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Appendix C: Phase 2 Enhancements to the City's Current System and Additional ZWMP Options

Statement of Purpose

This Phase 2 document identifying potential enhancements to the City's current waste management system and additional ZWMP options was originally issued to the City of Cambridge in November 2017. The purpose of this report was to present an overview of all of the potential waste management system changes that were considered during the development of the ZWMP, based on the performance of the City's programs documented in Phase 1 and the outcome of the review of the system and other options that have successfully reduced waste sent to disposal in other communities. The analysis presented herein represents the information available as of mid-2017.

This document is a supporting background document for the draft ZWMP, documenting the outcome of one component of Phase 2 of the ZWMP process. No further amendments will be made to this document based on review of the draft ZWMP. Any adjustments to the options discussed in this report have been documented in the ZWMP report.

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1 Enhancements to the City's Current Waste Management System

The following sections provide an overview of how the three major waste streams (trash, recycling and organics) are currently managed and options available to the City for enhancements to service provision for collection, processing and/or disposal.

1.1 Trash Transfer and Disposal

The City has limited options for trash and currently utilizes a transfer station owned and operated by Republic Services, located in Roxbury MA. This transfer station appears to be the closest transfer station with sufficient capacity to efficiently manage the City's trash. Other transfer stations that could manage the volume of trash generated in the City are located too far from the City of Cambridge to be feasible options, as the time to haul trash to these locations would affect the efficiency of trash collection. Other transfer stations located in closer proximity to the City appear to manage wood waste or other construction and demolition materials rather than curbside trash.

The Republic Services transfer station, while located in an industrial area, is located in close proximity to residential areas. It is likely that this land will appreciate in value with increasing residential development nearby and that the facility will experience additional pressures to minimize noise, odors, litter and vermin/vectors. Already staff at the transfer station make considerable efforts to minimize nuisance effects and be "good neighbors". However, it is unknown what the tipping point may be for land value and being able to mitigate operational impacts which may result in the closure of this facility in the long term. In the long term however, removal of organics from the City's trash, and potentially from other sources, may reduce the potential for odors, vermin, vectors etc. and will assist Republic Services in being a "good neighbor".

The City's contract with Republic Services requires them to accept and dispose of municipal solid waste delivered to the transfer facility by vehicles authorized by the City. Republic can use any method of disposal that has been proven to be satisfactory and reliable and in compliance with all federal, state and municipal laws and regulations. The following facilities are used for waste disposal;

- Covanta Resource Recovery Facility – Haverhill, MA
- Wheelabrator Energy-From-Waste Facility – Saugus, MA
- Covanta Semass Resource Recovery– Rochester, MA
- Waste Management Turnkey Landfill - Rochester, NH

Approximately 60% of trash is disposed of at a waste-to-energy facility and 40% is landfilled; however, this can vary from year to year. There is considerable contingency capacity built into the system which is beneficial for the City, with a number of different types and locations of disposal facilities which can be used in case of planned or unplanned shut-downs etc. It appears there is sufficient short and long-term capacity between these four facilities to manage the City's trash, and it appears that another

facility (i.e. the Wheelabrator energy-from-waste facility in Millbury, MA) could also serve as a potential disposal facility as required.

1.2 Recycling Collection and Management

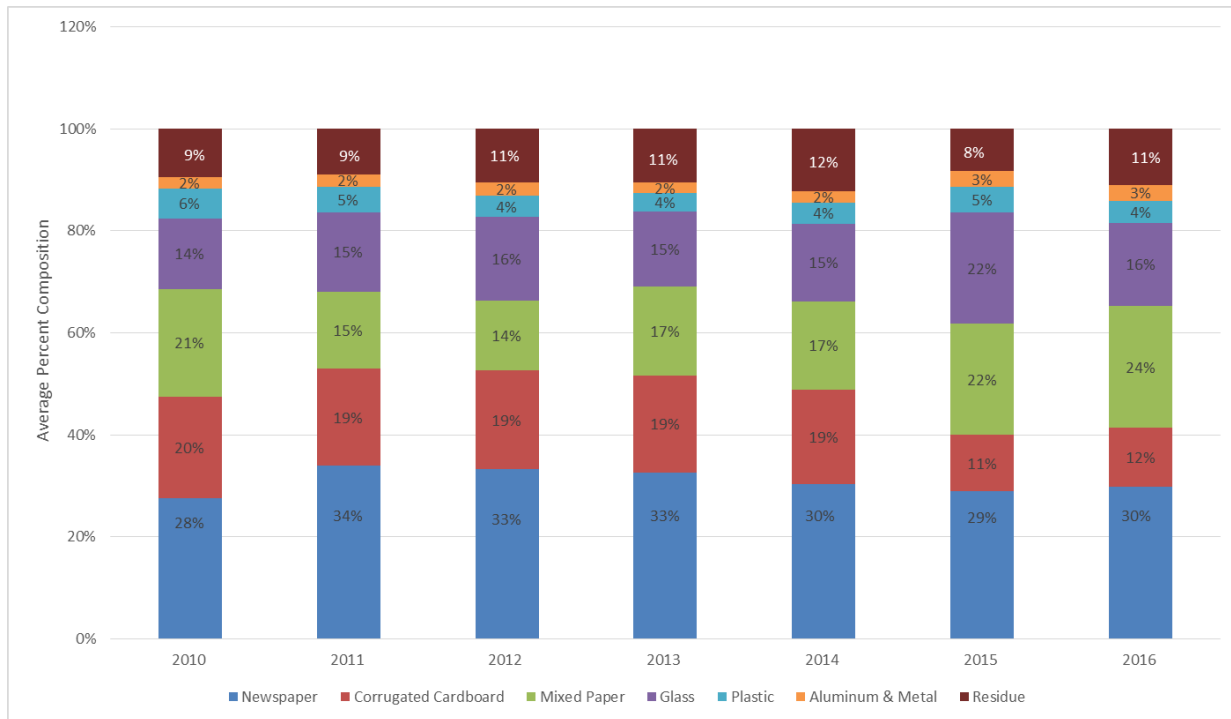
Decisions regarding the viability of diverting recyclables from trash are connected to the potential changes in the recycling commodity market.

At the time of writing this report, the recycling industry was potentially poised to undergo major changes with the proposed reduction in materials accepted in China which were to take place by the end of 2017. It is unknown at this time what the impact in the US will be as a result of these restrictions but it could well impact the prices for commodities and domestic markets for recyclable materials. In addition, the shift in oil and gas commodity pricing has decreased the cost of raw plastic resin production which will compete with recovered plastics in the market.

The City has indicated that they have, on occasion, generated some revenue through their recycling program, due in part to recycling markets and in part with the type of revenue sharing agreement with their processor. It is anticipated that recycling market conditions will not improve in the near-term, and that the City is unlikely to generate revenue through their recycling program.

Figure 1-1 presents the average percent composition of recycling from 2010 to 2016 processed at the MRF (as reported by the City's recycling processor). Over time, the composition of the City's recycling has remained relatively constant until 2015, where there was an increase in the amount of glass collected and a decrease in corrugated cardboard which carried into 2016. In general, newsprint, corrugated cardboard and mixed paper comprise approximately two thirds of the City's recycling. On average, residue comprises approximately 10% of the recycling stream.

Figure 1-1: Average Percent Composition of Recycling (2010-2016)



Source: City of Cambridge, Average Commodity Revenue

The City collects a full suite of materials in their recycling program, including aerosol containers and bulky rigid plastics which not all municipal programs accept. Examples of materials that are not currently accepted in Cambridge but which are accepted in some other municipal programs include; empty paint cans and lids; egg cartons; household metal (e.g. wire hangers, pots, pans, tools), plastic overwrap (e.g. toilet paper, paper towels). Many of these materials are currently on the City's "not accepted" list. It is recommended that these materials not be included in the City's recycling program in the near-term at least, as they are potential contaminants that could affect the marketing and diversion of other materials. It is anticipated that curbside contamination rates could become an increasing issue for the City, affecting processing costs.

The City currently provides 65 or 95 gallon recycling totes (carts) on wheels for weekly collection of single stream recycling. Residents may also convert any 32-gallon trash barrel for recycling, labeled with City stickers, or continue using blue bins. There are no limits on the amount of residential recycling placed out for collection. When the project team visited various setouts in the organics pilot area, it appeared that the majority of bins, which consisted mainly of the 95 gallon size, were well used and either at or near capacity.

Collection service is provided under contract by the private sector using semi-automated collection. Should the City consider taking on recycling collection in-house, they would have more flexibility to undertake co-collection of recycling with another stream, possibly organics. Containers would have to be compatible with whatever system the City will choose for collection of organics and trash. This may be an option to consider once the organics program has been established and if the City moves to a collection option whereby organics are collected weekly and trash and recycling are collected on alternate weeks. Any potential reduced frequency of recycling collection may also necessitate provision of additional recycling containers as the current usage of the containers is very high. This may negate any efficiencies gained through potential fleet size reductions as more time will be spent emptying additional containers and/or transferring materials to the MRF.

Figure 1-2: Metro Pedal Power collecting recycling



Source:
www.metropedalpower.com

The City has a contract with a small private service provider, Metro Pedal Power, to collect recyclables from public park areas. City staff have indicated that this service provider is more expensive compared to using collecting this material on a regular route. A benefit to this type of service is evidence of the City's commitment to reducing GHGs, which is an approach to providing collection service not commonly found in larger municipalities. The City will need to weigh the value of "walking the talk" versus saving money on collection with contracted private service providers collecting residential recycling.

With respect to processing recyclables, the City has limited options for service providers within reasonable direct haul distances from the City. The Casella MRF appears to be the closest facility capable of managing the City's recycling; other MRFs appear to be located an hour or more drive from Cambridge. Use of another MRF that is further from the City would require transfer/haul of recyclables and the need to find additional transfer capacity close to the City.

1.2.1 Recycling Center

The City operates a recycling center located at 147 Hampshire Street, Cambridge in the rear of the DPW yard. Use of the Center is free of charge for Cambridge residents, small businesses and non-profit organizations in Cambridge with 50 employees or less with limited hours (Tuesdays and Thursdays from 4 pm to 7:30 pm and Saturdays from 9 am to 4 pm).

The Recycling Center is co-located in an area also used by Public Works for;

- Maintenance;
- fueling and storage of DPW vehicles;
- storage of various materials including finished compost, wood chips, brush waiting to be chipped, street sweepings, concrete debris, gravel;
- power tools storage;

- city employee parking; and,
- storage for recycling containers.

Currently, the Recycling Centre consists of;

- a rolloff container for commingles;
- a rolloff container for corrugated cardboard;
- a baler/compactor;
- carts for food scraps;
- a small area for reusable goods;
- a rolloff for scrap metal;
- a container for waste electronics;
- a bin for Christmas string lights;
- collection bins for batteries, printer/ink cartridges, smoke alarms;
- a book donation bin and a shelving unit for an exchange of donated books; and,
- an attendant trailer space for office/storage space for various small materials and fluorescent light bulbs.



Figure 1-3: Recycling Collection Bins at the Recycling Center

The Recycling Center is located in a far corner of the DPW yard with no designated parking or drop-off areas for vehicles. It is surrounded by parked DPW vehicles and storage bunkers and therefore somewhat difficult for the public to find and navigate.

The City has investigated alternate layouts of the yard, recognizing the current layout is less than optimal for the Recycling Center and has potential health and safety issues particularly in regards to vehicle movement and interactions of pedestrians/users of the facility with vehicles. One option is to move the masonry material storage area and powered equipment storage to where the Recycling Center is currently located and relocate the Recycling Center to where the powered equipment storage area was formerly located and reduce the size of the attendant booth. Some reconfiguration of the collection bins for materials would be required. Further refinements would be suggested to the layout of the Recycling Center, should the City decide to proceed with a reconfiguration of the DPW yard. These could include size and type of collection containers for various waste streams depending on what materials are being collected, placement of containers for ease of collection and emptying, signage, etc.

Another option, although more involved, is to move the Recycling Center to the covered parking area on the south-west corner of the property, and reserve the yard area for DPW vehicles and equipment only. Ideally, the public would be able to drive through this covered area and exit onto Tremont Street. This option would separate the public from the DPW yard area and would allow the public access to facilities such as a permanent HHW depot and a reuse area as the Recycling Center would be somewhat protected from the elements.

While the reconfiguration of the Recycling Center is not within the scope of this project, changes to the layout of the Recycling Center could improve use by the public and more efficient management of materials. It is recommended that DPW further explore how the current Recycling Center is managed and its layout and location. Undertaking a survey of usage patterns at the Recycling Center and materials managed will assist with deciding how the Recycling Center may need to be reconfigured. Additionally, should the City decide to provide recycling to the commercial sector, a large quantity of recyclable material, particularly cardboard, may be managed at the curb and not at the Recycling Center which should be a consideration when assessing the future form and function of the Recycling Center. This and other potential options could reduce the need for the Recycling Center and the area occupied by the center could be repurposed, depending on the ZWMP options selected by the City for implementation.

1.2.2 Organics Collection and Processing

As discussed elsewhere in this report and in Technical Memorandum #1, the City is planning on collecting organics with in-house staff.

The City's current options for processing organics within a reasonable haul distance, includes Rocky Hill Farms located in Saugus and the Waste Management facility in Charlestown. The City is in the process of negotiating a contract with Waste Management to process the City's organics. In the longer term, it is anticipated that additional organics processing capacity will be permitted and developed in the State. This would provide a wider range of options for consideration by the City and could result in a range of viable bids through future organics capacity procurements.

1.2.3 Other Materials Collection, Transfer, Hauling and Disposal

There appears to be more choice available to the City regarding collection, transfer, hauling, and disposal of materials such as street sweepings, miscellaneous debris, catch basin waste and yard waste as there are more service providers and facilities that can handle smaller quantities of these kinds of waste materials. Several of the current contracts expire later in 2017. It is anticipated that the City would continue to procure collection, transfer, hauling and disposal services through a competitive procurement process as required.

Several services are provided on an as-needed basis and no contracts are required (e.g. HHW and Scrap Metal Collection from the Recycling Center and Processing).

1.2.4 Enhancements to Other Recycling Programs

The following sections provide an overview of other recycling programs currently offered by the City and identifies reasonable enhancements to management of these materials for consideration by the City.

Household Hazardous Waste

The City holds four HHW collection events annually in four locations in the City in April, June, September and November. Some HHW materials are accepted at the City's Recycling Center including mercury containing devices, non-alkaline batteries, discharged fire extinguishers, fluorescent bulbs, and empty gas canisters. Beyond these materials, should residents have HHW materials they wish to dispose of, they must either store them until a HHW collection event is held or find a private disposal option. It is very likely that in a city with a high proportion of multi-residential dwellings with limited storage space and residents who do not have a car to transport materials easily, hazardous waste is being disposed of in the garbage.



Figure 1-4: HHW Collection

Providing more accessible options for convenient and safe disposal of hazardous waste may encourage diversion of this waste from trash. Options that could be considered include holding more frequent one-day collection events on various days and times (i.e. not just always on a Saturday from 9 to 1), mobile collection of hazardous waste either through a mobile recycling center approach or door-to-door type of service which collects material on an appointment basis from residents. Some municipal programs offer this service to everyone, others limit it to seniors or residents with disabilities.

Some municipalities partner these HHW one-day or mobile collection events with collection of waste electronics. Chilliwack, a community located in B.C. Canada, allows residents to drop off some HHW (e.g. paint, gas (in approved cans), pesticides, herbicides, batteries) as well as other items such as smoke and carbon monoxide (CO) detectors and light fixtures at select bottle depots (collection of materials vary with locations). It may be possible to partner with bottle depots, particularly those listed as 'registered' bottle can redemption centers to collect small waste electronics. However, space is a significant consideration regarding the ability to manage other materials at existing bottle depots, and further assessment would have to be undertaken to assess the ability of locations in Cambridge to manage other materials.

Many municipalities in Canada collect a range of batteries at the curb and offer seasonal collection, sometimes coinciding with Earth Week or Daylight Savings Time events in the spring/fall when residents are encouraged to check their smoke detectors and replace their batteries. Residents may be provided with specially marked bags or can use zip-lock bags and are instructed to place the bags on their green bins or blue bins. On average, similarly sized communities in Ontario divert approximately 3 tons of batteries per collection event. These events are typically funded in part by product stewardship organizations. Although the City directs residents to dispose of alkaline batteries with regular trash, many elements of a battery can be recycled which keeps heavy metals out of landfills and incinerators.

Waste Electronics

Small electronics (e.g. small TVs/monitors, microwaves, stereos) are collected by City forces from the curb using a pickup truck. Larger electronics (e.g. large TVs/monitors,

copiers, printers) are collected by a dedicated City crew on a scheduled collection basis. Some electronics are accepted at the Recycling Center. Electronics are placed in containers at the Recycling Centre and collected by a private service provider for processing.

While collection costs for larger electronics are largely covered through the cost of the permit issued by the City, there is no way to recoup costs for collection of small electronics as they are only collected on an as-needed basis when collection crews call in an item.

Small electronics could be collected through mobile HHW events to gain efficiencies in collection. Alternatively small electronics such as cell phones, MP3 players and tablets can be collected through reverse vending machines such as ecoATMs which are already operating within the City. Consumers are paid cash for responsibly recycling their e-waste. The City could consider partnering with them or adding a link to their website so people can easily find ways to recycle these items.

Some communities collect small appliances and other waste electronics (computers, TVs) at bottle depots (e.g. Chilliwack, B.C.). Others, such as New York's Department of Sanitation (DSNY) collect waste electronics at the curb on an appointment basis. DSNY conducted a six-month pilot, and based on the success of the pilot, is planning to expand the service to other areas. Residents are allowed to place out up to 20 items per household for collection at no charge. These items are collected with special vehicles (i.e. not a standard collection vehicle). The program was started following a State disposal ban on some waste electronics in January 2015 and is estimated to cost DSNY approximately \$420/ton of material collected¹.

Large items, bulky goods and furniture

The City provides large item/bulky goods/appliance collection to residents. Some items are collected at the curb as part of regular collection; others are collected on a scheduled basis and may require an Appliance/Large Item disposal permit for each item being collected. The cost of each disposal permit is \$25 or \$20 for senior citizens (ages 62+). Metal items do not require a permit but residents must schedule a pickup. The City could consider changing this practice as metal items are often collected by "scavengers" before the City can get there. It may be more cost effective to have collection crews call in any remaining metal items left at the curb. Due to the large proportion of student housing in the city, the City experiences significant increases in volumes of bulky material during move-out periods.

Residents have a number of options for furniture disposal. The City encourages residents to utilize the services of organizations that collect furniture, including the MA Coalition for the Homeless, the Salvation Army, Boomerangs, MIT Student Furniture Exchange, Epilepsy Foundation and the Wish Project. Residents must contact these organizations directly to have furniture collected.

Alternatively, residents are allowed to put one piece of furniture out per week on trash day; however, these items are taken for disposal. Should the City wish to discourage

¹ <http://www.wastedive.com/news/update-dsny-to-make-curb-side-e-waste-collections-on-staten-island-permanent/439504/>

furniture items being placed out for disposal, permits for all bulky items could be required for collection, including items such as furniture, mattresses and box springs.

1.3 Promotion and Education

Effective promotion and education (P&E) is the most critical component of a successful waste management program. The following P&E tactics are currently used by DPW:

- DPW has a very extensive website for recycling and trash, however, the information in this website provides information on many other aspects of reuse, recycling and disposal.
- Regular eNewsletters are produced which are available on the website or sent through email to residents that have subscribed to the City newsletter.
- eNewsletters are also available for participants in the composting pilot areas which provide updates and information on the pilot program.
- Facebook is regularly used to provide updates on changes to collection, yard waste collection, rain barrel sales, and provide information on tours of facilities, newsletters, etc.
- Twitter is also used effectively, often with similar material posted on Facebook but also retweeting other items that may be of interest to residents.
- Youtube videos are available to educate residents on recycling, composting, and the “bring your own bag” ordinance, as well as other DPW topics.
- Presentations are conducted by DPW staff at schools for a variety of audiences or other locations such as tenants/condo meetings.
- Field trips can be scheduled for schools and/or the public on occasion to see the Recycling Center and/or the MRF.
- Handouts/Flyers (available electronically)
 - Recycling information for Businesses
 - Plastic Bag Recycling Information
 - Moving Reminders
 - Donate More, Trash Less
- Recycling Materials available upon request from the City
 - Yard Waste Sticker
 - Recycling Label
 - Recycling Fridge Magnet
 - 8.5 x 14 Recycling Flyers (available in Spanish, Kreyol, Portuguese, Chinese and Amharic)
 - 8.5 x 14 Laminated Recycling Flyers
 - 8.5 x 14 Donate More, Trash Less

- No Trash, No Plastic Bags Sticker
- Outreach
 - Recycling Neighbors Program – this is a new program targeting volunteers in neighborhoods to educate others about recycling, composting and waste reduction.

In general, DPW utilizes a wide variety of media, (electronic, social, print) and public outreach to convey information about their programs and options available to recycle and/or divert materials.

The DPW website is informative, however, it is very text heavy and somewhat difficult to navigate with a multitude of links. It is recommended that this website be revamped, especially with the introduction of an organics program, to ensure typos are removed, information is clear, succinct, and easy to find. High resolution pictures should be used wherever possible for easier comprehension (e.g. to help residents differentiate between similar sounding items such as incandescent light bulbs vs a compact fluorescent bulbs or a gas canister vs a propane tank). The website appears to have some capacity for translating into other languages but it does not appear to be functional. The City has indicated they have plans to update the website and add a “Waste Wizard” search function to assist residents with identifying the proper way to manage waste.

The City will need to develop a promotion and education (P&E) campaign to support the expansion and rollout of the Green Bin Program. The following are some components of a P&E campaign for consideration. It is also critical that the P&E program be continued following the rollout of the Green Bin Program, as it takes a significant level of encouragement to help residents adjust to using this type of program and to increase capture of organics from these programs.

One of the primary tools will be the DPW website. The following are examples of content that could be posted on the website to provide information to residents on the City’s solid waste management program, and in particular, the organics program.

- Provide information on how to use the bins, how to get bins, what goes in, compostable bags, where material goes, an FAQ that includes questions the City has received throughout the duration of the pilot program, etc.
- Instructions in other languages (e.g. English, Spanish, Simplified & Traditional Chinese, French)
- Videos – Live or Animated
- Links to resources for Single and Multi-family homes
 - Letter templates for tenants
 - Recycling information guide for building owners and managers
 - Acceptable Materials Poster
 - Template for letter to tenants
- Requirements for single and multi-family homes with respect to setouts, containers, limits etc.

Social Media is an important component of a successful P&E campaign; however, it requires dedicated resources to respond to questions and monitor posts. Use of social media can be very cost-effective and can reach many more residents than print, TV or radio advertisements. Examples of how social media could be utilized include;

- Facebook posts
- Targeted Facebook ads
- Twitter posts
- Instagram + Instagram ads
- Snapchat ads
- YouTube videos

There are a variety of other P&E opportunities the City could consider including;

- An ongoing communication program to target recycling contamination and to improve performance of the recycling program. The program should identify individual contaminants that aren't wanted, and target recyclable materials (particularly those with low capture rates) that the City wants more of.
- Presentations to residents, condo boards, lobby visits, community groups, neighborhood associations
- Signage/Decals for collection trucks
- Bus wrap
- Newspaper ads (see image to the right for an example)
- Door hangers
- Window displays
- Information booth
- Email campaigns
- Inserts in existing City communication items (tax bills, utility bills)
- Public outreach, including door-to-door outreach
- Contests
- Banner ads on news and information websites
- Advertising through MBTA (e.g. bus shelters, street furniture, vehicle and station advertising, website, billboards)
- Partnering with universities to advertise program to students/faculty
- Use of social networks/promotion by RAC and Council
- Stickers for Green Bins
- Oops stickers

1.4 Recommendations for Enhancements to the Current System

- Trash transfer and disposal – given the limited choices for trash transfer and disposal, it is recommended that the City continue to utilize the services of the current private service provider, and issue an RFP for trash transfer and disposal as contract expiry draws closer to identify any alternatives through a competitive procurement process.
- Recycling collection and processing – The City should review the current list of acceptable materials to identify if any materials may need to be removed to reduce recycling contamination rates. The City may consider bring recycling collection in-house to realize some collection efficiencies once the organics program has been implemented. There appear to be limited recycling processing options available to the City so it is recommended to continue using the current service provider until contract expiry and issue an RFP for recycling processing as a competitive procurement process. For processing locations

outside of a reasonable haul distance from the City bidders should be required to secure arrangements for transfer/haul to the processing location.

- Recycling Center – It is recommended that the City review the layout, target materials managed and role of the recycling center in the long term. Changes could increase safety for the public and City employees. Considering range of future programs or services that may be offered by the City, there may be less of a role for the recycling center in the longer term. The Recycling Center could be re-purposed as a permanent HHW depot for example.
- Organics collection and processing – The City intends to collect organics with City staff and procure processing capacity at the Waste Management facility in Charlestown.
- Other materials collection, transfer, hauling and disposal – There are private service providers available to manage materials such as street sweepings, catch basin waste, yard waste etc. The City can continue to procure these services through a competitive procurement process as required.
- Enhancements to other recycling programs:
 - The City could consider enhancing the HHW program by providing more frequent and/or accessible options for collecting this waste. Targeting specific items, such as batteries, reduces the potential for emissions in landfill and/or EFW and reduces waste requiring disposal.
 - The City could consider alternative collection methods for small electronics by providing drop-off opportunities at HHW or bottle depots or by collecting these items through a mobile recycling depot service.
 - Efficiencies may be gained in the collection of bulky waste through modifications such as discontinuing scheduled pickups of metal items that may no longer be at the curb for City collection due to scavengers. Instead these items may be called in by regular collectors or they could be managed through a mobile recycling depot service.
 - The City could consider other options for collection of large bulky items such as furniture, mattresses and box springs so they would be managed through the bulky program or some other collection service (e.g. partnership with non-profits) rather than included in the trash stream.
- Promotion and Education – the City has indicated that the DPW website will be revamped with the introduction of the organics program. A robust promotion and education campaign will be needed for the organics program, prior to implementation and on a continual basis to keep residents informed and engaged in the program. Continued promotion and education is essential to encourage use of the program and to increase organic material capture rates. The City can employ a combination of traditional print materials, social media, in person outreach and other tactics as discussed above to promote the new organics program, but also ensure residents are aware of other diversion programs and opportunities provided by the City and other organizations. Provision of additional 'free' compost bags at community events and other

venues would be a critical part of the ongoing promotion of organics diversion. Promotion regarding the City's recycling program, identifying contaminants to discourage and recyclables to encourage in the program will play a critical role in maintaining and increasing diversion through the recycling system. It is understood that the City is planning a full overhaul of the City's website, which is strongly encouraged as a primary outreach measure.

2 Additional Options for Consideration for the ZWMP

The following sections provide an overview of options that could form part of the City's Zero Waste Master Plan, including those designed to support the City's current waste management programs and various options for waste reduction and reuse, management of trash, recycling and other materials.

2.1 Waste Reduction and Reuse Activities

Options to reduce and reuse waste are essential for changing consumer mindsets and “wasteful” behavior.

The City already offers many options to residents to divert materials such as books and other gently used materials through the Recycling Center and there are other organizations who offer reuse opportunities without the City's involvement. The City should continue with their existing efforts to promote reduction and reuse wherever possible. The concept of reduce and reuse can be built into the City's P&E program to reinforce this message to residents.

The implementation of other options in the ZWMP should result in reduced waste, including options that further restrict garbage which will force residents to rethink their waste generation habits.

The following sections provide an overview of waste reduction and reuse options which have the potential to increase diversion and reduce the amount of trash requiring disposal.

2.1.1 Sharing Libraries

Opportunities for sharing items that are used infrequently are becoming more prevalent in many municipalities. The City could support organizations (e.g. non-profits, libraries) or develop partnerships with existing organizations to provide opportunities for the public to borrow materials/items such as bikes, cars, tools. Materials can be donated to the libraries or organizations can purchase and cover expenses through user fees.

These types of initiatives provide opportunities for local organizations/initiatives to grow and for innovative approaches to be developed. Additionally there are opportunities for community engagement and social equity by offering useful materials and objects regardless of family income. Depending on the level of engagement of the City in these initiatives, it is anticipated that at minimum, some staff time and effort would be required to promote and support these initiatives. Potential outcomes of this option would be a reduction in the purchase of materials that are used infrequently, increased community collaboration and networking opportunities, and increased awareness about unnecessary purchases and opportunities to reuse and share materials. It is difficult to track the impact of these initiatives on diversion; City support could be contingent on providing regular information on usage/activities. This type of initiative could be very successful in a city with such a high number of smaller multi-family units with limited storage space

and/or with a high student population who many not be able to afford or want to outright purchase an item with limited usage.

These type of lending libraries can be integrated with a traditional library since a lending system is already in place, a stand-alone facility, or integrated into another community or commercial space.

Examples of these types of libraries include:

- Tool lending libraries (hand and power tools)
- Kitchen library (kitchen appliances)
- Musical instrument library (short and long term rentals)
- Media lending library (electronics, AV equipment, photography equipment, computers, and other media items)
- Food tools (tools to grow and process food)
- Library of Stuff or Things (camping and sports equipment, party supplies, board games, toys)

Sharing libraries can be found in many North American cities such as Berkeley CA, Boulder CO, Portland (ME and OR), Minneapolis MN, Rochester NY, Toronto ON, Seattle WA and internationally. Locally, it appears that in Massachusetts, there is a tool lending library located in Somerville and that many of the public libraries, to varying degrees, lend out some items such as cake pans, toys, puzzles, board games, AV equipment, engravers etc.

Supporting sharing libraries is recommended to be carried forward for further consideration. The following table provides an overview of this option.

Table 2-1: Support Sharing Libraries Overview

Option: Support Sharing Libraries	
Description of Option	<ul style="list-style-type: none"> • The City would support the development of sharing libraries through a partnership with existing organizations.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> • Community development and opportunities for community engagement. • Difficult to track the impact on diversion. • Increased awareness about unnecessary purchases and opportunities to reuse and share materials. • Reduce end-of-life waste if fewer materials are being purchased.
Rationale for Consideration	<ul style="list-style-type: none"> • The City has a high proportion of multi-family tenants with limited space for storing items that are seldom used. • Sharing libraries can provide an opportunity to better promote and facilitate the reduction and reuse of waste materials to prevent waste from entering the system and requiring management through collection, processing and/or disposal.
Cambridge Experience	<ul style="list-style-type: none"> • It does not appear that there are any sharing libraries in Cambridge.

Option: Support Sharing Libraries	
Case Studies/Examples	<ul style="list-style-type: none"> • There is a tool lending library located in Somerville, MA and many public libraries in Massachusetts, to varying degrees, lend out some items such as cake pans, toys, puzzles, board games, AV equipment, engravers etc. • Tool lending libraries (hand and power tools) - Asheville NC, Berkeley CA, Buffalo NY • Kitchen library (kitchen appliances) - Portland OR • Musical instrument library (short and long term rentals) - Halifax NS • Media lending library (electronics, AV equipment, photography equipment, computers, and other media items) - Indianapolis IN • Food tools (tools to grow and process food) - Bloomington IN • Library of Stuff or Things (camping and sports equipment, party supplies, board games, toys) - Toronto ON, Sacramento CA
Short-term or Long-term Option	<ul style="list-style-type: none"> • Implement in the medium-long term, sustain over the long term.
Interaction with other System Components	<ul style="list-style-type: none"> • Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs.
Potential Cost Implications	<ul style="list-style-type: none"> • Potential additional costs are small, predominantly for staff time and P&E materials • Potential for small decrease in diversion processing and/or disposal fees by reducing the quantity of materials requiring management. • Potential for small reduction in operating costs related to collection, disposal, and processing if food waste is reduced.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Difficult to estimate quantities of waste reduced as materials are reused many times.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.
General Implementation Requirements	<ul style="list-style-type: none"> • Staff time and resources to research programs and partners. • P&E program to educate residents and promote benefits of sharing library. • Support activities by advertising on City website.

2.1.2 Food Waste Reduction Strategy

In 2015, the United States Department of Agriculture (USDA) and the EPA established a goal of reducing food loss and waste by half by the year 2030. The USDA and the EPA operate three programs designed to raise awareness about food waste reduction, increase participation in food waste reduction initiatives and track progress toward reaching the goal. These programs are geared towards businesses, faith groups, schools and educational institutions and other organizations.

1. U.S. Food Loss and Waste 2030 Champions – recognizes those businesses and organizations who have made a public commitment to reduce food waste by 50% by 2030.
2. Food Recovery Challenge – Members can join as participants if they generate food waste or as endorsers if they do not generate food waste but can help others reduce waste. The City of Cambridge is listed as an endorser. The program recognizes accomplishments by businesses, schools and other

organizations in preventing and diverting wasted food on a national and regional level.

3. U.S. Food Waste Challenge – Participants make a one-time pledge to reduce food waste and make a public pledge/disclosure of their activities intended to achieve this goal.

In addition to these programs, in collaboration with other organizations, the EPA has launched an online site called “Further with Food” which is intended to be a collaborative site to share resources and connect with others, which as the site evolves could be a useful source of information for the City for the development of their own food waste reduction strategy.

As an example of resources that may be useful, as part of the Sustainable Materials Management Web Academy ², a webinar held in March 2017 discussed “Reducing and Recovering Wasted Food in Schools – Lessons from the Cafeteria Line” and provided the results of a food waste audit in a school in Massachusetts which could be useful to the City in potentially recommending eliminating compostable trays, particularly as they quantified the amount of compostable trays, food scraps, recycling, liquids and trash.

Any of these resources could be used to educate businesses, organizations and residents about the benefits of food waste reduction from an economic, environmental and social perspective. Overall, there would be a shift to focus attention and participation in sustainable food movement and food security issues.

Development of a food waste reduction strategy is a key waste reduction element that is recommended to be carried forward for further consideration. The following table provides an overview of this option.

Table 2-2: Develop a Food Waste Reduction Strategy Overview

Option: Develop a Food Waste Reduction Strategy	
Description of Option	<ul style="list-style-type: none"> • Develop a strategy that promotes reduction of food waste, focusing on information and outreach programs to educate residents about the benefits of food waste reduction from an economic, environmental and social perspective.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> • It is estimated more than 38 million tons of food waste was generated in the US with only 5.1% percent diverted through composting.³ • Reducing food waste saves resources and reduces GHG emissions from vehicles and landfills. • Residents can save money by reducing food waste. • Food insecurity is a global problem.
Rationale for Consideration	<ul style="list-style-type: none"> • Option would reduce the need for new organics processing capacity, and would lower the amount of both organics and trash to be managed.

² <https://www.epa.gov/smm/sustainable-materials-management-web-academy>

³ <https://www.epa.gov/sustainable-management-food/sustainable-management-food-basics#what>

Option: Develop a Food Waste Reduction Strategy	
Cambridge Experience	<ul style="list-style-type: none"> • The City has some tips on reducing food waste on its website. • Food for Free provides rescued food to over 100 food programs in the area. • Spoiler Alert⁴, founded in Cambridge, provides a software solution to match up businesses, farms and nonprofits with food donations and discounted food sales. • Food for All, founded in Cambridge, is an app to connect leftover or unsold food from restaurants to consumers or food donation centers.
Case Studies/Examples	<ul style="list-style-type: none"> • The Love Food, Hate Waste campaign in West London, UK resulted in 14% reduction in avoidable food waste over a period of six months and for every £1 (\$1.30 USD) spent on the campaign, £8 (\$10.38 USD) was saved in collection and disposal costs. It was estimated that each participating household saved on average £24 (\$31 USD) over a six month period by not buying food that ended up being thrown out. • King County (WA) piloted the Food: Too Good to Waste (a food waste reduction campaign developed by the US EPA) on over 100 families with small children. The pilot achieved 28% reduction in food waste but fewer than 15% of families completed the five week pilot. • Hungry Harvest (Philadelphia, Baltimore, Washington) works with farmers and wholesalers to recover surplus and/or imperfect produce which is delivered to subscribers. • ReFED⁵ is an organization of businesses, non-profits, foundations and governments with a goal to reduce food waste in the U.S. It is creating “a roadmap to reduce U.S. food waste”, a national economic study and action plan driven by a number of stakeholders. The website provides a number of tools to reduce food waste with estimates of diversion potential, economic value, GHG reduction and water savings. • A number of retail stores have initiated pilot programs to sell imperfect produce (Whole Foods Market, Walmart, Giant Eagle). • The Food Loss and Waste Accounting and Reporting Standard was launched in 2016 as a global standard for companies and countries to measure, report on and manage food loss and waste. • The Real Junk Food Project is a series of cafes across the globe, using food diverted from waste. Goals of this project including reducing food waste, building community and reducing food poverty by encouraging patrons to “pay as you feel”.
Short-term or Long-term Option	<ul style="list-style-type: none"> • Implement in the short to medium term, sustain over the long term.
Interaction with other System Components	<ul style="list-style-type: none"> • Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs.
Potential Cost Implications	<ul style="list-style-type: none"> • Potential additional costs are small, predominantly for staff time and P&E materials. • Potential decrease in diversion processing and/or disposal fees by reducing the quantity of materials requiring management. • Potential for reduction in operating costs related to collection, disposal, and processing if food waste is reduced.

⁴ <https://www.spoileralert.com/>

⁵ <https://refed.com>

Option: Develop a Food Waste Reduction Strategy	
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> Based on reported program performance for top-performing larger jurisdictions, it should be possible for the program to reduce trash by 0.3 to 0.4 lbs/hhld/week. Some potential for increased diversion measured as pure waste reduction (4-5% reduction in residential waste generated as a result of less food purchases which is then wasted).⁶
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> Food waste reduction results in avoided GHG emissions through reduced landfill gas emissions, reduction in collection vehicles and fossil fuel consumption resulting from less wasted food requiring collection, transfer and disposal or processing.
General Implementation Requirements	<ul style="list-style-type: none"> Staff time and resources to research programs and partners. P&E program to educate residents and promote benefits of strategies. Support activities by advertising on City website.

2.1.3 Support Reuse Events

The City could consider supporting reuse events that allow residents to obtain gently used materials for reuse (e.g., furniture, toys) in a convenient, yet structured way so that the events do not contribute to uncleanliness, litter or illegal dumping. The events could include garage sales, curbside giveaway events in common areas (for multi-residential buildings) or at curbside (for single-family households), swap events (e.g., mom-to-mom sales, jewelry or clothing exchanges). Fix-it clinics are another form of reuse event already supported by the City that allow residents to continue to use their durable goods. Many municipalities promote once or twice yearly curbside events, generally held in the spring or fall.

These events create reuse opportunities and therefore reduce the amount of waste sent for recycling or disposal and increase the diversion of materials that could have otherwise ended up in landfill. They give the opportunity for residents to access used goods instead of buying new at either reduced rates or for free. There is potential for prohibited or unacceptable materials to be set out which may pose health & safety concerns (e.g., mattresses containing bed bugs, child car seats, helmets, etc.) and for residents not removing materials after the event which can create litter and an uncleanly neighborhood.

⁶ Potential for 3-4% residential waste reduction (assuming a target of 21-25% avoidable food waste reduction). An estimated 35-50% of green bin waste (food waste portion) considered avoidable food waste, which could be reduced over time by proper consumption and use of purchased food. Results from Food Waste Audits conducted in the City of Guelph, ON in 2014 showed that 53% of organics in the Green Bin were classified as avoidable food waste. Results from 2013/2014 waste audits conducted in York Region, ON show 35% of food waste is avoidable. Results from Metro Vancouver, BC baseline research (food waste reduction) shows that 50% of food waste is considered avoidable.

UK's Love Food Hate Waste campaign has resulted in 21% reduction in avoidable food waste since 2007 (Source: Food Waste Briefing Paper to the House of Commons Library, United Kingdom. September 2, 2015. No. CBP07045) and Denmark has achieved 25% reduction in food waste generation (Source: Food Waste in Denmark down 25% at <http://cphpost.dk/news/food-waste-in-denmark-down-by-25-percent.html>).

Food waste is generally 25% to 40% of total waste reduction (before waste is put in Green Bin or garbage). A 21% reduction in avoidable food waste, which is about 35% minimum of Green Bin material results in a potential 3% residential waste reduction. A 25% reduction in avoidable food waste results in a potential 4% residential waste reduction.

City involvement, at minimum, would include staff time and effort for promotion and education to promote the event and educate residents on set out of acceptable materials and removal after the event. Some enforcement may be required to manage materials remaining after the events. A method of estimating material diverted from landfill (likely through item counts) through the various events would be required to document the success of these events.

The potential for reuse events is recommended to be carried forward for further consideration. The following table provides an overview of this option.

Table 2-3: Supporting Reuse Events Overview

Option: Support Reuse Events	
Description of Option	<ul style="list-style-type: none"> The City could support reuse events that allow residents to obtain gently used materials for reuse in a convenient, yet structured way so that the events do not contribute to litter or illegal dumping. The events could include garage sales, curbside giveaway events in common areas (for multi-residential buildings) or at curbside (for single-family households), swap events (e.g., parent-to-parent sales, jewelry or clothing exchanges) and fix-it clinics.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Reuse events can keep materials from disposal and provide opportunities. Gives opportunity to residents to access used goods instead of buying new at either reduced rates or for free. Difficult to track the amount of material diverted from landfill through the various reuse events. Can consume staff time.
Rationale for Consideration	<ul style="list-style-type: none"> These events provide opportunities to reduce and reuse for residents and also provide opportunities to engage and educate residents about recycling resources.
Cambridge Experience	<ul style="list-style-type: none"> Fix-it clinics. Most universities have drop-off bins, Freecycle events or donation stations during move out and move in events.
Case Studies/Examples	<ul style="list-style-type: none"> The City of Edmonton, AB provides up to six grants of \$500 each to help offset costs of holding reuse events, subject to certain terms and conditions. The grants can be used towards advertising expenses, food for volunteers/attendants, gas and/or vehicle rentals to collect supplies and transport donated items, supplies needed for the events (bags, posters, signs etc.) and hall rental. The City will also assist with lending plastic bins to organize donated items, promotion of the event and assisting with volunteer recruitment. In New York City, GrowNYC, holds Stop 'N' Swap events throughout the year at various locations throughout the city. Their goal is to hold one event in each community annually. These events may be held in partnership with other organizations such as parenting groups and sometimes feature repair cafes. Materials brought to these events are weighed in order to estimate the tons diverted. In 2016, GrowNYC held 31 events which attracted over 8,000 people and diverted 39 tons of materials from disposal.⁷ Leftovers are sorted and recycled or donated for reuse to the extent possible.
Short-term or Long-term Option	<ul style="list-style-type: none"> Implement in the short to medium term, sustain over the long term.

⁷ GrowNYC Annual Report 2016

Option: Support Reuse Events	
Interaction with other System Components	<ul style="list-style-type: none"> Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs.
Potential Cost Implications	<ul style="list-style-type: none"> Additional costs would be low predominantly for staff time and P&E materials. Potential for small decrease in diversion processing and/or disposal fees by reducing the quantity of materials requiring management. Potential for small reduction in operating costs related to collection, disposal, and processing if food waste is reduced.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> Based on reported program performance for top-performing larger jurisdictions, it should be possible for the City to increase reuse to reduce trash by 0.7 to 0.8 lbs/hhld/week.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.
General Implementation Requirements	<ul style="list-style-type: none"> Staff time and resources to research programs and partners. P&E program to educate residents and promote benefits of strategies. Support activities by advertising on City website.

2.1.4 Exploring Opportunities for Waste Exchange

A waste exchange network, or center, and/or partnerships with existing organizations that collect gently used materials such as arts and crafts, school and office supplies, construction and demolition waste, plastic containers, used bicycles, sports equipment, tools etc. could be explored.

Some municipalities collect reusable items at various community events or facilitate collection of these items by including them on their websites. Others have partnered with non-profit organizations to offer reuse opportunities at community recycling centers which can facilitate tracking of waste diversion.

The City would need to determine if it would establish its own waste exchange center (potentially housed at the Recycling Center as an extension of its existing approach to allow for donations and removal of books and small household goods) and provide donations to partnering organizations or if it would partner with and/or promote existing organizations that collect and distribute used materials or if it would partner with other organizations to establish or promote existing waste exchange networks.

Waste exchange is recommended to be carried forward for further consideration.

The following table provides an overview of this option.

Table 2-4: Exploring Opportunities for Waste Exchange Overview

Option: Exploring Opportunities for Waste Exchange	
Description of Option	<ul style="list-style-type: none"> Establish or support waste exchange centers and/or networks.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> City can facilitate and/or support exchange of reusable goods. City can promote existing exchange networks/markets.

Option: Exploring Opportunities for Waste Exchange	
Rationale for Consideration	<ul style="list-style-type: none"> This option has the potential to divert unwanted material from landfill and to direct materials to organizations that can use them, and increase awareness of the need for unwanted supplies in the community.
Cambridge Experience	<ul style="list-style-type: none"> The City maintains a listing of organizations that accept donations, but not waste exchange.
Case Studies/Examples	<ul style="list-style-type: none"> MassDEP has a page⁸ devoted to donation and reuse for various materials to which the City could provide a link on their own website. In Ohio, the Ohio EPA, in conjunction with the US Business Council for Sustainable Development has launched the Ohio Materials Marketplace⁹ to connect companies or organizations looking for opportunities to use by-products or waste materials for new products or who wish to obtain recycled material streams. The intent of this free online platform is to create a closed-loop system to connect generators and users to divert waste from landfill, generating savings in cost, and energy and creating jobs and business opportunities. The site is maintained by Ohio EPA and actively managed, rather than serving as a simple “bulletin board” as is the case with other similar websites. The Waste Exchange Network¹⁰ and the Reuse Marketplace¹¹ assists with finding alternative uses or recyclers for materials that would otherwise be disposed of. While the Massachusetts Waste Exchange does not appear to be well used, this type of networking can match and connect organizations looking to sustainably dispose of materials and facilitates exchanges between them. The cities of Winnipeg, Edmonton and Toronto all support reuse through “artsjunktion” or reuse centers which accept arts and craft supplies to be used by schools, daycares, non-profits etc., or sold for a nominal fee. These centers run programs for birthday parties, group programs, workshops, etc. Partners in Project Green in Toronto, ON matches and connects organizations looking to sustainably dispose of materials and facilitates exchanges.
Short-term or Long-term Option	<ul style="list-style-type: none"> Implement in the short to medium term, sustain over the long term.
Interaction with other System Components	<ul style="list-style-type: none"> Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs.
Potential Cost Implications	<ul style="list-style-type: none"> Additional costs would be low, predominantly for staff time and P&E materials. Potential for small decrease in diversion processing and/or disposal fees by reducing the quantity of materials requiring management. Potential for small reduction in operating costs related to collection, disposal, and processing if food waste is reduced.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> Based on reported program performance for top-performing larger jurisdictions, it should be possible for the City to increase reuse to reduce trash by 0.3 to 0.8 lbs/hhd/week depending on what materials are being diverted.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.

⁸ <http://www.mass.gov/eea/agencies/massdep/recycle/reduce/donation-and-reuse.html>

⁹ <https://ohio.materialsmarketplace.org/>

¹⁰ <http://www.wastechange.com/cgi-bin/freexchange.cgi?gid=100244&action=unsub>

¹¹ <http://www.reusemarketplace.org/>

Option: Exploring Opportunities for Waste Exchange	
General Implementation Requirements	<ul style="list-style-type: none"> Depending on the City's level of involvement in supporting these initiatives, staff time may be required to research, verify and maintain relationships with partnering organizations and to maintain the City's website and other education/promotion materials (e.g., Recycle it Right links) with information on partnering organizations. P&E program to educate residents and promote benefits of strategies. Support activities by advertising on City website.

2.1.5 Recommended Reduction and Reuse Initiatives

The following table presents the reduction and reuse initiatives that are recommended for implementation in the near-mid-term. In general, these initiatives are important in promoting the concept of reduction and reuse, are relatively low cost and do not require a significant effort on the part of the City. They can contribute to the City's waste reduction and GHG reduction goals but on a smaller scale compared to larger initiatives.

Table 2-5: Summary of Recommendations for Reduction and Reuse Initiatives

Initiative	Rationale
Recommended for Implementation within the Next Seven Years	
Supporting Sharing Libraries	<ul style="list-style-type: none"> The City has a high proportion of multi-family tenants with limited space for storing items that are seldom used. Sharing libraries can provide an opportunity to better promote and facilitate the reduction and reuse of waste materials to prevent waste from entering the system and requiring management through collection, processing and/or disposal. Low/minimal additional costs, predominantly for staff time and P&E materials. However physical space and materials for sharing would have to be secured. Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.
Developing a Food Waste Reduction Strategy	<ul style="list-style-type: none"> Would be a continuation of existing food waste reduction efforts undertaken by the City (e.g. support for 'Food for Free'). Reducing food waste saves resources and reduces GHG emissions from vehicles and landfills. Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs. Low/minimal additional costs, predominantly for staff time and P&E materials Food waste reduction results in reduced GHG emissions through reduced landfill gas emissions, reduction in collection vehicles and fossil fuel consumption resulting from less wasted food requiring collection, transfer and disposal or processing.

Initiative	Rationale
<p>✓ Supporting Reuse Events</p>	<ul style="list-style-type: none"> • Would be a continuation of existing reuse efforts undertaken by the City (e.g. current fix-it clinics). • Reuse events provide opportunities to reduce and reuse for residents and also provide opportunities to engage and educate residents about recycling resources. • Low/minimal additional costs, predominantly for staff time and P&E materials. • Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.
<p>✓ Supporting Opportunities for Waste Exchange</p>	<ul style="list-style-type: none"> • Role for the City to encourage waste exchange through current networks. • Has the potential to divert unwanted material from landfill and to direct materials to organizations that can use them, and increase awareness of the need for unwanted supplies in the community. • Low/minimal additional costs, predominantly for staff time and P&E materials. • Potential to reduce quantities of materials requiring collection, processing and disposal and associated costs. • Some potential for reduction in GHG emissions by reducing the need to manufacture and distribute new products.

2.2 Trash Disincentives

The City of Cambridge is interested in exploring various trash disincentives that would encourage residents to utilize diversion programs and reduce the quantity of trash requiring disposal. Examples of trash disincentives include;

- A standard sized container;
- A PAYT program;
- Clear bags; and,
- Changes to trash collection frequency.

Options considered must be easy to implement, enforce and use and encourage diversion.

The City of Cambridge’s current Refuse and Litter Ordinance limits household trash to 150 pounds per week, 150 gallons per household in no more than three barrels, up to 50 gallons each. For example, a multi-family building with 6 units can have up to eighteen 50-gallon barrels and up to 900 pounds of trash per week set out for collection.

The following Table 2-6 outlines research done by HDR on a number of municipalities that employ one or more of the above listed trash disincentives. The table provides examples of how communities encourage diversion through financial incentives (e.g. PAYT for all trash or excess trash), or through standard sized trash containers (either provided by the municipality or as part of a PAYT program), and differing collection frequencies for various waste streams.

The sections following this table outline options for incentivizing residents to participate in diversion programs rather than disposing of waste in the trash.

Table 2-6: Examples of Various Trash Disincentive Mechanisms used by Municipalities in the US and Canada

City	Trash Container Size and/or Limit	Recycling Collection	Organics/Yard Waste Collection	Additional Trash Set-out Costs/Restrictions	Frequency of Collection	Notes
Property Tax Based						
Cambridge, MA	150 lbs/week, limit of 50 gallons or pounds per container.	65 or 95 gallon	Seasonal yard waste collection. Pilot Organics program at this time.		Weekly collection of trash and recycling.	
New York City, NY	Unlimited, bagged or binned trash (<44 gallons, 60 lb limit).	Clear bags or bundles (2 stream recycling).	The City is only providing a pilot program in select neighborhoods at this time. Yard waste/ leaf collection varies by area.	Not applicable	Once or twice weekly collection of trash and recycling.	
Columbus, OH	64 gallon 96 gallon	65 gallon	The City does not provide a residential organics program. Year round yard waste collection.	It does not appear that excess trash is accepted beyond what fits in container.	Weekly collection of trash and recycling.	Trash must be bagged and tied before being placed in container. Bulk collection provided at no charge.
PAYT - Variable Based Fees Model (for all services combined) – Cart Based (monthly fees)						
San Jose, CA	32 gallon - \$33.19 64 gallon - \$66.38 96 gallon - \$99.57	32, 64, 96 gallon. No additional charge.	The City does not provide a residential organics program. Yard waste collection free if put loose in street and for a monthly fee if collected in a cart.	Extra garbage can be placed out with a sticker costing \$6.25.	Weekly collection of trash and recycling.	
Tucson, AZ	48 gallon - \$15.00 65 gallon - \$16.00 95 gallon - \$16.75	96 gallon. No additional charge.	2x annual brush collection included.		Weekly collection of trash and recycling.	

City	Trash Container Size and/or Limit	Recycling Collection	Organics/Yard Waste Collection	Additional Trash Set-out Costs/Restrictions	Frequency of Collection	Notes
Brookline, MA	35 gallon - \$15.83 65 gallon - \$21.00 95 gallon - \$26.00 Also can provide 18 Gallon containers or bag-based system.	96 gallon. No additional charge.	The City does not provide a residential organics program. Seasonal yard waste collection provided at no additional charge.	Overflow must be placed in purple bags purchased @\$15 for 5 bags.	Weekly collection of trash and recycling.	City switched to PAYT in 2017. Formerly, residents charged \$200 annual trash fee. Collection starts May 30, 2017. Billed annually or quarterly.
PAYT - Variable Based Fees Model (for all services combined) – Bag Based						
Worcester, MA	Small yellow bag 10 bags/\$7.50 (15 lb limit). Large yellow bag 5 bags/\$7.50 (30 lb limit).	No additional charge.	The City does not provide a residential organics program. Yard waste collected at drop-offs only.	No limit on set out.	Weekly collection of trash and recycling.	Implemented in 1993 to generate revenue.
Fall River, MA	8 gallon bags – 8 for \$6.00 15 gallon bags – 8 for \$10 30 gallon bags – 5 for \$10 Bags must be placed in trash cart for collection.	95 Gallon. No additional charge.	The City does not provide a residential organics program. No additional charge for yard waste collection.	No limit on set out.	Weekly collection of trash and recycling.	PAYT program in place since August 2014. Implemented to generate revenue since a landfill closed. Program recently revamped with increased enforcement.
Variable Based Fees (for each service) Model (monthly fees)						
Seattle, WA	12 gallon - \$22.85 20 gallon - \$28.00 32 gallon - \$36.45 64 gallon - \$72.90 96 gallon - \$109.35	96 Gallon. No additional charge.	13 gallon - \$6.05 32 gallon - \$9.10 96 gallon - \$11.65 Food and yard waste collected in same bin. Additional yard waste set out collected at no charge.	\$10.60 per unit (bag or bundle) Additional yard waste may be placed out for \$5.80 per bundle.	Organics and trash collected weekly, recycling collected every two weeks.	Food waste is not allowed in garbage so residents must find a way to manage this waste stream.

City	Trash Container Size and/or Limit	Recycling Collection	Organics/Yard Waste Collection	Additional Trash Set-out Costs/Restrictions	Frequency of Collection	Notes
San Francisco, CA	20 gallon - \$16.19 32 gallon - \$25.90	32 gallon (\$2.06)	32 gallon (\$2.06) Food and yard waste collected in same bin. Additional yard waste set out collected at no charge.	There does not appear to be an option to dispose of material that does not fit in container.	Weekly collection of trash, recycling and organics.	A base charge of \$5.16 is charged per dwelling unit (1-5 unit residential buildings).

Full Flat Fee to cover all Waste Management Services Model

Clearwater, FL	96 Gallon cart provided by City.	96 gallon. No additional charge.	The City does not provide a residential organics program nor does it appear that they provide yard waste collection.	There does not appear to be an option to dispose of material that does not fit in container.	Weekly collection of trash and recycling.	Monthly fee of \$27.76 includes a base charge of \$9.25. Variety of charges for different customers and services.
Rochester, NY	96 Gallon cart provided by City.	96 gallon. No additional charge.	The City does not provide a residential organics program. Fall leaf collection and yard waste collection provided at no charge.	Overflow may be placed out in bags or alternative containers at no charge.	Weekly collection of trash, EOW collection of recycling	Annual fee varies by number of units, applied to tax bill. 1 unit - \$380 (= \$31.67/mo).

Hybrid PAYT Model

Minneapolis, MN	Monthly base fee of \$23.47. 94 gallon - \$5.00 32 gallon - \$2.00	95 gallon. 64 gallon available upon request. Service provided at no additional charge.	Opt-in organics program started in May 2017. Organics collection provided at no additional charge – 32 gallon carts provided for up to 2 units, 64 gallon for 2+ units. Seasonal yard waste collection provided at no additional charge.	Up to 2 additional bags allowed on occasion at no charge. Additional large cart available for \$5.00/month.	Weekly garbage, EOW recycling, weekly organics	Bulky collection included at no additional cost.
Plymouth, MA	15 gallon bags 8 for \$6.25 30 gallon bags 5 for \$6.25 Bags must be placed in 65 gallon container	95 gallon. No extra charge.	The City does not provide a residential organics program. Yard waste must be taken to transfer station.	Residents must sign up annually for service. Special trash bags must also be used for waste disposed at transfer station.	Weekly collection of trash, EOW collection of recycling.	Residents have option of subscribing to curbside collection for \$199 annually, bringing waste to transfer station (\$168) or both (\$367) in addition to costs to purchase trash bags.

City	Trash Container Size and/or Limit	Recycling Collection	Organics/Yard Waste Collection	Additional Trash Set-out Costs/Restrictions	Frequency of Collection	Notes
Springfield, MA	95 gallon - \$7.50/month (\$90 annual trash fee) for each City-provided container	95 gallon. No additional charge.	The City does not provide a residential organics program. Seasonal yard waste collection provided at no additional charge.	Bulk or overflow items require an \$8 sticker per item.	Weekly collection of trash, EOW collection of recycling.	Non-payment result in an accumulation of 12% interest and a lien against resident's property. PAYT was considered in 2008 but not implemented due to number of multi-family units and already established barrel system. City provides discounts under certain conditions.
Los Angeles, CA	Monthly solid waste fee of \$36.32 (SF) or \$24.33 (MF). 60 gallon container provided.	90 gallon. No additional charge.	City does not provide organics collection. Some vegetative waste may be placed out with yard waste. Yard waste collection included at no additional charge.	5-25 extra capacity tags may be purchased annually at a cost of \$2.00 each for additional set out of trash or yard waste.	Weekly collection of trash and recycling.	Bulky collection included at no additional cost. MF and Commercial must recycle. Commercial organics diversion being phased in.

Hybrid Flat Fee (Covers Certain Services) Partial Utility Model

Calgary, AB	Collection costs supported by property taxes. Residents must pay a monthly waste management charge of \$4.90 to offset residential disposal. 65 gallon black cart provided.	65 gallon - \$8.30/month.	City is rolling out City-wide organics program. Food, pet waste and yard waste collected together. \$6.50/month starting in Jan. 2018 (residents do not have to pay in 2017).	Overflow may be placed in plastic bags and collected at no charge. (Pilot black cart program showed only 13% of trash collected was placed outside carts).	Weekly collection of organics and recycling, EOW collection of trash once green bin program starts. (was weekly)	Program is being rolled out starting in June 2017. City intends to revisit volume based rate model once diversion programs are well established. Pilot for automated collection of trash carts saw no lost time due to injury on the job but there were >200 in same time period with manual collection ¹² .
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¹² <http://www.calgarycitynews.com/2010/03/garbage-collection-gets-overhaul.html>

2.2.1 Standard Trash Container

Currently residents have a variety of options regarding setout of trash at the curb and compliance with the weight and volume limits specified by the City for this container varies with 'enforcement' of the limits being at the discretion of the collection staff.

The City is considering provision of a standard trash container to residents. Distribution of a standard container could remove the variability in the trash set-outs, and provides a limit to the amount of material that can be set out for 'free' (i.e. no direct charge to the household). Carts, compatible with semi-automated collection, would be one form of standard garbage container, however, there are many available options for manual containers that would hold in the order of a single bag of garbage.

It appears that the City is leaning towards a cart-based system, compatible with semi-automated collection. Semi and fully-automated collection systems have been shown to reduce the number of worker injuries associated with lifting trash containers/bags. Fully automated collection is not under consideration, due to the difficulty in ensuring proper set-outs for automated collection given the narrow and congested streets (including on-street parking) throughout the residential sections of the City.

Increased worker safety is often one of the most common reasons for making a switch to a standard trash container, and either semi or fully automated collection. Many municipalities have cited the following health and safety reasons for switching:

- Reduced workers compensation costs;
- Reduced injury to workers with fewer repetitive strain injuries;
- Ageing workforce;
- Minimizes exposure to sharps (broken glass, needles); and
- Reduced exposure to traffic risks.

The size of a standard trash container will need to be considered carefully - allowing for a transition from the current system, while providing flexibility for future changes. Should the City consider every other week (EOW) collection in the future, a container large enough to hold two weeks' worth of trash should be provided. In a survey of organics pilot participants in February 2017, 72% of participants put out only one to two 13 gallon kitchen bags in the trash, with almost 50% putting out only one bag. It was recommended in 2017 that the City collect data on the current trash setouts and volumes in the pilot areas and other areas of the City to assist in making decisions regarding the appropriate size of container. The outcome of this collection survey is provided in Appendix E of the ZWMP report.

As shown in Table 2-6, there are a number of municipalities with PAYT systems that offer small trash bins to accommodate those residents who truly want to minimize their costs and are able to minimize trash disposed. Small carts offered range from 12 gallon to 20 gallons, medium size carts range from 32 to 35 gallons and large carts range from 64 to 96 gallons. Provision of a standard container based on 32 gallons per unit would allow the City to provide different containers in multiples of 32 (e.g. 64 gallons for 2 unit buildings, 96 gallons for 3+ units) and is an equitable division of capacity on a per unit

basis. 32 gallons works out to approximately three bags of trash per week which appears to be ample capacity based on the feedback from the organics pilot participants. Provision of 32 gallons per unit may provide a transition from the current system towards a smaller container, which should still provide sufficient capacity if the City decides to implement EOW trash collection in the future once the organics program is established.

Provision of a standard garbage container is recommended to be carried forward for further consideration.

The following table provides an overview of this option.

Table 2-7: Standard Trash Container Overview

Option: Standard Garbage Container	
Description of Option	<ul style="list-style-type: none"> Provision of a standard sized trash container (e.g. some multiple of 32 gallon per unit) to residents.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Currently, trash limits are very generous and rarely enforced. Use of a standard trash container is easy to enforce. A standard trash container could reduce ability of rodents/vermin to get into trash by replacing existing damaged containers and placement of bagged materials at the curb. A semi-automated standard trash container could reduce worker injury.
Rationale for Consideration	<ul style="list-style-type: none"> A standard sized trash container encourages diversion within existing programs (recycling) and new programs (organics) and can be combined with other trash disincentives to further reduce the amount of trash set out for collection.
Cambridge Experience	<ul style="list-style-type: none"> Currently, trash may be placed out for collection in trash barrels or heavy plastic bags (plastic bags may only be placed out on collection day, not before). Trash limits are rarely enforced.
Case Studies/Examples	<ul style="list-style-type: none"> Most municipalities that use standard containers, do so as part of a volume based Pay-as-you-throw (PAYT) system. Clearwater, FL provides a standard trash barrel (64 gallon) to residents. Rochester, NY provides a standard trash container (64 or 95 gallon) and allows residents to place overflow materials in other containers or bags. Columbus, OH provides a 90 gallon standard trash container, it does not appear there is any provision for excess trash.
Short-term or Long-term Option	<ul style="list-style-type: none"> Implement in the short-term (within the first three years of ZWMP implementation), and sustain over the long term.

Option: Standard Garbage Container	
Interaction with other System Components	<ul style="list-style-type: none"> • Standard trash containers would make enforcement of volume requirements much easier. • A standard trash container can be paired with other mechanisms such as a clear bag program or a PAYT program (including use of special bags or tags). • Would require some enforcement, particularly in the first six months or so after containers are introduced. It is anticipated that enforcement of the standard container size would be undertaken primarily by collection staff at the curb which would be directed to tag and leave containers/bags that are not compliant. However, there will still be a requirement for some form of enforcement in addition to that provided by collection staff in year one, decreasing in subsequent years which will require some additional customer service and/or enforcement resources. • Some residents may see this as an increase in level of service in that they would receive a 'free' container. • Standard garbage container could be for semi-automated collection which has potential to reduce worker injury and reduce vermin. • Should improve participation in diversion programs which may increase processing costs offset by savings in trash tipping fees.
Potential Cost Implications	<ul style="list-style-type: none"> • Promotion and education campaign is required along with container deliveries, and outreach professionals at outset of implementation. • Direct cost to the City to purchase and distribute containers in the order of \$45 per 64 gallon container, or around \$1.5 million. • Potential increase in recyclable processing fees with increased tonnage. • Potential for change in revenue from sale of recyclables due to increase in materials recovery, improvements in material quality and/or increased contamination. • Potential for change to organics collection/processing costs with increased diversion. • Potential reduction in trash transfer and disposal costs.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Restrictions in size of garbage container can assist with increasing diversion. • It is estimated that the reduction in trash would be in the order of 0.3 to 0.5 lbs/hhld/week or approximately 2 to 3% additional diversion.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Should reduce GHG emissions with added diversion of material from disposal.
General Implementation Requirements	<ul style="list-style-type: none"> • Promotion and education of this option will be critical, as it has the potential to affect weekly trash set-outs by many households. A multi-component campaign reaching out through various media over some months leading up to full implementation will be needed. • Requires the purchase and distribution of standard containers. • Will need to develop a system for new/replacement/exchanged containers and storage of containers. • Collection staff will be first line of enforcement, leaving behind trash which is not in the standard container and/or exceeds trash limits. City enforcement staff may be needed to follow up with repeat offenders. • Will require a change to City ordinance to limit the amount of trash set out and require the use of the standard container as provided by the City.

2.2.2 PAYT

Pay-as-you-throw (PAYT), also known as Save-as-you-throw (SAYT), can contribute to economic stability, environmental sustainability and equity as residents are charged based on the amount of waste they dispose of. Traditionally, residents are charged for the amount of trash they set out, through a bag tag or volume based rate system. Some municipalities also charge for other materials set out for collection (e.g. recycling and organics).

PAYT typically consists of proportional pricing, where residents are charged on a per-unit basis for trash (standard containers, bags or tags) or variable-rate pricing where residents are charged for the size of container, typically for trash only, which suits their needs. Some municipalities have also implemented financial incentives such as collecting recycling, organics or yard waste free of charge. For the most part, larger municipalities use volume-based PAYT systems, typically cart-based, while smaller municipalities utilize bag or tag systems. The choice of bag or tag approaches seems to be based more on regional trends and the availability of supporting services (e.g. see text regarding WasteZero services below), rather than on any specific documented performance differences between these approaches.

Examples of municipal PAYT programs with varying degrees of service included in the cost of collection are presented in Table 2-6.

It appears that the City wishes to implement a relatively simple system to encourage residents to divert more waste. A full volume-based PAYT requires considerable resources to administer, with multiple size carts required, a system for storing and exchanging carts and billing. A hybrid PAYT system for excess trash combined with a standard size trash container seems to be a better fit for the City. In this scenario, the City would make available special bags or tags for residents to use for excess trash that does not fit within the standard size container.

The City has the option to administer a bag/tag program themselves or contract with WasteZero to administer the program. WasteZero has an office in Cambridge and has partnered with 850 municipalities in the U.S. WasteZero has a retail store distribution program which offers trash bag warehousing, inventory management, accounting and reporting. WasteZero manufactures customized trash bags using recycled materials at their plant in South Carolina. Beyond production and distribution of bags, WasteZero also provides a number of services to municipalities including promotion and education.¹³

Should the City decide to administer this program themselves, there are a few options for consideration:

- Provide residents with a limited number of bags (e.g. 6) to initiate the program. Residents are required to purchase additional bags as needed. City would be required to administer program and coordinate sales with retailers or pay for this service through a service provider like WasteZero.

¹³<http://wastezero.com/>



- Provide residents with a limited number of bag tags (e.g. 6-12) to initiate the program. Residents are required to purchase additional tags as needed. City would be required to administer program and coordinate sales with retailers or pay for this service through a service provider like WasteZero.
- Do not provide residents with any bags or tags. Residents must purchase bags/tags as needed. City would be required to administer program and coordinate sales with retailers or pay for this service through a service provider like WasteZero.

Specially marked bags are very visible and immediately evident to collection staff, making it easy to enforce their use. Regular garbage bags would be left behind.

Bag tags also provide a visual cue to collection staff whereby only tagged bags are to be collected. Bag tags are somewhat easier to distribute by mail and may also get residents used to the idea of tagging waste, should the City decide to use tags for bulky item collection.

PAYT is recommended to be carried forward for further consideration. Use of specially marked bags are recommended over bag tags as they are more visible for collection staff, and provide more control over volume of material set out. The City will have to ensure the bag color is distinct from that used in neighboring municipalities and dissimilar to any bag which could be used to divert any other material (e.g. textile collection bags).

The following table provides an overview of this option and provides a comparison of fully PAYT and Partial PAYT where applicable.

Table 2-8: PAYT Overview

Option: Pay-as-you-Throw (PAYT)	Full PAYT	Partial PAYT
Description of Option	<ul style="list-style-type: none"> • Residents pay for all trash set out for collection. • Can use specially marked bags, bag tags or variable sized collection containers. 	<ul style="list-style-type: none"> • Residents pay additional fees beyond a “free” container. • Typically use either specially marked bags or bag tags that would be purchased at local retail outlets or at municipal buildings.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> • Currently, residents are unaware of ‘true’ costs of waste disposal. • Current waste limits are very generous. • A PAYT program provide can increase diversion as residents are more aware of waste generation and have more control over their waste disposal costs. • Program should be structured that City can recover costs and still generate sufficient revenue to support diversion programs. Need to determine the balance of costs recovered through the PAYT and those recovered through property taxes. • The number of multi-family residences may pose challenges due to anonymity of trash disposal (i.e. not everyone may use specially marked bags) which makes enforcement difficult. 	

Option: Pay-as-you-Throw (PAYT)	Full PAYT	Partial PAYT		
	<ul style="list-style-type: none"> A volume based rate system using carts is more complex to administer with purchase, delivery, exchange and replacement of carts, as well as billing. A volume based bag system is easier for the City to administer, or can be administered through a company like WasteZero. 	<ul style="list-style-type: none"> Bag tags or specially marked bags for excess trash is easy to administer, either by the City or by WasteZero. 		
Rationale for Consideration	<ul style="list-style-type: none"> This is a flexible option that can be implemented in a number of ways to encourage participation in diversion programs. 			
Cambridge Experience	<ul style="list-style-type: none"> Cambridge does not currently utilize this pricing structure. 			
Case Studies/Examples	<ul style="list-style-type: none"> There are 20 municipalities in Massachusetts who have some type of “Pay-as-you-Throw” (PAYT) program with curbside collection¹⁴. The majority of these municipalities are smaller than Cambridge (the largest is the Town of Plymouth with a population of 56,468). The majority require that residents purchase a bag with fees ranging from 1 to 3 dollars depending on the size of the bag. These bags must be used for trash set out and residents are encouraged to place bags in a lidded bin. Enforcement of use of these bags is easier as collection staff are able to see if trash has been placed in regular trash bags. In general, in Massachusetts, there are three types of PAYT programs; <ul style="list-style-type: none"> Residents must purchase special bags for trash disposal. Only these bags will be accepted for disposal. Residents must purchase stickers, labels or tags for trash bags or barrels. Collection of first bag or barrel free, with any excess trash placed in a special bag or tagged/labelled. Many large municipalities in the U.S. and Canada utilize a volume based rate structure whereby residents choose and pay for a trash container that fits their needs. <table border="0" data-bbox="540 1213 1425 1371"> <tr> <td data-bbox="540 1213 987 1371"> <ul style="list-style-type: none"> Cart Based - San Jose CA, Tucson AZ, Brookline MA, Seattle WA Bag Based – Worcester MA, Fall River MA </td> <td data-bbox="987 1213 1425 1371"> <ul style="list-style-type: none"> Bag Based – Plymouth MA Bag Tag Based – Springfield MA, Los Angeles CA </td> </tr> </table>		<ul style="list-style-type: none"> Cart Based - San Jose CA, Tucson AZ, Brookline MA, Seattle WA Bag Based – Worcester MA, Fall River MA 	<ul style="list-style-type: none"> Bag Based – Plymouth MA Bag Tag Based – Springfield MA, Los Angeles CA
<ul style="list-style-type: none"> Cart Based - San Jose CA, Tucson AZ, Brookline MA, Seattle WA Bag Based – Worcester MA, Fall River MA 	<ul style="list-style-type: none"> Bag Based – Plymouth MA Bag Tag Based – Springfield MA, Los Angeles CA 			
Short-term or Long-term Option	<ul style="list-style-type: none"> A partial user pay approach could be implemented in the short-term (within the first three years of ZWMP implementation) along with a standard trash container or phased in afterwards and sustained over the long term. Residents would be able to purchase specially marked durable plastic bags or garbage tags to place on their own bags, for waste in excess of that which can be accommodated in the standard container. 			

¹⁴ <http://www.mass.gov/eea/agencies/massdep/recycle/reduce/pay-as-you-throw-payt.html>

Option: Pay-as-you-Throw (PAYT)	Full PAYT	Partial PAYT
Interaction with other System Components	<ul style="list-style-type: none"> • Potential increase in rates of recycling and organics diversion depends on the direct costs and restrictions experienced by residents. • Impact to collection program from a compliance/monitoring standpoint as it increases the ability of the collection contractor to enforce compliance. However, it would also draw on more time from the curbside collections staff to scan the bags and tag for non-compliance that could affect collection efficiency. • Potential draw on enforcement staff for non-compliance. Non-compliance will be more difficult to enforce in Cambridge, given the density of housing and that it is more difficult to enforce this type of program in multi-unit buildings. This could require more effort to determine the unit/household responsible for incidents of non-compliance, like breaking open trash bags to find household identifiers. • Works well with implementation of some other programs and disincentives (e.g. biweekly garbage collection, clear bags). 	
Potential Cost Implications	<ul style="list-style-type: none"> • Low to moderate additional costs associated with the need for increased promotion and education, to address the potential increase in the volume of calls during the initial period of implementation and to address the need for additional enforcement. This would be more than offset by the revenues associated with the PAYT program. • Small potential for increase in recyclable and organic waste costs with increased tonnages and increased revenue from additional tonnage of recyclables diverted and a decrease in trash transfer and disposal costs. 	
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Higher costs associated with cart-based programs with provision, delivery, maintenance, exchange and storage of various sized carts. 	<ul style="list-style-type: none"> • Lower costs for provision of bags or tags which resident must purchase.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • It is difficult to determine the actual amount of waste reduction that could be achieved, as this measure is not isolated from others in communities that have implemented full PAYT. • Anticipated to increase diversion as residents will use recycling and organics program rather than paying to dispose of excess waste. 	
General Implementation Requirements	<ul style="list-style-type: none"> • Volume based PAYT programs provide a significant financial incentive to reduce waste. • Purchase of bags or tags can make residents more aware of costs of trash disposal and encourage waste reduction. • Promotion and education program to educate residents and promote benefits. • If a third party administers the PAYT program, staff time may be limited to contract administration compared to overseeing production, distribution and collecting revenue from program. • Some enforcement required, although will be primarily done by collection staff who will only collect properly marked trash. • Would require a change to City’s Refuse and Litter Ordinance. 	

2.2.3 Clear Bags

Clear bag-based garbage systems have been used by many municipalities throughout North America, although appear to be more commonly used in Canada. Based on studies that have been completed, clear garbage bag programs have been shown to

increase the capture of divertible material and further, have led to a decrease in waste management costs. A study completed on 13 municipalities in Nova Scotia showed that a clear garbage bag program (programs had been in place for two years) assisted these municipalities in reducing residential waste by 41%, increasing residential recycling by 35%, and increasing residential organics by 38%.¹⁵ Since launching their clear bag-based garbage program in summer 2015, the City of Halifax, NS has seen a reduction in trash of 24%, while recycling increased by 13%.¹⁶ Interestingly, there did not seem to be an increase in the amount of food waste collected; however, the City's organics program has been in place since 1998 and residents already actively participate in the program.

Clear garbage bags are a means of further restricting garbage collection, and providing a better mechanism for curbside enforcement of source separation and as an additional measure to encourage diversion. Some municipalities allow unlimited clear bags as long as they do not contain any material that should have been diverted. If residents are participating fully in the recycling and organics program, there should be little waste remaining. It could also be undertaken as an additional change to be considered in the short or mid-term based on the success (or lack thereof) of the overall diversion initiatives. For those municipalities still allowing the use of garbage bags, an additional benefit of clear garbage bags is a reduction in collection worker injuries from sharps and other materials such as broken glass.

The City does allow garbage to be placed at the curb in plastic bags on the day of collection. The majority of trash is placed in rigid containers, which could be the standard sized trash container provided by the City in the future. Given the number of multi-family units with storage issues and potential for vermin, use of clear bags as the primary method of trash setout does not appear to be a feasible option for the City. It could be considered in the future along with another disincentive such as every other week trash collection to further increase diversion of recycling and organics. This option could be used in conjunction with a standard container so that all trash is placed in clear bags and stored in the standard container or excess trash. This would allow for some level of inspection and enforcement as containers are emptied, however, this would not be easy to do for semi-automated collection as the curbside collection staff would not be able to handle or observe each bags emptied from the container. Clear bags could also be used for excess trash beyond the standard container, for which a bag tag could be required.

The City may have to allow one or more opaque bags to be placed inside clear bags for privacy. Some level of enforcement is required at the curb by collection staff to inspect bags for divertible materials (recycling or organics), however this can be difficult to do in the context of semi-automated collection. This option provides less incentive to reduce waste compared to full or partial PAYT since there is no financial disincentive associated with use of clear bags. However, it is a simple program to for the City to administer as residents purchase their own clear bags.

¹⁵ Quinte Waste Solutions and Stewardship Ontario. 2008. The Use of Clear Bags for Garbage as a Waste Diversion Strategy: Background Research on Clear Garbage Bag Programs across North America.

¹⁶ <http://www.cbc.ca/news/canada/nova-scotia/clear-bags-keep-trash-out-of-landfills-1.3928331>

This option is not recommended for further consideration at this time, primarily as it requires a higher degree of enforcement or difficulties with enforcement by City staff and effort by residents and is overall a more complex system to implement. Without a financial disincentive, residents may not be as likely to participate in diversion programs.

The following table provides an overview of this option.

Table 2-9: Clear Bag Based Trash System Overview

Option: Implement a Clear Bag Based Trash System	
Description of Option	<ul style="list-style-type: none"> Residents would place trash into clear bags which would be placed into a standard garbage container or used for excess trash.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Clear bags allow for easy inspection and enforcement of set-out for recycling or organics when they are set-out alone at the curb. This is more difficult when they are placed into a container. Residents can set out as many clear bags as required as long as they do not contain any recyclables or organics. There may be some issues with privacy. Clear bags could be used in standard container, but not as primary method of containing trash due to potential for rodents/vermin. More difficult to observe compliance with recycling or organics diversion requirements if bags are placed in a container that is emptied using semi-automated collection.
Rationale for Consideration	<ul style="list-style-type: none"> Enhanced enforcement of diverting materials would increase diversion and reduce trash disposal.
Cambridge Experience	<ul style="list-style-type: none"> Cambridge does not require the use of clear bags.
Case Studies/Examples	<ul style="list-style-type: none"> Durham Region, ON implemented biweekly collection of an unlimited number of clear garbage bags with a maximum of 4 privacy bags to ensure trash being incinerated does not contain any hazardous or electronic material and that recycling and organics have been diverted. Halifax, NS allows 5 clear bags and one dark bag for privacy for single family homes which are collected every other week. Since the program was implemented in 2015, trash has been reduced by 24% and a 13% increase in recycling. Omaha, NB allows up to 5 containers of trash in trash cans or clear bags. Worcester, MA introduced opaque yellow bags for trash with the implementation of a PAYT program in 1993. Staff considered clear bags but did not want to make too many changes at once.
Short-term or Long-term Option	<ul style="list-style-type: none"> Could implement in the short-term (as of FY20), sustain over the long term. Could be implemented with standard garbage container.

Option: Implement a Clear Bag Based Trash System	
Interaction with other System Components	<ul style="list-style-type: none"> • Impact to collection program from a compliance/monitoring standpoint as it increases the ability of collection staff to enforce compliance; however, it is difficult to do so if clear bags are coupled with a semi-automated standardized container. However, it would also draw on more time from the curbside collections staff to scan the bags and tag for non-compliance that could affect costs. • Potential draw on enforcement staff for non-compliance. • Impact to MRF and organics processing facility with increased tonnages. • Anticipated to increase rates of recycling and organics diversion as divertible material would be visible in clear bags and collection staff can be directed to not collect bags with visible divertible material. • Difficult to enforce non-compliant bags and identify who they belong to, particularly with multi-family locations. • Residents may see this as an increase in level of service if unlimited clear bags are allowed. Works well with implementation of some other programs and disincentives (e.g. biweekly garbage collection). • Could increase organics and recycling processing requirements and reduce disposal requirements by diverting more material from disposal.
Potential Cost Implications	<ul style="list-style-type: none"> • Initial costs to implement would be small, <\$5 per household per annum primarily for promotion and education as residents are responsible for purchasing bags, and for increased volume of calls from residents during implementation phase • Some additional costs anticipated related to enforcement. • Some additional costs anticipated for contracted collection services, due to lengthier stop times, tagging and reporting. • Potential increase in per ton recyclable and organic waste collection and processing fees with increased tonnages. • Potential decrease in waste disposal costs. • Increased revenue from additional tonnage of recyclables diverted.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • It is difficult to determine the actual amount of waste reduction that could be achieved, as this measure is not isolated from others in communities that have implemented clear bag programs and also because the organics program has not yet been implemented. • Best estimates would be for an increase of 0.2 to 0.3 lbs/hhld/week reduction of trash depending on the level of enforcement employed.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • May be some reduction in GHG emissions from diverting more material from disposal.
General Implementation Requirements	<ul style="list-style-type: none"> • P&E program to educate residents and promote benefits. • May require additional resources to address high volume of resident calls during first six months of implementation. • Additional ordinance enforcement resources to identify those residents who have placed non-compliant bags out for collection. • Consider the viability/necessity of undertaking a pilot program. • Consider issue of privacy, whether or not to allow any opaque privacy bags within the larger clear garbage bag. • May require a change to City ordinance.

2.2.4 Bi-Weekly Trash Collection

Once the City has implemented a curbside organics collection program which will remove much of the more odorous material from the trash stream, the option of biweekly (i.e. every-other-week) collection of trash is more viable. However, the materials currently planned for acceptance in the organics program at this time do not include all potentially odorous materials that are in the waste stream such as pet waste, diapers and other sanitary products.

One of the primary concerns with moving from weekly to biweekly trash collection is the possibility for negative public reaction. In many cases this is perceived as a decrease in level of service. Householders are also often concerned about the potential for increased odors from trash—especially in the summer months—due to the longer storage period (being stored at their home for two weeks rather than one). Notwithstanding, some portion of the populace is likely to welcome a switch to biweekly trash collection as the move will be perceived as an “environmentally-friendly” switch and as they may already be setting out garbage less frequently.

One of the main benefits with moving to biweekly trash collection is the potential cost savings associated with reduced collection frequency. Cost savings associated with biweekly collection reflect the concept that the trash collection fleet is greatly reduced (usually by 2/5 to half) as ‘half’ of the City would be collected on one week and ‘half’ the next.

In regards to diversion, residents are more likely to properly sort organics and recycling when these streams have frequent and convenient collection available for divertible materials (particularly effective with organics due to odors) and there is less frequent/convenient collection of trash. Reducing the frequency of trash collection and/or increasing the frequency of recycling collection has been demonstrated to have a positive effect on recovery rates for recyclable material.

Some communities have chosen to implement biweekly trash collection at the same time as an organics expansion, others have chosen to implement it later, once the organics program is established and the requirement for further disincentives can be evaluated.

Table 2-10 below provides a few examples of municipalities that have implemented biweekly collection. It should be noted that the majority of municipalities collecting trash biweekly do not allow materials such as pet waste and diapers in their organics program. Biweekly collection is much more common in Canada with established organics programs. There was little information available for U.S. municipalities.

Table 2-10: Municipalities with Biweekly Collection

Municipality	Trash Collection	Recycling Collection	Organics Collection	Notes
Toronto, ON	Biweekly, alternating with recycling collection.	Biweekly, alternating with trash collection.	Weekly	Pet waste, diapers and hygiene products are accepted in organics program.
Region of Peel, ON	Biweekly, alternating with recycling collection.	Biweekly, alternating with trash collection.	Weekly	Do not accept pet waste, diapers or hygiene products in organics.

Municipality	Trash Collection	Recycling Collection	Organics Collection	Notes
Portland, OR	Biweekly	Weekly	Weekly	Do not accept pet waste, diapers or hygiene products in organics.
Calgary, AB	Biweekly	Weekly	Weekly	Do not accept pet waste, diapers or hygiene products in organics.
Renton, WA ¹⁷	Biweekly collection for SF, weekly for MF.	Biweekly collection for SF, weekly for MF.	Weekly	Food scraps and yard waste collected together. Do not accept pet waste, diapers or hygiene products in organics.

Risks associated with biweekly trash collection include communication (promotion and education) challenges to ensure that residents are aware of and use the appropriate schedule for set-outs, and addressing winter collection cancellation problems/challenges.

Overall, a move to biweekly trash collection would be easier if the collection system could direct pet wastes and diapers from the garbage stream to the organics stream to deal with odor issues. As the Greater Lawrence Sanitary District (GLSD) system cannot receive materials containing pet wastes and diapers at the point in the system where the pre-processed curbside organics stream is accepted, removing these materials from the trash stream and into the organics stream is significantly constrained at this time. The opportunity to include these materials in the organic stream will depend on the range processing options available to the City in the long term. Should it not be possible to expand the organics program to include these odorous materials, special consideration such as separate/additional collection services may need to be given to certain households (e.g. providing weekly trash location to certain locations that have registered as requiring it such as in-home daycares, homes with elderly residents).

A transition to biweekly collection is not recommended for consideration in the near future. The option with greatest potential for success is implementation of a standard sized trash consideration in the near term. Biweekly collection can be considered as a future program shift. Selection of a standard sized trash container should consider capacity to manage two weeks of trash in order to accommodate a shift to biweekly collection. As mentioned in Section 2.2.1, it was recommended that the City should undertake a data collection exercise to identify how much trash is set-out by residents fully participating in the organics program as a guide to determining the capacity of a standard trash container. The results are reported in Appendix E.

The following Table 2-11 provides an overview of biweekly trash collection.

Table 2-11: Bi-Weekly Trash Collection Overview

Option: Bi-Weekly Trash Collection	
Description of Option	<ul style="list-style-type: none"> Trash would be collected every other week.

¹⁷ <https://www.epa.gov/transforming-waste-tool/zero-waste-case-study-renton-wa>

Option: Bi-Weekly Trash Collection	
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> • Less frequent trash collection will increase participation in diversion programs. • Challenging for multi-residential units to store trash for two weeks if residents do not fully participate in diversion programs. • Potential for odors if diapers, pet waste not diverted.
Rationale for Consideration	<ul style="list-style-type: none"> • Biweekly trash collection can encourage participation in diversion programs and provide collection cost savings. Fewer trucks result in GHG emissions reductions.
Cambridge Experience	<ul style="list-style-type: none"> • Cambridge does not provide biweekly trash collection.
Case Studies/Examples	<ul style="list-style-type: none"> • Many Canadian municipalities provide biweekly trash collection whereas more US municipalities provide biweekly recycling collection. • City of Toronto and Region of Peel provide weekly organics collection, with alternating weeks of recycling and trash collection. • Seattle, WA ran a biweekly trash collection pilot program in 2012, however, opted to stay with weekly trash collection. Recycling is collected biweekly. • Tacoma, WA also ran a pilot program for biweekly collection and implemented biweekly trash collection in 2013. • Portland, OR provides a standard level of service of biweekly trash collection but also allows residents to choose every four weeks trash collection and/or on-call service. • The City of Calgary in Alberta Canada is rolling out their organics program in summer 2017 and will switch to a biweekly trash collection schedule at the same time. Both weekly and biweekly collection were part of the five year pilot program and residents were able to adapt to biweekly collection schedule.
Short-term or Long-term Option	<ul style="list-style-type: none"> • Implement in the medium-long term sustain over the long term. • Once organics program has been established, it may be possible to move to biweekly trash collection, possibly alternating with recycling collection on alternate weeks.
Interaction with other System Components	<ul style="list-style-type: none"> • Potential draw on enforcement resources for non-compliance. • Impact to MRF and organics processing facilities with increased tonnages. • Potential to impact service delivery in the collection contracts depending on when option is implemented. • Potential for vehicles that are no longer used for trash collection to be reallocated to provide other services (e.g. bulky collection). • Potential for increased complaints due to odors from materials such as diapers, pet waste, especially in warmer months which could impact customer service staff. • Could increase organics and recycling processing requirements and reduce disposal requirements by diverting more material from disposal.
Potential Cost Implications	<ul style="list-style-type: none"> • Extensive P&E campaign would be required. • Potential increase in organic waste processing fees with increased tonnage. • Potential decrease in trash collection, transfer and disposal fees due to reduction in collection frequency. • Some additional costs anticipated related to enforcement. • Increased revenue from additional tonnage of recyclables diverted.



Option: Bi-Weekly Trash Collection	
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Potential for additional organics diversion through increased garbage restrictions. • Some increase in recyclable capture rates is anticipated. • Biweekly trash collection is likely to result in reasonable increases in organics recovery rates based on the current capture rates for food waste, and some modest increases in recovery of recyclable material likely resulting in a 0.3 to 0.8 lbs/hhd/week reduction in trash (or 2 to 5 % diversion).
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Potential for reduced impact to environment due to fewer collection vehicles being on the road at any one time. • Potential for increased diversion to lessen environmental impact due to decreased disposal needs and increase in amount of material diverted. • Reduction of organics in trash directed to landfill will reduce landfill gas emissions.
General Implementation Requirements	<ul style="list-style-type: none"> • P&E material development and distribution/notification. • Impact to organics processing facility with increased capture of organic waste. • In order to increase public acceptance, pet wastes and diapers could be captured within the organics program; however, at this time GLSD cannot process these materials with the current setup. May require some form of heat treatment at organics processing facility to kill pathogens which would enable GLSD to accept this material. • Review of special considerations program will be necessary, particularly as all organics cannot currently be accepted.

2.2.5 Recommendations for Trash Disincentives

The following table provides an overview of the rationale for recommendations on the various trash disincentives. Recommended options include a standard trash container, PAYT and biweekly trash collection.

The standard trash container option is recommended as the first option for implementation in the near term as it has the most benefits and is the easiest option to implement.

This option can be coupled with a hybrid PAYT program should the City allow collection of additional containers of trash. A system with variable rates/collection containers is not recommended due to the complexities in implementing and administering this program. Instead, a specially marked bag or bag-tag system is recommended for overflow trash. Either system is easy to implement and can be provided by WasteZero should the City wish to outsource the program. Use of specially marked bags would be consistent with municipalities around Cambridge.

Biweekly collection benefits are significant as are the risks and issues associated with implementation of this option in the near future. This option should be re-evaluated once the organics program is fully operational and the impact of a standard trash container more evident, and considered as part of the 5-year review of the ZWMP.

A clear bag-based trash system was not recommended for the City primarily due to the reduced potential for waste reduction and enforcement issues.

Table 2-12: Recommendations for Trash Disincentives

Initiative	Rationale
Recommended for Implementation in Next 1 to 2 Years	
<p>✓ Standard Trash Container</p>	<ul style="list-style-type: none"> • Easy to enforce by collection workers. • Reduces worker injury. • Can be paired with PAYT for overflow or excess trash. • Potential for increased diversion of recycling and organics. • Potential for trash reduction in the order of 0.3 to 0.5 lbs/hhld/week. • Some level of effort required by DPW staff at outset of program to implement program, and by enforcement staff once implemented for repeat offenders. • Base level of 32 gallons per unit should provide an equitable level of service for all types of housing and provides sufficient capacity for future changes to collection frequency (i.e. biweekly). This was to be confirmed through the collection survey undertaken in 2018.
<p>✓ PAYT (specially marked bags)</p>	<ul style="list-style-type: none"> • Should be considered as an option to provide some flexibility in the amount of trash that residents can place at the curb, particularly in periods like the holiday season. Other options such as occasional ‘double-up days’ could be considered. • Complements standard trash container by providing an option for excess trash. • Residents are more aware of how much waste they are disposing. • Should increase participation in diversion programs. • City can contract with organizations like WasteZero to administer program to lessen impact on City staff resources. • Bags provide more control over volume set out compared to tags. • Specially marked bags are highly visible. • Simple for residents to understand and use. • Easy to enforce for collection workers.
Recommended for Implementation within the Next 10 Years	
<p>✓ Biweekly Trash Collection</p>	<ul style="list-style-type: none"> • Can be a significant driver to increase participation in diversion programs, particularly organics collection. • Potential for trash reduction in the order of 0.3 to 0.8 lbs/hhld/week. • Can be problematic for families with children in diapers, or for people with medical issues. A Special Considerations policy may be required for certain households such as in-home daycares, homes with elderly residents. • Can be implemented at the same time as or following rollout of organics program, standard trash container or PAYT. • Most likely a longer term initiative used to drive participation once organics program is established.
Not Recommended for Near or Long Term Implementation	
<p>✗ Clear Bags</p>	<ul style="list-style-type: none"> • Enforcement of option requires a greater level of effort compared to a specially marked bag, particularly if bags are placed into a semi-automated standard collection container. • Residents may have issues with privacy. • More complex for residents to use. • No financial incentive to reduce waste and/or participate in diversion programs.

2.3 Management of Other Materials

There are some materials currently in the trash stream that could be diverted. The following sections present a discussion on the management of mattresses, carpets, textiles, porcelain and ceramics.

2.3.1 Management of Mattresses

MassDEP estimates that State residents dispose of 600,000 mattresses annually. With a high student population and a high tenancy rate, it is likely that a relatively high percentage of those mattresses are generated in the City. Recycling more mattresses would keep these difficult to manage, bulky materials out of landfills and incinerators and reduce GHG emissions through the recycling of metal springs, conversion of polyurethane foam into carpet padding and shredding the wood frames for use as biomass.

MassDEP is providing grants to encourage municipalities to collect mattresses and make mattress recycling a viable business. UTEC, one of the mattress vendors contracted by the State, has stated they need to recycle 40,000 mattresses to break even, and is hoping to do so in 2017 through increased recycling from colleges, hotels and hospitals.¹⁸

At this time, mattress recycling is a viable option for further consideration in the near-term, and was being considered by the City for early ZWMP implementation. The following table provides an overview of this option.

Table 2-13: Mattress Recycling Overview

Option: Mattress Recycling	
Description of Option	<ul style="list-style-type: none"> Collection and recycling of mattresses.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Mattresses take up valuable airspace in landfills and consist of materials that can be recycled. Mattresses are not easy to disassemble into recyclable components. There are very few processors of mattresses.
Rationale for Consideration	<ul style="list-style-type: none"> Keeping mattresses out landfills and incinerators will preserve airspace and recover recyclable components as wells as reducing GHG emissions.
Cambridge Experience	<ul style="list-style-type: none"> The City of Cambridge does not recycle mattresses, they are either landfilled or incinerated along with other waste collected at the curb.
Case Studies/Examples	<ul style="list-style-type: none"> Rhode Island has a statewide recycling program for discarded mattresses. Consumers are charged a \$10 fee upon purchase to fund collection and recycling programs. Connecticut requires mattress manufacturers to create a statewide recycling program, funded through a \$9 recycling fee levied on purchases of mattresses or box springs. A similar program is in place in California with an \$11 per unit fee.

¹⁸ <https://www.bostonglobe.com/metro/2015/08/16/massachusetts-wants-more-mattresses-recycled/EgMk1Fu11U5z2AlxzTEIDN/story.html>

Option: Mattress Recycling	
Short-term or Long-term Option	<ul style="list-style-type: none"> Implement mattress diversion program in the short- term (early implementation would allow for access to state funding), sustain over the long term.
Interaction with other System Components	<ul style="list-style-type: none"> If the City provides collection, would require a vehicle to collect mattresses unless they are co-collected with electronics or scrap metal/appliances. Requires storage and consolidation of mattresses for shipping to processor, which requires space which is not easy to find at existing City-owned properties/facilities unless contractor collects directly from curb. Requires staff time to apply for grants and paperwork to manage program.
Potential Cost Implications	<ul style="list-style-type: none"> A P&E campaign would be required to educate residents about benefits of recycling mattresses. Potential decrease in waste disposal costs. MassDEP has a grant program to encourage the source separation of mattresses and has three vendors under contract to manage mattresses. These vendors will either collect mattresses, accept mattresses on a per-unit basis or provide collection container rental and hauling. For the vendor located closest to the City (UTEC in Lawrence), the per unit price to process/recycle mattresses delivered to their facility is \$10. This company will also rent roll off containers or 48' trailers to store mattresses ranging from \$80 (40 yd3) to \$200 (48' trailer) and will also collect these storage containers for a fee, depending on distance from the sorting/processing facility. Curbside residential pickup is also available for an additional fee. Municipalities that meet grant terms and conditions will be authorized to utilize a state-contracted recycling Vendor at a subsidized rate for residentially generated, source separated mattresses. MassDEP will pay the transportation and processing subsidy directly to the designated state-contracted Vendors, based on a grant agreement between the municipality and MassDEP¹⁹. It appears that the City was/is eligible for \$82,000 in grants to recycle mattresses in November 2016. The City estimates they could collect 60-80 mattresses every 1 to 2 weeks.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> There is some potential for waste reduction with diversion of 50-70 tons of mattresses annually (0.06-0.08 lbs/hhd/week reduction)²⁰.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> Some potential for reduction in GHG emissions associated with recycling of mattress components and avoided disposal.
General Implementation Requirements	<ul style="list-style-type: none"> P&E material development and distribution/notification. City must apply for grant and coordinate collection/hauling/processing of mattresses. Depending on if the City is collecting mattresses, City would need to find somewhere to store mattresses (potentially in a shipping container at the Recycling Centre). Space would need to be reallocated to accommodate a shipping container in an already constrained area. If the service provider is collecting and transporting mattresses, the program is relatively easy to implement.

¹⁹ <http://www.mass.gov/eea/agencies/massdep/recycle/reduce/mattress-recycling.html>

²⁰ Based on an average weight of 66 lbs (for all sizes of mattresses)

2.3.2 Management of Carpets

Carpets have been identified as priority items for diversion from disposal by the Product Stewardship Institute and the Northeast Waste Management Officials Association as they are another bulky, difficult to manage material. It does not appear that there is any grant program through MassDEP at this time, nor have any vendors been identified that offer service to collect and/or process used carpets for recycling/recovery. Although it seems that there are companies who accept carpet in Massachusetts, it is unclear how this material is recycled. There are some organizations that accept small rugs as part of their textile collection programs (Bay State Textiles) and/or reuse program (The Reuse Center, Habitat for Humanity, Greater Boston) with some providing collection of area rugs.

It is estimated that carpet comprises 3.5% of waste sent for disposal in the U.S. Assuming the same composition for Cambridge trash, approximately 578 tons of carpet could be disposed annually, based on the potential amount in the residential waste stream managed by the City. The estimated generation rate is approximately 36 pounds per household annually.

At this time, implementing a diversion program for carpets is not recommended for further consideration in the near future, due to the lack of current collection and processing opportunities. This option may be re-evaluated upon review of the Zero Waste Master Plan in 5 years. The following table provides an overview of this option.

Table 2-14: Carpet Recycling Overview

Option: Carpet Recycling	
Description of Option	<ul style="list-style-type: none"> Collection and recycling of carpets.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Carpets take up valuable airspace in landfills and consist of materials that can be recycled. Accounts for approximately 1% of the waste stream by weight or 2% by volume (US EPA). There are very few carpet processors, either locally or State-wide.
Rationale for Consideration	<ul style="list-style-type: none"> Keeping carpets out landfills will preserve airspace and recover recyclable components which would reduce GHG emissions.
Cambridge Experience	<ul style="list-style-type: none"> The City of Cambridge does not recycle carpets, they are either landfilled or incinerated.
Case Studies/Examples	<ul style="list-style-type: none"> California has a stewardship program for carpets, with a fee of 25 cents per square yard levied on carpet sold to find ways to support development of end markets for recycled carpet products, underwrite collection and transfer of carpet to/from drop-off sites and for promotion and education.
Short-term or Long-term Option	<ul style="list-style-type: none"> Monitor opportunities for grants associated with carpet recycling and development of processing facilities in the medium-long term.
Interaction with other System Components	<ul style="list-style-type: none"> Would require separate collection and delivery to processor. Would require staff time to apply for grants and paperwork to manage program.

Option: Carpet Recycling	
Potential Cost Implications	<ul style="list-style-type: none"> • A P&E campaign would be required to educate residents about benefits of recycling. • Potential decrease in waste disposal costs. • It is unknown at this time if grants/funding for recycling would be available.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • With a capture rate of 40-50%, there is potential for waste reduction with diversion of approximately 230 - 290 tons of carpet annually or <1% of trash (approximately 0.3-.4 lbs/hhld/week)²¹ with curbside collection. Should residents be required to take their carpet to a drop-off point, the amount diverted would be much less (approximately <.1 lbs/hhld/week).
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Some potential for reduction in GHG emissions associated with recycling of carpet and avoided disposal.
General Implementation Requirements	<ul style="list-style-type: none"> • P&E material development and distribution/notification. • Identification of a carpet processor and procurement of services.

2.3.3 Textile Collection and Recycling

The US EPA estimates that the average US citizen throws away 70 pounds of clothing and textiles annually and that only 15% is recycled²². Based on a population of approximately 110,000, over 6 million pounds or almost 3,300 tons of textiles may be generated and disposed of by residents of Cambridge. Many municipalities rely on non-profit agencies to collect and process textiles, however, un-manned and overflowing donation bins can be a challenge for municipalities. Bins may be placed on private property without permission, and can become a dumping ground for unwanted household goods.

Jurisdictions in the US and abroad have implement various initiatives to reduce quantities of textiles disposed including:

- campaigns to raise public awareness about the value of clothes and encourage people to repair and care for their clothes to make them last longer. Workshops are offered on how to mend and sew clothes;
- development of drop-off opportunities targeting older clothes and household textiles that would not be sent to a charitable organization for reuse;
- curbside collection of textiles;
- collaborative efforts with industry to improve the sustainability of clothing from manufacturing to end of life; and,
- EPR programs targeting clothing, household linens and footwear.

²¹ Based on the estimates of carpet comprising 3.5% of trash disposal, and Cambridge managing approximately 10% of carpet generated in Cambridge.

²² <http://www.weardonaterecycle.org/>

The City could develop a textile collection strategy, which would build on the current system to divert additional materials from disposal. The City could work with existing community resource to implement a pilot program targeting different types/quality of textile goods (e.g. worn clothing, shoes, handbags) and/or different participants in textile collection (e.g. schools, markets, retailers) to collect information on the amount of textiles that can realistically be captured and market opportunities for these specific textiles. Textiles could also be collected at the Recycling Center. The City could identify partners to help promote textile collection and establish collaborative partnerships to assume roles in reuse and recycling. Staff time and resources would be required to carry out market research, establish the program, and develop a campaign and messaging along with a dedicated website information and promotional materials. Alternatively, the City could implement a curbside textile and small household goods collection program using the services of an existing organization, like the curbside collection service provided by Simply Recycling in the City of Somerville.

Development of a textile collection and recycling strategy is recommended to be carried forward for evaluation. This strategy would increase awareness of the benefits of recycling/reused of used textiles, reduce the amount of textiles in the garbage stream and reduce GHG emissions through avoided methane emissions through decomposition of fibers and fabrication of new products.

The following table provides an overview of this option.

Table 2-15: Textile Collection and Recycling Overview

Option: Textile Collection and Recycling	
Description of Option	<ul style="list-style-type: none"> Develop a textile diversion awareness campaign and strategy to keep textiles from disposal. Look at options to expand/promote depot style collection, or curbside collection based on services available from existing organizations.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> Potential to divert over 3,000 tons of textiles from disposal annually. Potential to partner with for- or non-profit agencies to collect and/or recycle textiles.
Rationale for Consideration	<ul style="list-style-type: none"> Keeping textiles from landfill will preserve airspace, preserve natural resources and reduce GHG emissions.
Cambridge Experience	<ul style="list-style-type: none"> The City of Cambridge does not collect textiles, but promotes diversion through non-profit agencies and businesses.

Option: Textile Collection and Recycling	
Case Studies/Examples	<ul style="list-style-type: none"> • In Massachusetts, Bay State Textiles provides collection containers at a number of schools (approximately 430) throughout the state and provides rebates to the schools based on the weight of donations. Bay State Textiles is also affiliated with the used clothing collection trailer located in various communities where residents can drop off textiles and shoes. • WasteZero offers a curbside textile collection program with a rebate offered to municipalities through a partnership with Simple Recycling. • Residents in San Francisco, CA are encouraged to place out textiles with their bulky item recycling curbside collection or they can schedule a special textile collection. Textiles do not count towards the no-charge curbside collection annual limit. • The City of Austin, TX has partnered with a for-profit recycler, Simple Recycling, who collect textiles free of charge. Simple Recycling provides all resources including provision of special green bags for residents to use, and pays the City of Austin \$20 per ton of material collected. • The City of Markham, ON has banned textiles from disposal and is the first municipality in North America to do so. Residents must take their textiles to donation containers located across the City. There are over 50 City-managed bins located at fire stations and recycling depots as well as being placed in 60 multi-residential buildings. Donation containers contain sensors to detect fullness and signal when a bin needs emptying. The City has partnered with two non-profit agencies to collect and recycled all donated textiles. The City has a clear garbage bag program which makes it easy for collection staff to enforce and estimates textile diversion alone can save the City \$86,000. • In New York City, textiles can be dropped off at 30 Greenmarkets held throughout the City through GrowNYC or through a program (re-fashionNYC) run by the Department of Sanitation through a partnership with a non-profit agency (Housing Works) where bins are placed in multi-residential buildings and textiles collected to support the agency.
Short-term or Long-term Option	<ul style="list-style-type: none"> • Implement in the short-term, monitor other opportunities for funding or diversion in the long term.
Interaction with other System Components	<ul style="list-style-type: none"> • Could integrate textiles into regular curbside program. • Can be combined with depots or drop-offs. • Can be combined with a clear bag program. • Textiles drop-off could be provided at Recycling Center.
Potential Cost Implications	<ul style="list-style-type: none"> • Potential for revenue depending on service provider. • Could decrease trash disposal costs. • Potential additional costs are small, predominantly for staff time and P&E materials.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Potential for substantial diversion depending on the range of materials accepted. • At 50% capture of textiles that may be disposed of, approximately 10% or 1,500 tons of textiles could be diverted annually. This equates to a trash reduction of approximately 1.8 lbs/hhd/week.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Potential for GHG emissions reduction with avoided methane emissions from landfill and through reduced manufacturing of new products.
Potential for System Efficiencies and Improvements in Level of Service	<ul style="list-style-type: none"> • Collection could be incorporated into other collection programs or through partnerships with for or non-profit organizations.

Option: Textile Collection and Recycling	
Potential Processing or Disposal Capacity Requirements	<ul style="list-style-type: none"> Requires some storage capacity or ability to deliver collected material to a processor if collection provided by City. Could result in reduced disposal capacity requirements.
General Implementation Requirements	<ul style="list-style-type: none"> Staff time to plan and deliver City-provided program and/or develop and maintain partnership with another agency/organization. P&E program required for residents to inform them of all materials accepted in the program.

2.3.4 Porcelain and Ceramic Recycling

Among the items currently collected as trash are porcelain and ceramic items which can be recycled. Items such as toilets, urinals, bath tubs, sinks, bidets, tiles and countertops can be recycled. Toilets are typically recycled by crushing the ceramic and porcelain which can be added as a feedstock or dry aggregate for building materials, including asphalt and concrete. Additionally, metal and plastic components can be separated and recycled. This program could be combined with programs that promote water conservation, such as rebates for low-flush toilets where residents are provided with a rebate for recycling and replacing less efficient toilets.

Storage of these items may be an issue for the City as they are bulky. These items could be collected along with bulky or scrap metal items and stored at the DPW yard until there are sufficient quantities to haul to a processor.

This could be a long-term option for the City to consider to assist with achieving their waste reduction goals.

The following table provides an overview of this option.

Table 2-16: Porcelain and Ceramic Recycling Overview

Option: Porcelain and Ceramic Recycling	
Description of Option	<ul style="list-style-type: none"> Develop a strategy to divert porcelain and ceramic materials from disposal.
Gap/Challenge/Opportunity	<ul style="list-style-type: none"> These materials are bulky and heavy, do not break down in a landfill or burn in a thermal treatment facility. Grinding up these materials results in a material that can be used in road construction or landfill cover. Metal and plastic parts can be recycled.
Rationale for Consideration	<ul style="list-style-type: none"> Option would keep these materials out of the disposal stream. Porcelain and ceramics can be recycled.
Cambridge Experience	<ul style="list-style-type: none"> The City collects these items at the curb along with regular trash. The City website provides links to two businesses that sell used toilets and/or recycles sinks and toilets in Massachusetts.
Case Studies/Examples	<ul style="list-style-type: none"> In Fort Collins, CO, toilets and urinals are recycled for free and crushed porcelain combined into an aggregate to be used as road base. Two large municipalities in Ontario (Toronto and Region of Durham) provide curbside collection of toilets at no charge.
Short-term or Long-term Option	<ul style="list-style-type: none"> Implement in the medium-long term option, monitor other opportunities for funding or diversion in the long term.

Option: Porcelain and Ceramic Recycling	
Interaction with other System Components	<ul style="list-style-type: none"> • Could integrate with bulky waste collection. • Could form part of a program to conserve water.
Potential Cost Implications	<ul style="list-style-type: none"> • Could decrease trash disposal costs. • Some cost associated with storage, haulage and processing of collected material.
Potential Effect on Waste Reduction	<ul style="list-style-type: none"> • Potential for minimal waste reduction (approximately 32 tons or <1% annually) depending on the range of materials accepted²³ which equates to approximately 0.04 lbs/hhd/week.
Potential Effect on GHG Emissions	<ul style="list-style-type: none"> • Some avoided emissions as crushed porcelain and ceramic could replace materials used in road bed construction. • Preservation of landfill airspace, prolonging life of landfill.
Potential for System Efficiencies and Improvements in Level of Service	<ul style="list-style-type: none"> • Collection could be incorporated into other collection programs or through partnerships with for or non-profit organizations.
Potential Processing or Disposal Capacity Requirements	<ul style="list-style-type: none"> • Requires some storage capacity or ability to deliver collected material to a processor if collection provided by City. • Could result in reduced disposal capacity requirements.
General Implementation Requirements	<ul style="list-style-type: none"> • Staff time to plan and deliver City-provided program and/or develop and maintain partnership with another agency/organization. • P&E program required for residents to inform them of all materials accepted in the program.

2.3.5 Recommendations for Management of Other Materials

The following presents the recommendations for management of other materials. It is recommended that the City consider collection and recycling of mattresses and textiles. There is existing infrastructure in place to manage these materials and either funding or revenue available at this time. Recycling of carpets, porcelain and ceramics is not recommended in the near future as there is no viable market for these difficult to manage materials, however they could be considered in the ZWMP review in five years to determine if circumstances would support developing a program for this materials.

²³ It is estimated that between 8 and 10 million toilets are sold annually in the US. On a per capita basis, approximately 3,000 toilets may be installed annually in Cambridge. If the City manages 10% of those, approximately 14 tons of toilets may be collected annually, assuming the remainder are handled by the private sector (e.g. renovation/construction companies). As a rough estimate, it was assumed that the same tonnage of sinks and bathtubs may also be managed for a total of 28 tons of porcelain and ceramics managed.

Table 2-17: Recommendations for Management of Other Materials

Initiative	Rationale
Recommended for Implementation within the Next 5 Years	
<p>✓ Mattress Recycling</p>	<ul style="list-style-type: none"> • Early initiative for implementation • Funding is available through MassDEP. • There is a local vendor who can manage collection and/or processing. • Would support local companies and keep difficult to manage material out of landfill/EFW. • Reduces GHG emissions. • Much of a mattress/box spring is recyclable. • Easy to integrate into existing program as City already collects mattresses. • Contributes to waste reduction goal. • Potential waste reduction of <1 lbs/hhd/week • Value in supporting recycling initiatives which could lead to a stewardship program, even though presently, Cambridge does not manage a large quantity of mattresses.
<p>✓ Textile Collection and Recycling</p>	<ul style="list-style-type: none"> • Early initiative for implementation based on existing collection and processing opportunities. • City can procure services of external vendor to collect and process materials. • Greatest potential for contributions to reaching waste and GHG emission reduction goals. • Potential for revenue depending on service provider. • Potential waste reduction of 1.8 lbs/hhd/week.
Not Recommended for Near Term Implementation (keep for longer term implementation – within the Next 10 to 20 Years)	
<p>✗ Carpet Recycling</p>	<ul style="list-style-type: none"> • No source of funding available. • Lack of collection and processing opportunities. • Recyclability of carpets depends on composition. • City manages small fraction of material generated, mostly handled by private sector. • Potential waste reduction of <0.1 lbs/hhd/week
<p>✗ Porcelain and Ceramic Recycling</p>	<ul style="list-style-type: none"> • Materials would require storage until sufficient quantities amassed to send to processor. • Lack of collection and processing opportunities. • No source of funding available. • City manages small fraction of material generated, mostly handled by private sector. • Potential waste reduction of <0.1 lbs/hhd/week