CITY OF NORTHAMPTON
SOLID WASTE MANAGEMENT
ALTERNATIVES STUDY

REPORT

FINAL DRAFT

Prepared for
City of Northampton
Department of Public Works

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In Association with
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APPENDICIES

1.0 Section 1 - Introduction

The City of Northampton (City) owns the Northampton Sanitary Landfill that is scheduled to close in June 2011. The City Board of Public Works (BPW) has undertaken this study of solid waste management alternatives in anticipation of closing the existing landfill.

This study is organized in chapters as follows:

Section 1 provides a discussion of the state-wide regulatory setting that is the background for all aspects of solid waste management planning. An overview of the existing solid waste program is also provided. Section 2 presents a summary of the existing waste-shed and users of the landfill. Also provided is information about the composition of the solid waste generated. Information about Zero Waste planning is presented in Section 3 with a summary of existing Citywide waste diversion efforts and suggestions for how the City can move ahead with expanded waste diversion efforts. An important aspect in maximizing waste diversion is source separated organics (SSO) management.

Section 4 reviews alternative, innovative technologies for solid waste management that are being used in this country, the mid-east, Japan and in Europe. The purpose of this review is to determine whether alternative solid waste technologies are financially feasible and whether they have renewable energy or environmental benefits that are considered better than more traditional disposal technologies, such as landfilling. Are any of these new technologies considered viable alternatives for a community like Northampton?

Section 5 provides information about waste and recycling collection, including an overview of the existing collection systems as well as alternative options. Section 6 summarizes the availability of alternative transfer stations and disposal facilities.

Section 7 focuses on the financial aspects of the proposed landfill expansion. A sensitivity analysis is presented to determine the theoretical break-even tonnage and revenue for the proposed landfill expansion. The purpose is to focus on the regional aspects of the current landfill operation and evaluate the sensitivity of the financial feasibility of the Phase 5 landfill expansion to the permitted tonnage. In other words, it evaluates whether a continued regional landfill operation is warranted from a financial perspective or whether the future Phase 5 landfill can be operated at a reduced tonnage rate in order to extend the landfill life. This analysis will answer the question about whether the landfill expansion can be operated to serve Northampton only. Consideration is given to the financing risks of the proposed expansion.

An evaluation of several solid waste management options is contained in Section 8. These options include:

- Option 1 Current Collection System– Expand Landfill
- Option 2 Current Collection System - Close landfill
- Option 3 City-Wide Contract for Curbside Collection – Expand Landfill
- Option 4 City-Wide Contract for Curbside Collection – Close Landfill

- Option 5 Provide No Service - Close landfill

Section 9 discusses the permitted landfill as an asset that has a value to the City. Alternative project implementation and financing options are explored. Section 10 presents a summary and conclusions for the study.

The overall goal of the study is to provide the information needed to make a decision for the future of solid waste management for the City.

1.1 REGULATORY SETTING

The Commonwealth of Massachusetts plays a major role in determining the various aspects of state-wide solid waste management. Since 1990, the Commonwealth has developed goals, objectives and a hierarchy for the management of municipal solid waste that are described in the document entitled "Toward a System of Integrated Solid Waste Management" (Master Plan). The Master Plan was last updated in 2006, with periodic solid waste data updates also published by the Department of Environmental Protection (DEP). The 2006 Master Plan established a plan and vision for solid waste management for the period 2001-2010. The Master Plan set goals of 70 percent waste reduction and 56 percent recycling by the year 2010.

DEP is currently preparing a new Draft Master Plan for release to the public in summer 2009, with a final plan being issued in 2010.

The Master Plan and associated regulations guide the direction of solid waste management programs and systems state-wide. It is this state-wide system of markets and facilities that must be considered as the City of Northampton moves forward with its own planning efforts.

The DEP uses various tools to implement the priorities established in the Master Plan. One tool that was first used in 1990 is the use of a waste disposal ban on certain materials. This ban is implemented by the Solid Waste Management Facility Regulations (310 CMR 19.000). Currently, the following materials are banned from disposal: lead batteries, leaves and other yard wastes, tires, white goods, aluminum containers, metal or glass containers, single polymer plastics, recyclable paper, cathode ray tubes, asphalt pavement, brick and concrete, and wood. The establishment of waste bans on certain materials has a strong impact on market development for recycling of these materials, as well as a trigger for investment in the facilities needed to collect, sort, process and recycle these products.

Generally, other tools employed by DEP as stated in the Master Plan include "expanding and targeting waste ban compliance and enforcement, leveraging resources and building partnerships, and prioritizing materials and sectors where the greatest amount of waste reduction can be achieved."

In the last few years DEP efforts have included a wide variety of successes including the following sample taken from the DEP website (www.mass.gov/dep):

- **Product Stewardship:** Funded Product Stewardship Institute. DEP worked with the carpet industry and other states to implement the Carpet America Recovery (CARE)

agreement; secured a $50,000 Electronics Industry Alliance grant on electronics collection with Massachusetts Goodwill facilities; and worked with Bottle Bill stakeholders to develop recommendations to support revisions to the Bottle Bill regulations.

- **Source Reduction:** Assisted 30 municipalities considering Pay As You Throw (PAYT) programs; continued to award home compost bin grants and hold workshops; and facilitated surplus equipment exchanges for municipalities. Provided grants to eight new municipal PAYT programs.

- **Hazardous Products Reduction:** Supported development of regional collection programs; provided six school chemical management grants and supported other efforts to remove mercury from schools and hospitals; funded workshops on reducing use of pesticides and fertilizers.

- **Commercial Recycling and Composting:** Expanded the Supermarkets Recycling Organics Initiative to more than 50 stores; developed a food waste recycling brochure for haulers and fact sheet; established Earth911's Business Recycling Website with Earth911 and Staples, Inc.; and established business recycling partnerships in nine municipalities.

- **Residential Recycling and Composting:** Funded 22 technical assistance projects; provided targeted recycling and composting equipment grants; held Annual Waste Reduction forums; and held extensive workshops and training sessions.

- **Market Development:** Awarded four Recycling Industry Reimbursement Credit (RIRC) grants for more than $150,000, leveraging an additional $270,000 in matching funds for development of organics and C&D processing capacity; and awarded a loan of $185,000 to a composting business through the Recycling Loan Fund. Issued $1.2 million in Recycling Loan Fund loans; established a business Recycled Product Purchasing Collaborative; and helped state agencies to purchase $60 million of recycled products.

- **Household Hazardous Products:** Increased the number of municipal mercury collection programs to 232 through overseeing combustion facility material separation plans, and also through providing municipal grants, increased municipal HHP collection programs through grant programs.

- **Construction and Demolition Debris (C&D):** Established a waste ban on asphalt, brick and concrete, wood and metal; worked with the C&D Subcommittee and Work Groups on C&D processing, market development, and other issues; supported a clean wood separation study; completed a wood market analysis; and worked with gypsum manufacturers and other stakeholders to increase recycling of gypsum wallboard.

As the City moves forward with planning the future of solid waste management, it generally needs to move forward in sync with the DEP state-wide planning efforts and with the programs, grants and other opportunities that may be available. As the examples above describe, the DEP offers grants and technical assistance with waste diversion activities that can be considered part of a Zero Waste Plan for the City of Northampton. In addition, the planning for any new facility development may be eligible for grant assistance and will also be subject to the regulatory requirements established by DEP.

Within this study other references to the DEP Master Plan and regulations will be mentioned when they play a role in decision-making. All readers are encouraged to visit the DEP website and become more familiar with their efforts on state-wide solid waste planning.

1.2 CURRENT SOLID WASTE MANAGEMENT SYSTEM

The City of Northampton provides a variety of solid waste management related services to the residents, businesses and institutions of the City. This section provides an overview of the current City system of solid waste collection, hauling, recycling and disposal. Other sections of the report provide additional detail regarding specific waste diversion and recycling programs.

1.2.1 Waste and Recycling Collection

The City provides two recycling and waste drop off facilities for use by Northampton residents. One facility is located on Locust Street and the other on Glendale Road. In addition to solid waste, the residential drop-off centers located at the landfill and Locust Street site accept recyclables such as paper, cardboard, glass and plastic bottles, and cans. Other materials are also collected and diverted for recycling or reuse, including waste oil, antifreeze, mercury containing products, fluorescent lamps, car batteries, rechargeable batteries, yard waste, bulky waste items (such as mattresses and tires), clean wood, metal and electronic waste items (TVs, computer monitors). The residential drop-off center at the landfill is open from 7:00 am to 3:00 pm Monday – Friday and 7:00 am to noon on Saturday. The Locust Street drop-off center is open 7:00 am to 4:00 pm Monday – Saturday.

Residents are required to purchase a vehicle permit for $25/year to have access to these facilities. The vehicle sticker permit fee for senior citizens is $5/year. Vehicle permits for recycling-only are issued at no cost.

Residents are also required to purchase a bag sticker for each bag of solid waste discarded. Currently, a bag sticker cost $1. The sticker is divided in four parts to be used as follows:

- Full sticker – Maximum 40 gallons (30 pounds)
- Half sticker – Maximum 20 gallons
- Quarter sticker – Maximum 10 gallons

Residents also have the option of having their waste and recycling picked up at the curb by contracting with one of several local haulers. Local businesses and institutions also contract with haulers in the area for waste collection and hauling to the Northampton Landfill or other regional disposal facilities. Small commercial companies that self-haul are required to purchase a commercial permit for $75/year per vehicle, which allows access to all city solid waste facilities. A large commercial waste hauler vehicle permit is $150/year.

Section 3.3 of this report provides additional details about specific materials that are collected at the drop off centers and diverted from the landfill.

1.2.2 Hauling

Recyclables that are collected at the Locust Street drop off facility are hauled by the City to the Springfield Materials Recycling Facility (MRF). Solid waste that is collected at the Locust Street drop off facility is hauled by the City to the Northampton Landfill. Scrap metal from Locust Street is also hauled by City staff to scrap metal dealers.

Recyclables that are collected at the Glendale Road drop off center are hauled by Solid Waste Solutions (SWS) to the Springfield MRF. Waste collected at the drop off is moved to the landfill by SWS. Scrap metal collected at the landfill is hauled by SWS to scrap metal dealers.

1.2.3 Waste Disposal and Composting

The City of Northampton owns a municipal solid waste landfill off Glendale Road that serves the waste disposal needs of the Northampton residents, municipal departments and local businesses and institutions. A leaf and yard waste composting operation is also maintained adjacent to the landfill. The composting site is open to City residents and to commercial users for the disposal of leaf and yard waste.

The landfill is permitted to dispose of up to 50,000 tons per year of municipal solid waste (MSW) and is expected to reach capacity by the middle of 2011. In addition to City residents and businesses, there were 16 area communities that used the landfill in calendar year 2008. These communities have a Memorandum of Understanding (MOU) with Northampton for use of the Northampton Landfill. The MOU allows each community to dispose of their waste at the landfill but does not obligate a community to send their waste to the landfill. Member communities are required under the MOU to implement waste diversion programs to ensure that materials banned from landfilling by DEP regulations, such as unacceptable or recyclable materials, are not disposed. About 8 percent of the waste landfilled, or about 4,000 tons per year, is from the City of Northampton drop off areas or from City Schools and other City Departments. A detailed discussion of the landfill users and waste-shed is provided in Section 2.0.

The City charges the following day pass fees for one time use of the landfill:

$5.00	any vehicle used by a City resident
$10.00	any vehicle used by a non-resident

Currently, the tip fee at the landfill is $72.50/ton. In addition, the City employs a tier discount system for large commercial customers based on the total amount of each monthly invoice, applied as a rebate on the monthly invoice if the outstanding balance is paid in full within 45 days. The current tier structure is as follows:

Greater than $25,000/month = $5.00/ton discount
Greater than $50,000/month = $7.50/ton discount
Greater than $75,000/month = $10.00/ton discount

Clean wood waste is accepted as a recyclable material with a tipping fee of $25/ton. Commercial users of the composting facility are charged $25/ton for dropping off leaf and yard waste.

The City staffs and manages the financial aspects of the landfill, including using City staff to run the scale operations and the drop off center. Operation of the landfill, including managing the waste disposal area, compaction and cover activities is through a contract with Solid Waste Solutions (SWS). SWS also manages and coordinates deliveries of daily and intermediate cover material required to cover the landfilled waste. This cover material may include DEP approved alternative cover materials such as auto shredder residue, catch basin cleanings, contaminated soils, and other materials. The City receives revenue for the acceptance of the various cover materials as a per ton tipping fee that is shared with SWS (currently at $4/ton). SWS is also responsible for operating the composting facility.

1.2.4 Solid Waste Enterprise Fund

Solid waste management finances in the City are managed using of a Solid Waste Enterprise Fund (SWEF). This enterprise fund operates similarly to a business: revenues and expenses are tracked in an isolated account. In this case, the solid waste enterprise fund is managed separately from the City General Fund.

The SWEF generates revenue in a variety of ways including:

- Tip fees paid by landfill users
- Residential vehicle sticker permit fees
- Pay by bag sticker fees
- Revenue generated from materials that are recycled at the Springfield Materials Recycling Facility
- Revenue from scrap metal recycling
- Royalty payments for energy produced from landfill gas
- Lease payments for the cell tower on the landfill property
- Interest income

For Fiscal Year 2010 the total revenue projected is about $4.6 million, of which about $3 million is raised from tip fees at the landfill. (Note that about $1.15 million of revenues in FY2010 is a transfer from the landfill closure fund to pay for closure related expenses.)

Expenses that are paid through the SWEF typically include:

- Landfill operations costs, including City staff and private contractors
- Leaf and yard waste composting costs
- Operations costs for 2 drop off centers, including City staff and private contractors
- Capital costs associated with landfill capping and other construction projects
- Host Community Fee transferred to the General Fund
- Payment in Lieu of taxes (PILOT)
- Direct and Indirect costs for City Hall Staff salaries
- Free waste disposal for the School Department, Smith Vocational High School, Parks and Recreation Department, Housing Authority, Police and Fire Departments, Municipal Buildings, Council on Aging, Child's Park, Look Park and authorized community cleanups.

For the Fiscal Year 2010 budget the host community fee is $468,000, the PILOT is $19,500, the direct and indirect expenses are $345,000, and the value of free waste disposal to City Departments is about $43,500. The above items total about $876,000 that contributes to the City General Fund through cash or services.

The financial planning of any solid waste management facilities, whether the Phase 5 landfill expansion, an organics composting facility, or other facility requiring capital investment, will be developed within the enterprise fund system. A financial evaluation must be able to clearly exhibit that any proposed facility construction and operation is financially self-sustaining with revenues generated from operations.

2.0 Section 2 - Waste Generation and Composition

2.1 WASTE SHED SUMMARY

This section presents an overview of the waste shed that currently uses the landfill. This presentation is aimed at providing an understanding of the current landfill service area. In subsequent sections of this report, waste shed size will be a factor considered in Phase 5 Landfill operations and financing. Options for solid waste management will also include options that pertain to the City of Northampton waste only.

2.1.1 City and Town Waste

The Northampton Regional Sanitary Landfill accepts solid waste that is delivered from municipal collection systems in many surrounding communities. In 2008, sixteen municipalities delivered waste to the landfill. The City has contractual arrangements with these 16 communities (i.e., utilizing a "Memoranda of Understanding", hereinafter referred to as a "MOU"). An MOU allows a municipality to use the landfill, but does not require that the community to send their waste to the Northampton Landfill. The MOU guarantees continuous access to the facility for the disposal of waste materials for a period of five years as well as a base price for disposal, which can be reduced but not increased. The MOU also addresses a variety of facility restrictions and conditions. Municipalities with an MOU must agree to establish, maintain and/or regularly participate in diversion programs that are necessary to ensure that unacceptable or recyclable materials (as defined in the MOU) are not delivered to the Northampton landfill for disposal. For example, all member municipalities must have an established mandatory recycling ordinance, access to at least one household hazardous waste (HHW) collection each year and localized systems for diverting source-separated materials (e.g., waste ban materials) to recycling and composting facilities.

Many of the area communities with MOUs are associated with the Hilltown Resource Management Cooperative (HRMC). The HRMC was established in 1989 with eleven member towns including Ashfield, Chesterfiled, Cummington, Goshen, Hatfield, Huntington, Middlefield, Plainfield, Westhampton, Williamsburg and Worthington. The Town of Hatfield left the HRMC in 2005. In the early 2000s the Franklin County Solid Waste Management District (FCSWMD) delivered solid waste from many if its 21 communities. The FCSWMD was established in 1989 with 21 member towns. Currently, Gill is the only FCSWMD community using the landfill.

As depicted in Table 2-1, Municipal Waste Programs Using Northampton Landfill, the 16 towns with MOU's delivered a total of 5,399 tons of waste in calendar year 2008. Also shown on this table is the recycling rate for each community, reflective of their efforts at waste diversion in accordance with MOU and DEP requirements. The City of Northampton drop-off centers collected and disposed of 3,925 tons of waste in 2008. See Table 2-2, Municipal Waste Disposal Tonnage, City of Northampton. In summary, municipal waste collection programs accounted for 9,324 tons of waste in 2008, or about 18.8 percent of the total amount of waste tonnage.

2.1.2 Commercial Waste Haulers

The four major waste haulers (Allied Waste Services, Alternative Recycling Systems, Duseau Trucking and Waste Management) delivered more that 60% of the total tonnage disposed at the Northampton landfill in 2008. Waste delivered to the landfill by commercial haulers is classified as commercial. See Table 2-3, Major Waste Hauler Tonnage.

A significant portion of the waste classified as commercial is actually residential waste that is commingled with the commercial waste stream. These diverse sources of waste are collected with refuse collection vehicles (i.e., packer trucks) with combined collection routes. The trash dumpsters that serve condominiums and apartments are collected on the same route as nearby restaurants and office buildings.

Some businesses and institutions self-haul their waste, but most of these establishments contract for waste collection with one of the major haulers. All waste delivered by major haulers from residential, commercial and institutional sources is classified as “commercial waste” at the Northampton landfill. The data that is collected at the scale-house cannot be subdivided into residential, commercial, institutional or industrial waste. A considerable percentage of the commercial waste delivered to the landfill is from residential subscription services in Northampton, Easthampton, Hatfield and other neighboring municipalities.

While commercial waste haulers generally maintain both residential and commercial accounts, they tend to specialize in one or the other. Within City limits, Duseau Trucking’s waste tonnage is reportedly 50/50 residential vs. commercial, Alternative Recycling System is closer to 30/70, and Waste Management is almost all commercial.

The dominant business sectors in and around the City of Northampton are services (including healthcare and education), retail and wholesale trade, government, and hospitality (lodging, food services, arts, entertainment and recreation). Commercial businesses include restaurants, hotels, medical offices, grocery stores, printers, retail offices and general commerce.

Table 2-1

Municipal Waste Programs Using the Northampton Landfill

Municipality	Direct Haul, Tons	Recycling Rate	MOU	PAYT	Comments
Amherst	349	16%	X	X	Individual MOU
Ashfield	417	48%	X	X	HRMC
Chesterfield	181	51%	X	X	HRMC
Cummington	249	41%	X		HRMC
Gill	214	44%	X	X	FCSWMD
Goshen	169	53%	X	X	HRMC
Granville	242	40%	X	X	Individual MOU
Hadley	430	n/a*	X	X	Individual MOU
Hatfield	315	n/a*	X	X	Individual MOU
Huntington	491	45%	X	X	HRMC
Middlefield	149	39%	X		HRMC
Plainfield	116	58%	X	X	HRMC
Southampton	825	64%	X	X	Individual MOU
Westhampton	345	46%	X	X	HRMC
Williamsburg	577	38%	X		HRMC
Worthington	272	53%	X	X	HRMC
Subtotal	**5,399**				16 municipalities
Northampton	3,925	34%	N/A	X	RSW & Bulky Waste From 2 Drop-off Facilities
Total	**9,324**				

Notes:

MOU – Memorandum of Understanding
PAYT – Pay as You Throw
HRMC – Hilltown Resource Management Cooperative
FCSWMD – Franklin County Solid Waste Management District
RSW – Residential Solid Waste

Table 2-2

Municipal Waste Disposal Tonnage

City of Northampton	Tons Disposed
Locust Street Department of Public Works Drop-Off	1,909
Northampton Landfill Drop-Off	1,322
Public Schools and Parking Division	384
Exempt (1)	194
Wastewater Treatment Plant Residuals (Grit)	116
Total	**3,925**
Percent of CY 2008 Waste Disposed	**7.9%**

Regional Towns	Tons Disposed
Hilltown Resource Management Cooperative (HRMC)(2)	2,965
Southampton	825
Hadley	430
Amherst	349
Hatfield	315
Granville	242
Gill	214
Easthampton (Wastewater Treatment Plant Grit Only)	59
Total	**5,399**
Percent of CY 2008 Waste Disposed	**10.9%**

Notes:

(1) Includes: All City Departments, Northampton Housing Authority, Child's Park, Look Park, and Authorized Community Cleanups.
(2) HRMC includes the towns of: Ashfield, Chesterfield, Cummington, Goshen, Huntington, Middlefield, Plainfield, Westhampton, Williamsburg and Worthington.

Table 2-3

Major Waste Hauler Tonnage

Major Haulers	Tons Disposed
Duseau Trucking	11,436
Waste Management	8,671
Alternative Recycling Systems	5,613
Allied Waste Systems	4,531
Wickles Trucking	52
Total	**30,303**
Percent of CY 2008 Waste Disposed	**61.3%**

The following is a brief summary of Northampton's manufacturing sector. Industries in Northampton include Kollmorgen (periscopes, optical sensors), Perstorp Compounds (molding compounds and products), Minute Maid Company (soft drink packaging), Packaging Corp of America (corrugated boxes and displays), Millitech (satellites, radar, sensing devices), Chartpak (graphic symbols and markers), Yankee Hill Machine Company (machine products), Florence Casket (caskets), MicroCal (biotech instrumentation) and Berkshire Electric Cable (insulated copper wire).

2.1.3 Self-Haulers of Waste

The Northampton landfill has a variety of customers that can be classified as small hauling/cleanout services, institutions, and self-hauling businesses. Refer to Table 2-4 Small Haulers, Major Business and Institutional Customer Tonnage.

Small Hauling/Cleanout Services

The Northampton landfill currently serves 10 dedicated small hauling businesses. In general, these small haulers use roll-off containers ("short boxes"), box trucks and dump trucks/trailers rather than employing packer trucks and dumpsters. The type of work that they do may be described as property cleanout services (estates, attics, barns, sheds, basements, yards, etc.), appliance and bulky waste removal, and construction and demolition debris disposal. Their total annual tonnage accounted for about 4,211 tons or 8.5% of the total waste disposed in 2008.

Institutions

Institutions such as Smith College, Deerfield Academy and Eaglebrook School have been included in the self-hauling category because they deliver waste in their own packer trucks (note: the University of Massachusetts, which employs a major hauling company, is an exception in this case). The Northampton landfill also serves the Clarke School for the Deaf, the Hampshire County Jail and the VA Hospital. These seven local institutions contributed about 1800 tons or 3.6% of the total waste disposed in 2008.

Table 2-4

Small Haulers, Major Business and Institutional Customer Tonnage

Hauling/Cleanout Services	Tons Disposed
B'n'B	1,443
Allen's Roll-off	1,210
One Call Does It All	686
QuadCom Carting	278
Baldwin's	166
Martin's Farm	138
Sticks & Stones	130
Short Haul	66
Dan's Odd Jobs	51
Northstar Disposal	41
Total	**4,211**
Percent of CY 2008 Waste Disposed	**8.5%**

Institutional Customers	Tons Disposed
Smith College	836
University of Massachusetts	358
Veteran's Administration (VA) Hospital	266
Deerfield Academy	201
Eaglebrook School	74
Clarke Scholl for the Deaf	24
Hampshire County Jail	15
Total	**1,775**
Percent of CY 2008 Waste Disposed	**3.6%**

Major Business Customers	Tons Disposed
Young Roofing	184
Roberts Roofing	142
Valley Home Improvement	142
RCI Roofing	125
Total	**594**
Percent of CY 2008 Waste Disposed	**1.2%**

All Other Commercial Customers (336 Permits)	Tons Disposed
Total	**3,198**
Percent of CY 2008 Waste Disposed	**6.5%**

Self-Hauling Businesses

Self-haulers typically use small dump trucks and pickup trucks to deliver their waste to the landfill. Some self-haul customers only deliver bulky wastes, difficult to manage wastes or wastes that are not picked up by their commercial waste hauler at their place of business. The majority of the landfill's self-haul customers are small businesses, contractors, property managers and non-residents who have chosen not to use commercial collection services for a variety of reasons. The four largest self-hauling customers are roofing and building contractors, accounting for 1.2% of the total waste disposed in 2008. The remainder of commercial self-haul customers (with 336 permitted vehicles) delivered 6.5% of the total waste disposed in 2008.

Together, the small hauling/cleanout services, institutions, and self-hauling businesses described above delivered 19.8% of the waste disposed in 2008.

2.1.4 Commercial Wasteshed

A telephone survey of the four major haulers was conducted by the City to determine which cities and towns are included in these haulers' routes when they use the Northampton Landfill for disposal. It was determined that these four haulers had customers in 38 cities and towns. The results are summarized in Table 2-5, Private Hauler Route Locations.

Table 2-5

Private Hauler Route Locations

Haul Route Location	Duseau Trucking	Alternative Recycling	Waste Management	Allied Waste Services
Amherst	X	X	X	
Ashfield		X	X	
Bernardston	X		X	
Buckland	X	X	X	
Charlemont		X	X	
Chester			X	
Chesterfield		X	X	
Colrain			X	
Conway			X	
Cummington		X	X	
Deerfield	X	X	X	
Easthampton	X	X	X	X
Erving			X	
Gill		X	X	
Goshen		X	X	
Greenfield	X	X	X	
Hadley	X	X	X	X
Hatfield	X	X	X	X
Holyoke		X		
Huntington			X	
Leverett		X	X	
Miller's Falls			X	
Montague	X	X	X	
Northampton	X	X	X	X
Northfield			X	
Pelham			X	
Plainfield		X		
Shelburne	X	X	X	
Shutesbury	X			
South Hadley		X		
Southampton		X		
Sunderland		X	X	
Turner's Falls		X	X	
West Springfield		X		
Westhampton	X	X	X	X
Whately	X	X	X	
Williamsburg		X	X	X
Worthington		X		
Total Cities and Towns - 38				

Note: Route information was obtained from representatives of each hauling company.

2.2 WASTE GENERATION AND COMPOSITION

The section provides background information about solid waste generation in the City of Northampton and waste composition information. The solid waste generation data is needed to determine the approximate amount of waste that would be delivered to the Phase 5 landfill and whether that tonnage is adequate to fund a City only landfill. Waste characterization is important in terms of the potential size of the organics waste stream and management strategies for that material.

2.2.1 Waste Generation

As described in Section 2.1, solid waste collected in the City may be classified as residential or commercial depending on how it is delivered to the landfill. Since commercial loads may have waste from stops in several communities it is impossible to precisely account for Northampton-only waste generation using scale house records. However, estimates can be made using per capita waste generation figures that have been studied and published.

In 2007 the US Environmental Protection Agency (EPA) published a report entitled “Municipal Solid Waste in the United Sates, 2007 Facts and Figures”. The EPA has been tracking solid waste data since around 1960 and the information is a reasonable guide. In this report the EPA stated that the current per capita waste generation rate is 4.6 pounds per person per day. The 2000 census for the City indicates that the population of the City is about 29,000. Applying the per capita generation rate reveals a total waste generation estimate of 133,400 pounds per day or 66.7 tons per day. On an annual basis the solid waste generation rate is about 24,500 tons. EPA estimates that 1.5 pounds per person per day is recycled (32.6%) or 43,500 pounds per day, or 21.8 tons per day, or 7950 tons per year. Subtracting the recycled material from the total waste generation number reveals that about 16,550 tons of material require disposal annually.

An earlier, but more local study of solid waste generation was completed in 1995 by Camp Dresser & McKee for the Eastern Hampshire Regional Refuse Management District, which at the time consisted of the Towns of Amherst, Hadley, South Hadley, Leverett, Shutesbury, and Pelham (Eastern Hampshire Study). A detailed review of records completed at that time indicated a waste generation rate of 4.0 pounds per person per day. This number includes residential (1.88 pounds per person per day) and commercial waste (2.12 pounds per person per day). Although this is an older estimate it may more accurately reflect the rate in Northampton given potential regional differences in waste generation and differences in how the EPA prepares their national estimates. Applying this generation rate to Northampton’s population reveals a total solid waste generation rate of 116,000 pounds per day, or 58 tons per day. On an annual basis the solid waste generation rate is about 21, 200 tons. If a conservative recycling rate of 30 percent is used, the corresponding annual quantity of waste requiring disposal is about 14,800 tons.

2.2.2 Waste Composition

For the purposes of this solid waste study, waste composition analyses will be described based on data published in other studies. Determining the actual waste composition for a community is a very time consuming and expensive process. A waste composition study involves sampling and weighing of representative solid waste samples from loads from various haulers. Representative samples of waste are divided into pre-determined categories and weighed. Both commercial and residential waste streams are typically analyzed. In the case of the current users of the landfill it would be difficult to characterize the source of commercial loads brought in by major waste haulers, since they may combine loads from several towns and a mix of residential and commercial accounts. Generally, sampling programs for a waste characterization study are run a few times throughout a year to capture seasonal variations in waste. This type of detailed waste composition study is more typically performed when the data is being used to determine the size and preliminary design of process facilities (such as a material recycling facility, composting facility, etc.) and is beyond the scope of this study. For this study we have relied on other published data for waste stream composition to enable readers to better understand the contents of the solid waste stream.

The Eastern Hampshire Study provides waste composition data from this region based on actual field studies completed in the mid-1990s. The waste composition reported in that study was determined based on sampling, sorting and weighing samples from the residential and commercial waste stream in each of the District communities. Table 2-6 summarizes the residential and commercial waste composition (including recyclable materials). Note, that the study found that about 45 percent of waste generation was from residential homes, 50 percent from commercial sources and about 5 percent was construction and demolition debris. A combined waste composition is also presented in the table.

Although, this study provides a reasonable guide to the Northampton waste stream there are several changes that may have occurred in the waste stream composition since the Eastern Hampshire Study was completed. These may include a reduction in paper in the waste stream due to a decrease in hard copy subscriptions, reduced newsprint size and number of pages in daily newspapers, use of lighter weight paper, and other related changes. Similarly, there has been a trend for several years in “lightweighting” product containers as well as in increase in reliance on plastic packaging.

Another source of waste composition data is the US Environmental Protection Agency (EPA). Table 2-7 presents information published by EPA for waste composition from 1960-2007. Table 2-8 presents a breakdown of materials recovered from the waste stream through recycling or other diversion. The balance of material requiring disposal (discards) are depicted in Table 2-9. This series of tables provided by EPA provides good background information about the waste stream flow from generation to recycling to disposal.

TABLE 2-6
EASTERN HAMPSHIRE REGIONAL REFUSE DISTRICT
WASTE STREAM COMPOSITION

Component	***Residential Wastestream Percentage***		***Commercial Wastestream Percentage***		***Weighted Average Wastestream Percentage***	
	Sub-Cat.	*Catergory*	*Sub-Cat.*	*Catergory*	*Sub-Cat.*	*Catergory*
PAPER		41.0%		33.8%		37.2%
Newspaper	8.4%		7.4%		7.9%	
Corrugated	7.0%		7.0%		7.0%	
Office	2.7%		1.7%		2.2%	
Mixed	5.4%		3.4%		4.3%	
Other	17.5%		14.3%		15.8%	
PLASTICS		5.8%		7.6%		6.8%
HDPE Containers	0.9%		0.6%		0.7%	
PET Containers	0.4%		0.3%		0.3%	
Other	4.5%		6.7%		5.7%	
GLASS		7.5%		2.9%		5.1%
Glass Containers	7.3%		2.6%		4.8%	
Other	0.2%		0.3%		0.3%	
METAL		3.2%		4.0%		3.6%
Bi-metal Containers	2.3%		0.8%		1.5%	
Aluminum Containers	0.4%		0.6%		0.5%	
Other Ferrous	0.4%		2.3%		1.4%	
Other Non-Ferrous	0.1%		0.3%		0.2%	
FOOD		17.0%		27.0%		22.3%
LEAF & YARD		13.3%		2.2%		7.4%
OTHER ORGANICS		4.7%		9.5%		7.2%
TIRES		0.1%		0.1%		0.1%
WHITE GOODS		0.1%		0.3%		0.2%
BATTERIES		0.3%		0.2%		0.2%
HAZARDS		0.5%		0.1%		0.3%
OTHER INORGANICS		6.5%		12.3%		9.6%
TOTAL		100.0%		100.0%		100.0%

Source:

Data from Eastern Hampshire Regional Refuse District Comprehensive Solid Waste Management Plan, Executive Summary dated May 1995.

TABLE 2-7

MATERIALS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
UNITED STATES
(in percent of total generation)

	Percent of Total Generation								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2004**	**2005**	**2006**	**2007**
Paper and Paperboard	34.0%	36.6%	36.4%	35.4%	36.7%	34.6%	33.9%	33.6%	32.7%
Glass	7.6%	10.5%	10.0%	6.4%	5.3%	5.2%	5.3%	5.3%	5.3%
Metals									
Ferrous	11.7%	10.2%	8.3%	6.2%	5.9%	6.0%	6.0%	6.1%	6.2%
Aluminum	0.4%	0.7%	1.1%	1.4%	1.3%	1.3%	1.3%	1.3%	1.3%
Other Nonferrous	0.2%	0.6%	0.8%	0.5%	0.7%	0.7%	0.7%	0.7%	0.7%
Total Metals	*12.3%*	*11.4%*	*10.2%*	*8.1%*	*7.9%*	*8.0%*	*8.0%*	*8.1%*	*8.2%*
Plastics	0.4%	2.4%	4.5%	8.3%	10.7%	11.8%	11.7%	11.7%	12.1%
Rubber and Leather	2.1%	2.5%	2.8%	2.8%	2.8%	2.9%	2.9%	2.9%	2.9%
Textiles	2.0%	1.7%	1.7%	2.8%	3.9%	4.4%	4.5%	4.7%	4.7%
Wood	3.4%	3.1%	4.6%	6.0%	5.5%	5.6%	5.6%	5.5%	5.6%
Other**	0.1%	0.6%	1.7%	1.6%	1.7%	1.7%	1.7%	1.7%	1.7%
Total Materials in Products	***62.0%***	***68.8%***	***71.8%***	***71.4%***	***74.5%***	***74.0%***	***73.7%***	***73.6%***	***73.2%***
Other Wastes									
Food Scraps	13.8%	10.6%	8.6%	10.1%	11.2%	11.8%	12.1%	12.2%	12.5%
Yard Trimmings	22.7%	19.2%	18.1%	17.1%	12.8%	12.7%	12.8%	12.7%	12.8%
Miscellaneous Inorganic wastes	1.5%	1.5%	1.5%	1.4%	1.5%	1.5%	1.5%	1.5%	1.5%
Total Other Wastes	***38.0%***	***31.2%***	***28.2%***	***28.6%***	***25.5%***	***26.0%***	***26.3%***	***26.4%***	***26.8%***
Total MSW Generated - %	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***

Notes:

* Generation before materials recovery or combustion. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Includes electrolytes in batteries and fluff pulp, feces, and urine in disposable diapers.

Data from USEPA Municipal Solid Waste in the United States: 2007 Facts and Figures. Details may not add to totals due to rounding.

TABLE 2-8

MATERIALS RECOVERED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
UNITED STATES
(in percent of generation of each material)

	Percent of Generation of Each Material								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2004**	**2005**	**2006**	**2007**
Paper and Paperboard	16.9%	15.3%	21.3%	27.8%	42.8%	47.1%	49.5%	51.4%	54.5%
Glass	1.5%	1.3%	5.0%	20.1%	22.6%	21.2%	21.0%	21.3%	23.7%
Metals									
Ferrous	0.5%	1.2%	2.9%	17.6%	33.2%	34.4%	33.6%	33.9%	33.8%
Aluminum	Neg.	1.3%	17.9%	35.9%	26.9%	21.6%	20.7%	20.3%	21.8%
Other Nonferrous	Neg.	47.8%	46.6%	66.4%	66.3%	69.6%	69.0%	69.3%	69.3%
Total Metals	*0.5%*	*3.5%*	*7.9%*	*24.0%*	*34.9%*	*35.3%*	*34.5%*	*34.7%*	*34.8%*
Plastics	Neg.	Neg.	0.3%	2.2%	5.8%	5.8%	6.0%	6.9%	6.8%
Rubber and Leather	17.9%	8.4%	3.1%	6.4%	12.2%	15.2%	14.9%	14.7%	14.7%
Textiles	2.8%	2.9%	6.3%	11.4%	14.0%	16.2%	16.3%	15.8%	15.9%
Wood	Neg.	Neg.	Neg.	1.1%	9.5%	9.3%	9.3%	9.3%	9.3%
Other**	Neg.	39.0%	19.8%	21.3%	24.5%	27.1%	27.3%	27.1%	26.2%
Total Materials in Products	***10.3%***	***9.6%***	***13.3%***	***19.8%***	***29.7%***	***31.1%***	***31.9%***	***32.8%***	***34.0%***
Other Wastes									
Food, Other***	Neg.	Neg.	Neg.	Neg.	2.5%	2.2%	2.3%	2.2%	2.6%
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	51.7%	62.4%	61.9%	62.0%	64.1%
Miscellaneous Inorganic wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	***Neg.***	***Neg.***	***Neg.***	***7.2%***	***27.0%***	***31.6%***	***31.1%***	***30.9%***	***31.9%***
Total MSW Recovered - %	***6.4%***	***6.6%***	***9.6%***	***16.2%***	***29.0%***	***31.2%***	***31.7%***	***32.3%***	***33.4%***

Notes:

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Recovery of electrolytes in batteries; probably not recycled.

*** Includes recovery of paper and mixed MSW for composting

Neg. = Less than 5,000 tons or 0.05 percent.

Data from USEPA Municipal Solid Waste in the United States: 2007 Facts and Figures. Details may not add to totals due to rounding.

TABLE 2-9

MATERIALS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 2007
UNITED STATES
(in percent of total discards)

	Percent of Total Discards								
Materials	**1960**	**1970**	**1980**	**1990**	**2000**	**2004**	**2005**	**2006**	**2007**
Paper and Paperboard	30.2%	33.2%	31.7%	30.5%	29.6%	26.6%	25.1%	24.1%	22.3%
Glass	8.0%	11.1%	10.5%	6.1%	5.8%	5.9%	6.2%	6.2%	6.1%
Metals									
Ferrous	12.4%	10.8%	8.9%	6.1%	5.6%	5.7%	5.8%	6.0%	6.1%
Aluminum	0.4%	0.7%	1.0%	1.0%	1.4%	1.5%	1.5%	1.6%	1.5%
Other Nonferrous	0.2%	0.3%	0.5%	0.2%	0.3%	0.3%	0.3%	0.3%	0.3%
Total Metals	*13.1%*	*11.8%*	*10.4%*	*7.3%*	*7.3%*	*7.5%*	*7.7%*	*7.8%*	*8.0%*
Plastics	0.5%	2.6%	5.0%	9.7%	14.2%	16.2%	16.1%	16.1%	16.9%
Rubber and Leather	1.8%	2.4%	3.0%	3.2%	3.5%	3.5%	3.7%	3.7%	3.8%
Textiles	2.1%	1.8%	1.7%	3.0%	4.8%	5.4%	5.6%	5.8%	5.9%
Wood	3.7%	3.3%	5.1%	7.0%	7.0%	7.3%	7.5%	7.4%	7.6%
Other**	0.1%	0.4%	1.5%	1.5%	1.8%	1.8%	1.8%	1.8%	1.9%
Total Materials in Products	***59.4%***	***66.6%***	***68.8%***	***68.3%***	***73.8%***	***74.2%***	***73.4%***	***73.0%***	***72.6%***
Other Wastes									
Food Scraps	14.8%	11.3%	9.5%	12.1%	15.4%	16.7%	17.3%	17.6%	18.2%
Yard Trimmings	24.2%	20.5%	20.1%	17.9%	8.7%	7.0%	7.1%	7.2%	6.9%
Miscellaneous Inorganic wastes	1.6%	1.6%	1.6%	1.7%	2.1%	2.1%	2.2%	2.2%	2.2%
Total Other Wastes	***40.6%***	***33.4%***	***31.2%***	***31.7%***	***26.2%***	***25.8%***	***26.6%***	***27.0%***	***27.4%***
Total MSW Discarded - %	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***

Notes:

* Discards after materials and compost recovery. In this table, discards include combustion with energy recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Includes electrolytes in batteries and fluff pulp, feces, and urine in disposable diapers.

Data from USEPA Municipal Solid Waste in the United States: 2007 Facts and Figures. Details may not add to totals due to rounding.

Having knowledge about the composition of the waste stream is needed to comprehend the innovative waste conversion technologies discussed in Section 4 since some of the technologies only process part of the overall MSW waste stream, leaving other components to be recycled, landfilled or managed in some other manner. For example, a mixed waste composting facility will commonly accept compostable materials such as paper, leaf and yard wastes, food waste and other organics. The data from Table 2-6 reveals that about 74 percent of the waste stream could theoretically be sent to a mixed waste compost facility, leaving 26 percent of the materials to be recycled or managed as residuals requiring disposal.

Understanding the fundamentals of waste composition is also useful for general discussion and consideration of food waste, or source-separated organics. Using the Eastern Hampshire Study data, the City of Northampton could be expected to generate about 13 tons per day of food waste. A discussion of food waste quantity and processing options are discussed in Section 3.

3.0 Section 3 - Zero Waste Planning-Materials Diversion

3.1 ZERO WASTE OVERVIEW

The term zero waste means both reducing the amount of waste generated at the source and diverting waste from the landfill through increased reuse and recycling. "Zero Waste" should be thought of as a goal, the realization of which will depend on technical, economics and political considerations. Zero waste recognizes that waste is not inevitable, that discarded materials are potentially valuable resources, which we need to move beyond "end of pipe" strategies, maximize recycling and composting, reduce consumption and foster efforts to design waste out of the system.

Zero waste policies and programs can be defined in any number of ways. A useful way of thinking about these initiatives was developed by the City of Oakland, California for its zero waste plan:

- Upstream – waste produced to make products and packaging through manufacturing, mining and extraction.
- Downstream – waste generated by consumers, including products at the end of their useful lives and organics from yard trimmings and food scraps.

Upstream policies and programs address the source of waste. The Institute for Local Self-Reliance has estimated that for every ton of municipal solid waste generated, there are 71 tons of waste generated "upstream" through mining, manufacturing, harvesting and construction. [1] Upstream polices and programs address product and packaging waste by requiring manufacturers and retailers to take responsibility for their products and packaging. Based on a Product Policy Institute study waste generated per capita from products and packaging almost doubled in the U.S. between 1960 and 2000 from approximately 610 to 1,210 pounds per year, while the total of non-product and packaging wastes increased by approximately 11% (i.e., from approximately 370 to only 410 pounds per year).

Upstream initiatives are focused on the material supply chain and seek to cause producers and suppliers to modify their procurement and production processes to minimize the amount of waste generated during their product's development, manufacturing, distribution, sales, utilization and ultimate disposition. The upstream efforts seek to minimize the amount of material that ultimately ends up on the curb, i.e., at the end of the pipeline. These elements of a zero waste program include initiatives examining product and packaging bans, product and packaging takeback initiatives, and regional and statewide advocacy.

[1] Brenda Platt and Neil Seldman, Institute for Local Self-Reliance, Wasting and Recycling in the U.S. 2000, GrassRoots Recycling Network, 2000, p. 13. Based on data reported in Office of Technology Assessment, Managing Industrial Solid Wastes from manufacturing, mining, oil, and gas production, and utility coal combustion (OTA-BP-O-82), February 1992, pp. 7, 10.

Downsteam policies are focused on managing what ends up on the curb that is typically where the municipal sector interfaces with the waste stream, i.e., at the end of the pipe. Downstream initiatives address opportunities for increasing diversion and reducing generation of solid waste from the residential, commercial and self-haul sectors. These include implementation of changes to consumer purchasing behavior, mechanisms for increasing diversion, and addition of processing and treatment capacity targeting additional portions of the waste stream. Downstream elements of a zero waste program include seeking to ensure the highest and best use of products and packaging at the end of their useful lives, reusing products and packaging, retaining their original form and function to the maximum extent, recycling or composting materials that are not reduced or reused, and recovering energy and managing residuals.

Elements of a zero waste program may include:

- Comprehensive recycling programs
  - Multi-material
  - Convenient
  - Available to all generators
- Organics diversion
  - Yard trimmings
  - Food scraps
  - Compostable paper
- Construction and Demolition(C&D) diversion
  - Generator-based
  - Hauler-based
  - Facility-based
- Zero Waste Policies
  - “New rules”
  - Disposal bans
  - Mandatory recycling
  - Product stewardship
  - Comprehensive outreach and technical assistance
- Zero Waste Infrastructure
  - Neighborhood scale
  - Reuse and recycling
  - Materials recovery
  - C&D processing
  - Organics processing
- Residual Waste Management
  - Alternative technologies
  - Residual waste transfer
  - Residual waste disposal

3.2 ZERO WASTE INITIATIVES – WHAT OTHER JURISDICTIONS ARE DOING

One of the largest zero waste initiatives underway today is the City of Los Angeles' Solid Waste Integrated Resource Plan. This plan recognizes that achieving zero waste will require radical changes in three areas: product creation, product use, and product disposal. Through a stakeholder outreach process that has taken over a year and involved over 70 meetings, the City has developed a detailed list of potential options that it will evaluate in moving forward with its Zero Waste Plan. Over 80 separate initiatives were identified. These potential options are listed below.

Product Creation

Initiatives in this area are targeted at modifying the way that products are designed, manufactured and distributed. A major element of these initiatives involve requiring producers to take more responsibility referred to as extended producer responsibility (EPR) for the waste management aspects of the product life cycle and product bans. EPR initiatives and product bans being examined elsewhere include the following:

- EPR for toxics,
- EPR for difficult to recycle materials
- EPR for easy to recycle materials
- Packaging legislation
- Single use bag ban
- Advance disposal fees and takebacks
- Local product sales bans
- Local takeback requirements
- Local product bans from transfer and disposal
- Voluntary local EPR programs
- Precautionary principle
- Product redesign for toxics
- Product redesign for difficult to recycle products

Product Use

Initiatives in this area are targeted at modifying consumer behavior to change purchasing practices and foster markets. Initiatives include:

- Environmentally preferable purchasing (EPP) for recyclables
- EPP for takebacks and less toxics
- Purchase from green businesses and zero waste processors
- Zero waste procurement practices
- Local market development
- Regional market development
- State recycled content legislation
- Other state and federal market development initiatives

Product Disposal

Initiatives in this area are targeted at maximizing the diversion of materials from the waste stream into their highest and best use. Depending on the material, that may involve reuse in its original form, returning the material within the product to the materials production cycle or transforming the material to recover the material, chemical or energy value contained within the product. Initiatives utilized in other jurisdictions include various programs targeting residential, institutional and commercial generators. Elements under consideration in Los Angeles include:

- City Department Mandatory Diversion
- Event Recycling
- Residential Pay as You Throw
- Residential Blue Bin Ambassadors for additional capture
- Residential textiles
- Residential black bin to MRF
- Mandatory C&D recycling
- Resource recovery parks
- Resource recovery centers
- Bulky item reuse and refurbishment
- Public area recycling
- Multi-family recycling
- Source separation recycling ordinance (mandatory recycling)
- Zero waste at schools
- Organics out of landfills
- Restaurant food scrap recycling
- Organics markets – City to farmers
- Residential yard trimmings increase
- Yard trimmings disposal ban
- Residential food to green bin
- Planning and zoning (help farmers, composters, reuse and recycling businesses obtain permits)
- Modifying refuse and recycling rates to encourage diversion instead of disposal
- Incentive rates and fees for commercial and residential
- Waste hauling and landfill fees and surcharges
- Franchises
- Non- or semi-exclusive franchises
- Exclusive franchise
- Mandatory commercial dirty MRF
- Dirty MRF all residuals
- Multi-family recycling
- Mandatory organics separation
- Multi-family green waste collection
- Rolling out recycling services to all public schools in the City
- Rolling out recycling services to all multi-family buildings in the City

Municipal programs historically have focused on the wastes generated by the residential and governmental sector. More recently, more attention has been paid to addressing the waste management practices of the commercial sector, as the commercial sector plays a significant role in generation of solid waste and there are many opportunities to reduce the amount of waste being disposed by commercial generators. Program initiatives being considered include:

- Mandatory business recycling programs
- Requiring all businesses to have recycling services (of any kind)
- Requiring all businesses to separate specific materials for recycling
- Requiring all businesses to reach a specific diversion level (e.g. 50%)
- Banning certain materials from disposal (cardboard, C&D)
- Mandatory C&D recycling--50%, etc.(current program--increased diversion rates)
- Requiring all food service establishments to participate in a food scrap diversion program
- Requiring all commercial haulers to reach a specific diversion level
- Requiring all commercial haulers to provide recycling services to all of their customers
- Requiring preprocessing of all loads prior to disposal (MRF first)
- Requiring processing of all C&D loads
- Requiring processing of all roll-off loads
- Modifying refuse and recycling rates to encourage diversion instead of disposal

In examining potential opportunities for increasing the diversion of materials from disposal, it is important that consideration be given to modification of applicable institutional factors that impact the process of siting and developing program components. These include:

- Enforcement Measures
- Permit assistance
- Zoning assistance

A major aspect of any solid waste management program is education and outreach. Creating and sustaining a solid waste management program requires constant attention to getting the word out to the stakeholders. Educational and outreach efforts to modify consumer behavior take several forms. Program elements being contemplated elsewhere include:

- Education, education, education (K-12, LAUSD curriculum)
- Training and instructions
- Inspiration
- Messages
- Signage
- Feedback and contests
- Large scale media campaigns (e.g., Don't Mess with Texas, Flex Your Power)
- Social marketing programs for specific generator types or districts (Business Improvement Districts or Building Owner and Manager Association)
- Focus on more business assistance
- Increased outreach and technical assistance to commercial businesses to increase recycling
- Direct technical assistance (City staff or contractors)

Conclusion

While clearly many of these elements are not suitable for a smaller community like Northampton, it is instructive to look at the elements of their zero waste management plan that identify upstream elements focusing on product stewardship, manufacturer responsibility, "green" design and product bans and downstream elements that focus on things within the City's direct control, like purchasing practices, recycling, composting and disposal activities, mandatory diversion, and technical assistance and education.

3.3 RESOURCE RECOVERY PARKS

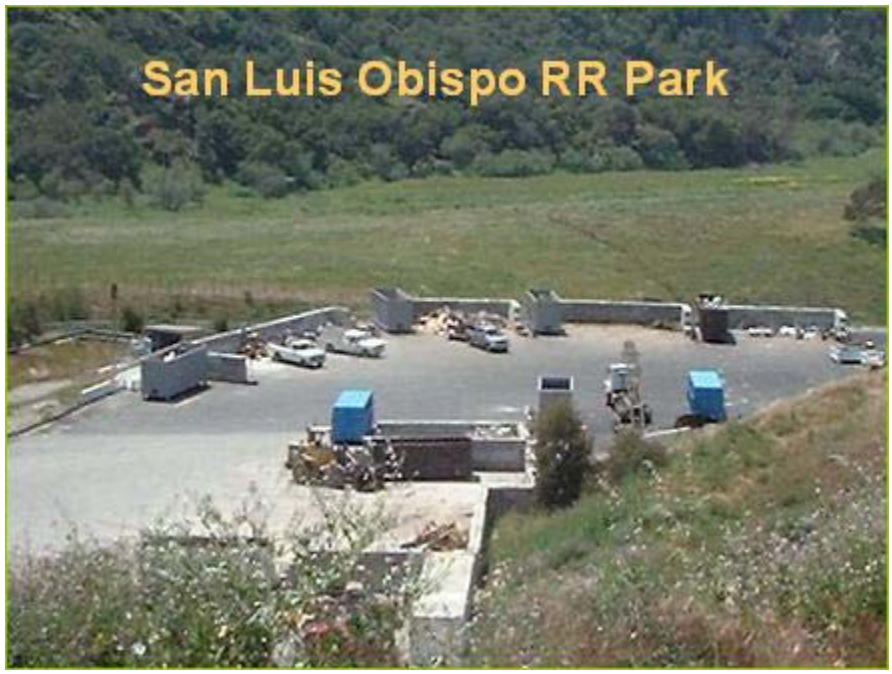
3.3.1 Overview

Some communities have increased diversion opportunities for self-haul generators by providing more opportunities to recycle more commodities or compost more organics through the development of resource recovery parks at landfills and transfer stations and by providing the economic incentives to divert.

Resource recovery parks are designed to encourage diversion of materials from disposal by co-locating recycling, reuse and composting capability. These facilities may co-locate reuse, recycling, composting, manufacturing, and distribution activities. Comprehensive Resource Recovery Parks are designed to accept all market categories of materials from the public. Typically, these facilities are located in industrially zoned areas that are reserved for companies that process secondary materials or make products from these materials. The Resource Recovery Park concept has been evolving naturally at landfills and transfer stations since these types of facilities are central locations where discarded materials have historically been hauled. These facilities have continued to provide additional recycling opportunities for self-hauled loads. A Resource Recovery Park co-located with a landfill or transfer station that is near the center of waste generation can make the landfill or transfer station more sustainable by diversifying revenue, conserving capacity, and extending the useful life of those facilities.

3.3.2 Resource Recovery Park Examples

Figure 3-1 Resource Recovery Park



The Resource Recovery Park at the Cold Canyon Landfill in San Luis Obispo has developed a method of incentivizing self-haul customers to separate materials for recycling. Figure 3-1 is a photograph of the Resource Recovery Park. As shown, there are several drop-off areas within the site for different materials. Users are encouraged to divert the materials from disposal through a tiered fee charged to self haul customers, based on whether or not the user sorts the load into recoverable materials in the "resource recovery park" portion of the facility or simply continues onto the disposal portion of the facility. Each small load is charge $12.50 per load to go through the facility access gate and enter the site. These vehicles are directed to the drop-off area where the materials are separated for recycling. Anyone not wishing to separate their materials can alternatively go directly to the landfill face and tip their materials, provided that they pay an extra $20 per load for the Facility Use fee. By using this economic signal, the landfill achieved 97 percent compliance with the source-separation requirement. This pricing approach is identical to allowing people to access the drop off areas at the City Drop-off site for free, while charging for taking waste to the landfill. The Northampton Landfill and drop-off center is already a Resource Recovery Park that includes drop-off for recyclables, e-waste and bulk waste; leaf composting; and includes landfill gas recovery.

The following additional examples highlight possible options that the City could consider in expanding the Resource Recovery Park features at the Northampton Landfill to accommodate more diversion programs and processing (to be provided by the City or through leases to tenants). These activities implemented elsewhere include:

Urban Ore Resource Recovery Park, Berkeley, California

- Building materials exchange
- Hardware exchange
- Arts and media exchange
- General store
- Salvage and recycling

Potential subleases under consideration at Urban Ore

- A nonprofit organization that rebuilds and upgrades computers and then sells them at low cost to low-income people.
- A company that makes high-quality countertops out of recycled glass embedded in Portland cement.
- Overflow warehousing for another reuse company.
- A blacksmith who makes products from scrap steel.

Davis Street Resource Recovery Park, San Leandro, California

- Curbside recycling processing
- Construction and demolition debris processing
- Yard trimmings processing
- Garden center (retail sales)
    - Mulch
    - Compost
    - Bark
    - Playground chips
- Accepts (drop off or for a fee):
    - Wood Waste
    - Tires
    - Plastics
    - Paints
    - Motor Oil
    - Metals
    - Mattresses
    - Green and Food Waste
    - Glass
    - Electronic Waste
    - Cardboard, Newspapers and Office Papers
    - Bulbs and Ballasts
    - Batteries
    - Appliances
    - Inerts
- Education Center

Davis Street tenants have included:

- Tire regrind facility
- Reused building materials

Monterey Regional Waste Management District Regional Environmental Park, Marina, California

- Last Chance Mercantile
  - Sporting Goods
  - Automotive Parts and Accessories
  - Lumber and Construction Materials
  - Clothing and Linens
  - Hardware and Electrical
  - Furniture
  - Housewares
  - Gardening Supplies
  - Mulch and Compost
  - Paints, Varnishes & Cleaners
  - Miscellaneous Other Items

- Electronic Waste
- Materials Recovery Facility
- Household Hazardous Waste Collection Facility

In subsequent sections, a summary of current City programs and other area diversion programs will be provided and compared with the components of the resource recovery parks described above to identify potential new diversion opportunities and management program opportunities for the City.

3.4 CURRENT DIVERSION PROGRAMS

This section summarizes waste diversion efforts by the City. Included is a discussion of materials diverted at the drop off center, special collection events, and other recycling programs to maximize the diversion of materials from the waste stream. Lastly, other programs run by non-profits in the Northampton area and other diversion-related programs are discussed. The goal of this section is to provide a comprehensive view of materials diversion programs available to City residents and businesses. Gaps in diversion efforts will be identified and discussed in subsequent sections of this report.

Many of the materials that are recycled are done so in accordance with the DEP waste disposal bans (310CMR19.000) and/or the City of Northampton Solid Waste Ordinance (Chapter 272, see Appendix 3-1). The ordinance requires that more types of materials get recycled than the DEP Waste Bans since recyclable materials are defined as: “materials that are accepted at the Springfield Materials Recycling Facility (SMRF) and/or materials that are subject to a ban on landfill disposal imposed by the Massachusetts Department of Environmental Protection and/or the Northampton Board of Health.” As detailed below, the Springfield MRF accepts materials beyond the waste ban requirements.

Opportunities for materials diversion, reuse and recycling in the region go beyond the diversion of materials that is required by the DEP waste bans and City Ordinance. These opportunities are also discussed below.

3.4.1 DEP Waste Ban Materials

The City of Northampton accepts DEP waste ban materials at the Locust Street and/or the Glendale Road drop off recycling centers.

The following are brief excerpts from the DEP Document entitled "Guidance for Solid Waste Handling and Disposal Facilities on Compliance with MassDEP Waste Bans", dated December 23, 2005, that describe waste ban materials.

"Waste Bans are prohibitions on the disposal and transfer for disposal of certain hazardous and recyclable items at solid waste facilities in Massachusetts. The goals of the waste bans are to conserve capacity at existing solid waste disposal facilities, minimize the need for construction of new facilities, and to support the recycling industry by ensuring that large volumes of material are available on a consistent basis. The waste bans also prohibit certain toxic substances or materials that may adversely affect our environment when landfilled or combusted.

Asphalt Pavement, Brick, and Concrete: asphalt pavement, brick and concrete from construction activities and demolition of buildings, roads and bridges and similar sources.

Cathode Ray Tubes: any intact, broken, or processed glass tube used to provide the visual display in televisions, computer monitors and certain scientific instruments such as oscilloscopes.

Glass Containers: glass bottles and jars (soda-lime glass) but excluding light bulbs, Pyrex cookware, plate glass, drinking glasses, windows, windshields and ceramics.

Lead Batteries: lead-acid batteries used in motor vehicles or stationary applications.

Leaves: deciduous and coniferous leaf deposition.

Metal: ferrous and non-ferrous metals derived from used appliances, building materials, industrial equipment, transportation vehicles, and manufacturing processes.

Metal Containers: aluminum, steel or bi-metal beverage and food containers.

Recyclable Paper: all paper, corrugated cardboard, and paperboard products, except tissue paper, toweling, paper plates and cups, wax-coated corrugated cardboard, and other low-grade paper products.

Single Polymer Plastics: all narrow-neck plastic containers where the diameter of the mouth of the container is less than the diameter of the body of the container. This includes single polymer plastic containers labeled 1 – 6.

Tires: a continuous solid or pneumatic rubber covering intended for use on a motor vehicle. Shredded tires, defined as tires that have been cut, sliced or ground into four or more pieces such that the circular form of the tire has been eliminated, can be landfilled.

White Goods: appliances employing electricity, oil, natural gas or liquefied petroleum gas to preserve or cook food; wash or dry clothing, cooking or kitchen utensils or related items; or to cool or to heat air or water.

For purposes of the waste bans, white goods include, but are not limited to, refrigerators, freezers, air conditioners, water coolers, dishwashers, clothes washers, clothes dryers, gas or electric ovens and ranges, and hot water heaters. White goods do not include microwave ovens.

Wood: treated and untreated wood, including wood waste. Wood waste is defined in the solid waste regulations as follows: Wood waste means discarded material consisting of trees, stumps, and brush, including but not limited to sawdust, chips, shavings and bark. Wood waste does not include new or used lumber or wood from construction and demolition waste and does not include wood pieces or particles containing or likely to contain asbestos, chemical preservatives such as creosote or pentachlorophenol, or paints, stains or other coatings.

Yard Waste: deciduous and coniferous seasonal depositions (e.g., leaves), grass clippings, weeds, hedge clippings, garden materials, and brush 1 (one) inch or less in diameter (excluding diseased plants)."

In accordance with the DEP regulations, the City of Northampton has a Waste Ban Plan that is implemented at the landfill. At the Northampton landfill, each load that is delivered for disposal is monitored, and any violations of the Waste Ban Regulations are recorded and reported to the MassDEP on an ongoing basis. The DEP also performs random monthly waste ban inspections.

3.4.2 Springfield Material Recycling Facility (MRF) - Recyclables

The Springfield MRF has been serving western Massachusetts for almost 20 years and plays an important role in Western Massachusetts recycling programs. The MRF is the facility that accepts materials for recycling, processes and ships them to various markets for reuse. This facility has provided continuous access to recycling markets for all Western Massachusetts communities. The Springfield MRF has specific guidance about materials that can be accepted for recycling (See Appendix 3-2). Some of the materials that they accept beyond the waste ban materials are described below:

- Plastic containers #1-#7 (including plastic containers other than narrow-neck bottles)
- Aseptic packaging (milk and juice cartons, soymilk, soup and drink boxes);
- Paper (not included in DEP's definition of "recyclable paper")

Paper egg cartons, clean pizza boxes, notebooks and writing pads with metal spirals, junk mail, colored paper, glossy paper, construction paper, shredded paper, envelopes with plastic windows and metal clasps, boxboard, gift wrap, tissue paper, greeting cards, paperback books, phonebooks, lottery tickets and sticky notes.

3.4.3 Other Northampton Policies Related to Waste Diversion

The following is a list of additional materials that are diverted at the City drop-off facilities and the landfill. In addition at the landfill, surcharges are imposed on waste loads that contain waste ban items such as mattresses, scrap metal, CRTs, tires and propane tanks to promote compliance. A complete City Fee schedule is located in Appendix 3-3. Low-cost or free recycling of a variety of other materials provides businesses and residents with a big incentive to make sure that the following materials do not go to waste:

- Mattresses ($10/unit fee or $40 for any mattress removed from a waste load delivered to the landfill for disposal)
- Scrap metal (variable fee or $25 for any scrap metal removed from a waste load delivered to the landfill for disposal)
- CRT's (variable fee or $25 for any CRTs removed from a waste load delivered to the landfill for disposal)
- Tires (variable fee or $25 for any tire removed from a waste load delivered to the landfill for disposal)
- Propane, helium, oxygen and oxyacetylene tanks (variable fee or $25 for any propane tanks removed from a waste load delivered to the landfill for disposal)
- Mercury containing products such as fluorescent lamps and bulbs, button batteries, thermostats, thermometers, flow meters, mercury switches, elemental mercury (fee for businesses only)
- Ballasts (fee for businesses only)
- Electronic wastes (free)
- Batteries: rechargeable batteries and button batteries (free)
- Hard and soft cover books, videos, compact discs, DVD's and audio books (free)
- Automotive products such used motor oil, antifreeze (free)
- Textiles and shoes (free)

3.4.4 Other Events and Programs

In addition to materials recycled or diverted at the City drop-off centers and the landfill, the City also spends considerable effort on other programs related to waste minimization. The following identifies these events, programs and regional efforts.

Green Action In Northampton Schools ("GAINS") Initiative

In the 2008-2009 academic year, Green Northampton (a local non-profit organization), the DPW, and Central Services have been working with the public schools to engage students in critical thinking about issues of sustainability as defined in the City's "Sustainable

Northampton Comprehensive Plan". Currently, a local parent (and experienced teacher) provides the primary support each school's Green Team– comprised of students, teachers, administrators, maintenance staff, food preparation workers, and/or parents. As an example, this volunteer has assisted three Green Teams to design and implement "Zero Trash" projects in their cafeterias and classrooms. Teachers used these projects for earth science and mathematics instruction, the food prep staff used them to reduce costly waste, and the students became community leaders while learning about an important community issue and how they could contribute to the City's Sustainability Plan. This program will be expanded in the 2009-2010 academic year through a $15,000 grant from the Northampton Education Foundation.

Household Hazardous Waste (HHW) Collection Program

The City has been hosting HHW collection events every year since 1985. Like most of Northampton's events and programs, these collections are open to member communities served by the Northampton landfill. For the past decade, non-residents have participated in the City's HHW collections, and Northampton residents have been given access to other communities' events through reciprocal arrangements.

"Mass Recycles Paper" Campaign

The City is actively participating in MassRecycle's statewide Paper Recycling Campaign, and serves on the Steering Committee for this effort. Examples of activities to support the campaign include (but are not limited to):

- Paper recycling guidelines were mailed out with the DPW's water bills;
- The City has hosted three free regional paper shredding events, and will continue to offer this service twice a year. This program was created to address the frequent practice of trashing (rather than recycling) shredded paper, as well as to educate residents and businesses that some types of documents should be securely recycled.
- Paper shredding services are also offered at various times of the year by local banks and at Whalen's office supply.
- The City has borrowed the Campaign's professionally designed tabletop display for use at events.

Sharps and Unwanted Medications

The City distributes sharps boxes and accepts containerized needles and lancets for free, and is currently working with the Police Department and Cooley Dickinson Hospital to accept unwanted medications at no cost from residents.

Public Area Recycling

Using well-designed collection container manufactured by MassCor, the Parks and Recreation Department collects bottles and cans from every park and sports field in the City. In cooperation with the Parking Division, the Pedal People collect bottles and cans from the

MassCor containers in downtown Northampton. The DPW also provided Central Services with a set of "Clearstream" collection containers that are ideal for public occasions, such as graduations, concerts and other one-day events. Currently, the City is working with Look Park to expand their recycling efforts.

Technical Assistance and Support for Businesses and Institutions

In the past, the City has provided technical assistance to set up and/or expand recycling programs for residents (single family, multifamily, condominium, housing authority, transient housing programs, etc.), commercial establishments (small/medium/large businesses and industries), institutions (non-profit organizations, private schools & colleges, churches, nursing homes, a hospital and a correctional facility), municipal (City offices, public schools) and public areas (events, street receptacles, parks. etc.). In addition to providing technical assistance (research, site visits, etc.), the City has administered a "mini-grant program" to provide equipment, signage, educational materials, sheds, etc. in the past. Under this program, the City donated up to $200 to qualified applicants in the form of:

- In-stock equipment such as 96-gallon totes, several types of recycling containers for paper and bottles and cans, composting bins, etc.
- Reimbursement for customized equipment, signage, educational materials, etc.
- Cooperative projects, such as providing recycling sheds in City parking lots (Masonic Street, Armory Street, Strong Avenue) to serve residents and businesses in the downtown area.

From time to time, the City has partnered with other organizations to address waste management issues, including the Northampton Chamber of Commerce, the Daily Hampshire Gazette, the Hilltown Resource Management Cooperative, the Franklin County Solid Waste Management District, the Pioneer Valley Planning Commission, and others.

The City has been an active participant in the Springfield Materials Recycling Facility (MRF) Advisory Board for nearly 20 years. In addition, City staff regularly participates in DEP's Solid Waste Advisory Committee meetings scheduled quarterly in Boston.

Educational Tours, Workshops and Meetings

The City regularly provides tours of the landfill for students (from kindergarten to the graduate level) and other types of youth groups, interested citizens and solid waste professionals. For example, the City conducted a workshop at the Smith Vocational High School composting site and a walking tour downtown Northampton for the Northeast Recycling Council (NERC) in 2004. At that time, the City's success with establishing a comprehensive organics diversion program was renowned.

From time to time, the City has organized workshops on composting, water conservation (including a new series focused on the installation and use of rainbarrels and rain gardens), "Healthy Lawn and Landscaping" workshops (focused on reducing the use of chemicals), worm-bin construction and use, and others.

City staff have also presented at local, state, regional and national conferences and workshops, as well as organizing local forums and meetings for solid waste professionals, including (but not limited to several DEP Waste Ban workshops and the Massachusetts Organics Summit.

Blue Recycling Bin and Compost Bin Program

The City has been distributing recycling bins for two decades, and currently provides free bins to residents (one per household) on an ongoing basis through the DPW office, at special events (e.g., Earth Day) as well as through a mini-grant program for multifamily properties, condominiums and businesses. Additional bins are available a discount.

Throughout the 1990's, the Northampton Board of Health and the Center for Ecological Technology co-sponsored regional compost bin distribution programs of the "Earth Machine" and "Brave New Composter" for residential backyard composting. To date, 2260 "Earth Machine" composters have been distributed in the City. Currently, the DPW conducts 5 compost bin distributions a year (in April, May, June, September & October), averaging 60-80 bins per event. By buying in bulk, using State contracts, buying directly from the manufacturer and charging no sales tax, the City is able to sell this equipment directly to residents at a significant discount.

The MassDEP estimates that a single composting bin can divert an average of 500 pounds of organic material per year from disposal. Using this factor, 175 tons of organic waste annually would be converted into soil amendment from the 700 bins that have been sold in the last three years alone. The backyard composting program has been cost-effective and successful in diverting source separated organics and yard waste from disposal at the landfill, as well as reducing each participant's carbon footprint.

"Towards Zero Waste" Project

As a collaborative project of the Northampton DPW, Central Services, GREEN Northampton and Green Action in Northampton (GAIN), desk-side trash containers will be removed from all municipal buildings and schools, and replaced with 500 custom-printed, 1.15 liter side-saddle trash bins attached to paper recycling containers in 2009.

3.5 OTHER NORTHAMPTON AREA DIVERSION PROGRAMS

There are numerous organizations in the region that provide outlets for the reuse of materials. Non-profit organizations will often accept donations, and for-profit organizations (such as second-hand clothing and furniture shops) are great sources of used goods. The following is a partial list of local reuse programs and organizations.

3.5.1 Building Materials

The following non-profit organizations accept donations of building materials.

- Restore Home Improvement Center: Springfield MA, www.restoreonline.org
- ReNew Building Materials & Salvage: Brattleboro VT, www.renewsalvage.org
- Habitat for Humanity: www.habitat.org/cd/local/affiliate.aspx?zip=01060

The following is a list of materials that may be accepted by one of these organizations.

- appliances (washers, dryers, ranges, refrigerators, air conditioners and hot water heaters in good working order, etc.);
- blocks (red brick, pavers, cinderblocks, chimney tiles, etc.);
- electrical supplies (switches, outlets, cover plates, outlet boxes, Romex, non-fluorescent lighting, ceiling fans, conduit, 100-200 amp service boxes, bath fans, etc.);
- fencing (chain-link, stockade, picket, post and rail, etc.);
- finishes (shelving, cabinets, countertops, fire extinguishers, closet rods, towel bars, coat hooks, mirrors, etc.);
- flooring (slate, marble, carpet, vinyl, tile, wood, etc.);
- furniture (dressers, shelves, chairs, tables, bureaus, filing cabinets, etc.);
- hardware (joist hangers, nails, hand tools, power tools, ladders, etc.);
- HVAC (threaded black pipe, copper pipe, hot water boilers, hot air furnaces, oil tanks, round rigid duct, floor heat registers, thermostats, propane wall-vent heaters, woodstoves, cast iron radiators, black stove pipe, double wall pipe, metal, asbestos, etc.);
- insulation (rigid foam, fiberglass, etc.);
- lumber (dimensional, plywood, sheetrock, wall paneling, tongue and groove pine, strapping, molding, sheathing, stair stringers, handrails, etc.);
- paints & related products (polyurethane, wood stain, new latex paint, unopened caulk and construction adhesive, etc.); doors (entry, panel, patio, luan, commercial slab, storm, sliding, etc.);
- plumbing (claw foot tubs, low-flow toilets, metal tubs, tub surrounds or shower enclosures, PVC pipe, copper pipe, unused fittings and faucet, etc.);
- roofing (slate, gutters, asphalt, tar paper, rolled, metal, ice & water shield, etc.); siding (vinyl, wood clapboard, shingles, novelty, etc.),
- sinks (vanity top, wall-hung, drop-in, stainless, iron, etc.); and
- windows (insulated, wood, storm, screen, etc.),

3.5.2 Online Waste Exchange Programs

Waste exchanges operate on regional, national and even international levels to serve both businesses and residents. They are easy to find online and are growing in popularity and number. FreeCycle is the largest and most well-known.

Basically, someone lists something they want to get rid of, and someone else claims it. Participants can also request items through these services. Waste exchanges for residents are operated on a local level so that people can pick up or deliver the waste items within a reasonable distance.

What can be reused or recycled through a waste exchange? Practically anything that has some value to someone somewhere. Some examples of local exchanges include:

- FreeCycle: www.freecycle.org
- Craig's List Western Mass: westernmass.craigslist.org/zip/
- Massachusetts Materials Exchange: www.materialsexchange.org/
- Massachusetts Material Trader: (website expected in Summer 2009)

3.5.3 Local Charitable Organizations

Many local non-profit organizations accept a variety of products and materials for reuse. By donating items to charitable organizations, residents can save money on disposal costs and free up valuable storage space. Many non-profit organizations will also provide a donation receipt for tax purposes. Local non-profit organizations that accept donations include (but are not limited to):

- Survival Center, Northampton: Food, in-season clothing in good repair, small household items, children's books and toys, shoes and linens.
- Birthright, Amherst: Baby and maternity clothing.
- Cooley Dickenson Hospital's Hospice Shop, Northampton: Clothing (adult and children's), household goods and small appliances.
- Community Center Clothing Closet, Easthampton: Seasonal clothing, some small household goods.
- Goodwill Industries, Northampton: Antiques, collectables, small appliances, artwork, bedspreads, blankets, curtains, tablecloths, decorative pillows, bicycles, books, records, tapes, CD's, DVD's, clothing, belts, scarves, ties, pocketbooks, cookware, dishes, pots, pans, house wares, decorative items, jewelry and sporting goods.
- The Hospice Shop of the Fisher Home, Amherst: Adult clothing and shoes, jewelry, household decorative objects.
- Parson's Closet Thrift Store, Easthampton: Clothing, small household goods and bedding.
- Salvation Army, Hadley: Clothing, hats, handbags, shoes, belts, ties, bedding, chair covers, drapes, throw rugs, furniture, appliances and electronics in good working order, bicycles, musical instruments, games, books, electronic media, sporting goods, lawn and garden equipment, and more.

3.5.4 Local ReUse Businesses

For-profit organizations such as second-hand clothing and furniture shops often purchase material from the public directly or by consignment—an attractive alternative to holding a tag sale. Local for-profit organizations that are in the business of reuse include (but are not limited to):

- Kids Kloset: Northampton
- Kidstuff: Florence
- Mom & Wee Consignment: Belchertown
- New York Shop Exchange: Northampton
- On a Whim Consignments: Northampton
- Plato's Closet: Amherst
- Retro Genie: Northampton
- Roz's Place Vintage and New: Northampton
- Second Chances: Amherst
- Sid Vintage: Northampton
- Trading Post: Amherst
- Uncle Margaret's Closet: Northampton
- Urban Exchange: Northampton

3.5.5 Regional ReUse Guides

In April 2009, two "ReUse, Reduce, Recycle" guides for the Pioneer Valley, were published by the Springfield Republican, the Daily Hampshire Gazette, the Amherst Bulletin, and the Greenfield Recorder. City staff authored several sections of these guides. Approximately 151,100 copies of these guides were distributed to residents throughout Hampshire, Franklin and Hampden Counties. In the guides, local reuse and recycling information was provided, including the following materials (most of which have not been previously mentioned in this section):

Aluminum siding
Automobiles and boats
Bicycles
Bubble wrap
Carpeting & rugs
Cell phones
Coat hangers
Eyeglasses
Fire extinguishers
Flags
Hearing aids
Ink cartridges
Packaging materials
Paint and paint-related products

Pallets
Plastic shopping bags
Smoke detectors
Styrofoam

3.5.6 Bag Share Program

BagShare is part of the Hilltown Sustainability Initiative and has a program goal of reducing reliance on plastic and paper bags. Baskets of reusable fabric bags are kept at participating shops (and library) patrons borrow a bag if they need one. The bag is then returned to that location or another BagShare location for another to use.

Community Bag Sews (sewing circles) are organized by volunteers with materials and sewing machines donated by individuals and local businesses. Volunteers work together to produce reusable cloth bags.

The ultimate goal of the BagShare project is to help stores and consumers become disposable bag free (paper and plastic) and bring their own reusable bags. This program also helps keep materials out of the landfill:

- Scrap fabric: donated from individuals and businesses
- Upholstery samples from furniture stores
- Malt bags: from local breweries
- Misprinted tote bags from silkscreen companies
- Pre-made totes: donated by individuals and businesses. Banks and other venues donate extras from fundraisers and promotional events.
- Handles: can be made from re used seat belts or ties

In Northampton the following stores are participating in the BagShare program: Florence Hardware, Coopers Corner and State Street Fruit Store, A2Z Science & Learning Toy Store, Cornucopia Natural Foods, and Serios Market. Preparations are being made to add River Valley Market to this list, as well as other stores in the City.

Another type of bag program, the Northampton Chamber of Commerce designed and produced 6,000 reusable shopping bags, which are currently being distributed though 25 businesses. Some of these establishments sell the bags at cost ($1.25 each), some at a discount ($1.00 each) and some give them away. The Chamber and member businesses promote the use of Northampton's reusable bags in a variety of ways. For example, customers who refuse a bag or use a reusable bag at FACES may enter a raffle to win a gift certificate. Currently, the Chamber is building upon the success of this project by expanding the number of participating businesses and creating new designs for their next order of reusable bags.

3.5.7 Planning for a ReUse Center

Historically, there has been a great deal of interest in establishing a comprehensive reuse center in the City. In fact, the possibilities for this were extensively researched by a City-sponsored ReUse Committee with $10,000 of funding from the MassDEP and assistance from the Center for Ecological Technology in 2004. As a result, it was determined that the MassHighway site adjacent to the DPW facility would be the ideal for a "one-stop-unshopping" center, referred to as the ReBay Center.

The following information about the possible content of a ReBay Center and other committee considerations is excerpted from stakeholder meeting minutes:

"Draft vision/mission statement of reuse operation

The Northampton reuse operation's mission is to take useful materials out of the waste stream and distribute them to others that can use them. The operation serves the residents, businesses and reuse infrastructure of the region served by the Northampton landfill.

The goals of the operation include:

- Helping citizens of developing nations through redistribution via aid agencies
- Providing reuse education and referrals to residents
- Creating a place that people like to visit on a regular basis
- Constructing and furnishing the facility with reused materials whenever possible
- The operation should be self-sustaining (through volunteers and/or revenue generated) after 2 years

Preferences for various models of reuse operations - could be one variation or a combination. As proposed, the reuse operation would progress in the following order:

1. Reuse depot run by volunteers with ongoing and event-based reuse including community flea markets, and tag sales run by volunteer organizations
2. Reuse depot as above but with paid staff
3. In addition to the reuse depot, subleasing to retail reuse store(s) and micro-enterprise using used materials as feedstock for value-added repair and manufacturing.

Additional Information on the Reuse Committee's Vision

<u>The reuse operation may include</u>:
*Bike repair and parts redistribution
*Computer
*Elder assistance in recycling
*Artisan events - found-object art projects and showings

*Student involvement and projects
*CET's ReStore branch and-or storage
*Deconstruction storage and possible retail
*Building materials redistribution for H4H and low income housing
*Storage - redistribution for art, educational, and office supplies, and for medical support items (walkers, wheel chairs, porta-chairs, etc)
*Possible "Lending Library"
*Redistributing outdated but usable items to less developed regions. (e.g. Bikes Not Bombs, Hands Across The Water, The Lazarus Foundation and Phoenix Project that reprogram outmoded computers for inner city schools)

A list of types of items to be reused:
Housewares
Yard and Garden
Toys
Books - Media
Tools - Hardware
Clothing - Textiles
Office supplies
Furniture
Bikes - Recreation
Automotive
Bin collections (packing peanuts, CD's, etc.)
Cordage - Wire
Construction material
Electronics
Paints
Art supplies
Medical items
Cleaning supplies

A list of items that will require special attention or handling
Paint
CRT's (Fluorescent tubes)
Mattresses
Propane tanks
Universal waste (mercury)
Batteries
Freon appliances
Tires on rims”

The plan that the ReUse Committee envisioned included the development of extensive partnerships with many of the non-profit organizations and reuse businesses described in this section. Currently, the DPW is working with MassHighway to acquire this site.

3.6 SOURCE SEPARATED ORGANICS (SSO)

Prior to implementation, all aspects of a source separated organics program must be thoroughly planned. Food waste is putrescible and may cause odor, vermin and other management problems. It is critical that all aspects of program management from food waste separation and storage, hauling, processing and end product marketing and distribution be done in an effective manner. This section will provide state-wide background information as well as more local data and information for the City to consider in regards to establishing a food waste/source separated organics program.

3.6.1 Background – State-Wide Organics Planning

In the Solid Waste Master Plan: 2006 Plan Revision (2006 Master Plan) DEP identified food waste and organics as an important part of their waste reduction strategy. DEP has estimated that food waste accounts for at least 10 percent of the total waste stream. Major sources of food waste include leftover food and paper products contaminated with food from homes, restaurants, cafeterias, and institutions. In addition, residual food waste comes from grocery stores and commercial food processors. When properly managed through composting or other treatment processes food waste and other source separated organic materials can be transformed into an organic material rich in nutrients that is perfect as a soil amendment.

The following excerpt from the 2006 Master Plan describes DEP plans for commercial waste reduction efforts related to food waste.

"Food Waste and Other Organics: Food waste and other organics make up nearly 30 percent of commercial waste disposal, and even more of potential additional commercial waste reduction. The picture for food waste is much different than paper. Massachusetts has a limited infrastructure for hauling and processing food waste. MassDEP estimates that more than 1.1 million tons of commercial and institutional food waste will be generated annually in Massachusetts by 2010, with less than 10 percent currently diverted. MassDEP believes that Massachusetts can achieve a 34 percent diversion rate for this material, or 380,000 tons per year, by 2010. However, only 130,000 tons of annual food waste processing capacity is currently permitted in Massachusetts, leaving a gap of at least 250,000 tons statewide. Establishing in-state food waste processing capacity is critical because this material cannot be cost-effectively transported long distances. Like most solid waste management capacity, food waste processing capacity has been difficult to site due in large part to objections from communities about potential traffic, noise, and odor impacts.

MassDEP's strategy for increasing food waste diversion will focus on simultaneously building the Commonwealth's processing and hauling infrastructure and working with targeted groups of commercial and institutional generators that generate the most food waste and have the best opportunity to cost-effectively divert food waste from disposal. These sectors include supermarkets, hospitals and other health care facilities, hotels and convention centers, colleges and universities, and state institutions such as prisons."

In the 2006 Master Plan DEP described a series of initiatives that they characterized in three categories as new, revised/expanded, and continued. These are also excerpted below:

"NEW COMMERCIAL

- **Expand Organics Processing Capacity**: Work with farms, cities, and towns and large institutions to expand organics processing capacity in Massachusetts, including:

    - Work with interested cities and towns with well-run composting operations to expand those sites to accept food waste from local food waste generators, and

    - Work with large institutions to develop increased on-site composting capacity. MassDEP will work closely with existing and new facility operators through a combination of outreach and technical assistance to expand organics processing capacity and ensure that composting operations are well run and do not create odor or other nuisance concerns.

REVISED/EXPANDED

- **Expand Supermarket Partnership:** MassDEP will continue an innovative partnership with major supermarket chains, the Massachusetts Food Association (MFA), and haulers and compost facilities to increase supermarket composting and recycling. Major elements of this partnership include:

    - A memorandum of understanding (MOU) between MassDEP, the MFA, and major supermarket chains to establish program and performance standards for supermarket recycling and composting programs. This MOU exempts participating supermarkets from waste ban inspections, similar to exemptions for municipalities with Department Approved Recycling Program (DARP) status.

    - Hands-on technical assistance to supermarkets from leading industry consultants to help them establish and maintain effective diversion programs.

CONTINUED

- **Explore Waste Ban for Commercial Food Waste:** As stated in the *Beyond 2000 Plan*, MassDEP will continue to consider adding commercial and institutional food waste as an item banned from disposal. As with other waste bans, this will be dependent on sufficient infrastructure being developed to handle commercial and institutional food waste. An extension of the waste bans to commercial food waste would require a regulatory change with public hearing and comment."

In addition to the DEP's focus on commercial sources of food waste, the 2006 Master Plan discussed residential food waste programs mainly through encouraging home composting programs, through workshops, grants for home compost bins and kitchen food waste collection

buckets, composting educational exhibits, and distribution of literature and other materials to promote the benefits of home composting.

Recent discussions with John Fischer (DEP Branch Chief, Waste and Toxics Planning) revealed that DEP's current position in 2009 regarding a commercial food waste disposal ban is the same as stated in 2006. DEP is concerned about having adequate collection and processing/composting capacity in-place before deciding on implementing a disposal ban on commercial organics. In addition, the DEP is currently considering revisions to the regulations that govern the siting and permitting of composting facilities. Regulations are discussed in more detail in Section 3.6.6.

A waste ban on commercial food waste disposal with a delayed implementation date may be what is needed in order to spur private industry planning and investment in the equipment and facilities needed to support a commercial food waste ban. Bans on other materials in the past have been successful in spurring private sector solutions to materials management resulting from waste bans.

3.6.2 Background – Western Massachusetts Food Waste Composting Efforts

From the fall of 1996 through the spring of 2000, the Center for Ecological Technology (CET) conducted an on-farm composting project in Western Massachusetts that focused on creating a network of collection, hauling and on-farm composting for commercial and other organic waste. (Building a Market-based System of Farm Composting of Commercial Food Waste, dated 2000, by CET) Through education and technical assistance to farmers, generators, and haulers CET used a decentralized approach to reduce the risk of the system failing. At the completion of the project 70 businesses had diverted 22,000 tons of organic material, and 6 haulers were delivering food waste to seven farms where materials were being composted. CET also reported that about 170 tons per week of organics were being diverted.

CET concluded that the program's success was attributable to progressive state policies related to on-farm composting of off-farm materials, the area's semi-rural demographics, and previous interest and experience in composting.

The main obstacles to program implementation were identified by CET as: "the risk to potential participants associated with the lack of an established infrastructure, lack of critical mass of participants to make the logistics and economics work, and the need for quality control in separation and processing."

Looking back now, it seems that the project was highly effective in demonstrating the overall feasibility of establishing a source separated organics management program in Western Massachusetts. However, little of the collection and composting infrastructure that was developed for the program remains today.

Martin's Farm in Greenfield remains the only composting site in the Pioneer Valley that is currently accepting commercial organics. Greenfield is a half-hour drive from Northampton, and a few of the City's supermarkets and restaurants continue to send organic wastes there. Bear

Path Farm in Whately accepts small quantities of SSO from the Food Bank Farm and from the Enterprise Farm winter farmer's market.

For most of the generators that had participated in the past, there are no cost-effective options for SSO composting. The lack of SSO composting facilities in the region is the most significant barrier to the revitalization of diversion programs for SSO.

Although a detailed study on the reasons for the failure of on-farm composting operations has not been completed there are several possible difficulties that led to the compost operation closings. These could include:

- Difficulty in finding the appropriate mix of SSO and other bulking materials such as animal bedding
- Composting was secondary to farming activities resulting in inadequate management of composting, ultimately resulting in ceasing operations
- Problems with SSO truck access to the farm and delivery of material
- Problems with the quality of SSO delivered, including plastics and other contaminants
- SSO loads with large quantities of waxed cardboard required shredding or other processing prior to composting
- Possible problems with odors, birds, blowing paper and debris

3.6.3 Background – Northampton Food Waste Composting Efforts

From 1991-1997, the Smith Vocational High School (SVHS) Farm maintained a food waste composting operation at the school farm on Locust Street. At that time, SVHS provided SSO collection services for area restaurants, as well as delivering compost. In 1997, the composting site was moved to land owned by the Department of Agricultural Resources (DAR) on Burt's Pit Road in Northampton. The diversion of SSO in Northampton was formally expanded in 1998-99 as part of the above-discussed CET project. The infrastructure for diverting SSO's in Northampton was extensive and economically sustainable In 1999, SVHS received a technical assistance grant from the DEP, which allowed a composting consultant to design and construct a composting pad at the DAR site. Concurrently, SVHS received earmarked funds from the State to purchase a Wildcat compost windrow turner.

At the operation's peak in 2002, dozens of food waste collection systems were operating throughout the City, and the SVHS compost site was receiving 25-30 tons per week of SSO's. The Board of Health and Parking Division worked together to establish three cooperatives to serve restaurants in the downtown area. Program participants included the City's large supermarkets (e.g., Stop & Shop and Big Y), food processors (e.g., Hot Mama's), small markets (e.g., Serio's and Coopers), restaurants (e.g., La Cazuela and Northampton Brewery), institutions (e.g., Smith College and the Hampshire County Jail), health care facilities (e.g., Cooley Dickinson Hospital and several rest homes), and the public schools (e.g. four elementary schools, one middle school, and the high school). At that time, five waste haulers (Alternative Recycling Systems, Allied Waste, Duseau Trucking, Martin's Farm, and Waste Management) delivered Northampton's SSO's to the SVHS farm in Northampton, Four Rex Farm in Hadley, and Martin's Farm in Greenfield. In 2003, Northampton hosted tours for

numerous groups (e.g. the Northeast Recycling Council), and was able to exhibit a full range of waste generator types, collection methods (e.g., totes, dumpsters and compactor collection systems) and service models (e.g., single accounts, cooperatives and subcontracting).

In 2004, all operations at SVHS's compost site ceased due to personnel changes at the farm. After this shut-down, nearly all of the region's SSO diversion systems disappeared within months, including a successful public school program which had been operating for several years.

Currently, the Department of Public Works (DPW) is assisting SVHS in cleaning up their site on Burt's Pit Road, with the expectation that composting operations will resume on a small-scale basis in the fall of 2009. In the meantime, the DPW is investigating the potential for other local farms to accept SSO's as well as exploring ways to expand upon the success of backyard composting programs.

3.6.4 Food Waste Generation

In order to consider a source separated organics program a general understanding of the amount of SSO that requires handling must be estimated. A view of SSO generation from a number of perspectives is summarized below.

Waste characterization data is presented in Section 2 from the Eastern Hampshire Study. Data from that study also indicates that residential food waste represented about 17 percent of the residential waste stream, or about 0.32 pounds per person per day. Commercial waste contained about 27 percent food waste or about 0.57 pounds per person per day. Applying these food waste generation numbers to Northampton's population of about 30,000 reveals a residential food waste generation number of about 4.8 tons per day. The commercial food generation rate would be about 8.6 tons per day. In total the City of Northampton (residential and commercial) generates about 13 tons per day of food waste. This value may underestimate the quantity of SSO generated in Northampton since the data is based on the Eastern Hampshire Study and Northampton has a higher concentration of restaurants than the Eastern Hampshire towns. Northampton also has a high concentration of schools and other institutions that would likely increase this tonnage estimate.

In an effort to spur development of infrastructure necessary for SSO programs across the state the DEP commissioned a report entitled **Identification, Characterization, and Mapping of Food Waste and Food Waste Generators in Massachusetts,** dated September 19, 2002, and prepared by Draper/Lennon, Inc. of Concord, New Hampshire. The report presented a database identifying and locating major food waste generators throughout the state; characterized the types and quantities of food waste generated; and developed Geographic Information System (GIS) tools that could be used to support local or regional efforts to divert, compost or otherwise process source separated organic material. The report is located at http://www.mass.gov/dep/recycle/priorities/foodwast.pdf

The report identified 5,799 food waste generators statewide and found that the three main contributors to this waste stream were food manufacturers or processors, supermarkets or grocery stores, and restaurants. To be included, food manufacturers or processors had to have

at least 5 employees; supermarkets or grocery stores had to have more than 15 employees or at lest $1.5 million in annual sales; and restaurants had to have at least 10 employees and at least $200,000 in annual sales. In addition to these generators, the study included food wholesalers/distributors, hospitals, nursing homes, colleges, universities and other schools, correctional facilities and resorts/conference centers.

As noted in the report, manufacturers, processors and wholesalers tend to be the single largest food waste generators, but, as such, they have particular characteristics. Any given product has a unique organics waste stream, and the process may not lend itself to straightforward separation of uncontaminated organic material. However, because of the expense associated with large quantities of organic waste, many of these generators have already implemented diversion or composting programs.

Of the other main types of generators, supermarkets are a prime source of potential organics diversion because of the small number of large chain stores and the relatively consistent quantity and quality of the organics waste. Although restaurants collectively are the single largest generators, they are more challenging as a group since individually their waste stream is small, diverse and more subject to contamination. The University of Massachusetts is the largest single generator in the area, and it has been composting food waste collected from kitchens, dining halls and some on campus retail locations since 1998.

Using the report database, Table 3-1 was prepared for the Central Pioneer Valley area from Southampton and South Hadley north to Deerfield. (A more detailed breakdown of the data in Table 3-1 is located in Appendix 3-4**)** The table is intended to show the details of food waste generation within a reasonable geographic proximity to Northampton that could be diverted for composting or other organics processing or utilization. Although the report recommends that the database for major generators be updated every 2 years, no updates have been made since 2002. A review of the source data also reveals that several changes in SSO sources have changed over time, yet it is believed that this summary provides a reasonable order of magnitude estimate of food waste generation in the Central Pioneer Valley.

TABLE 3-1

SUMMARY OF CENTRAL PIONEER VALLEY COMMERCIAL ORGANICS GENERATION

CITY/TOWN	Commercial Organics (tons per day)
Amherst	8.86
Belchertown	0.27
Deerfield	0.58
Easthampton	1.13
Hadley	3.15
Northampton	9.66
South Hadley	2.88
Southampton	0.91
Sunderland	0.32
Williamsburg	0.30
TOTAL	28.06

Based on this database analyses about 25-30 tons per day of commercially generated organics are generated in the Central Pioneer Valley area.

To summarize, the quantities of SSO being generated in Northampton are on the order of about 4.8 tons per day from residential sources and in the range of 8.6-9.7 tons per day from commercial/institutional sources. In the immediate Central Pioneer Valley Area non-residential SSO generation is estimated to be in the range of about 25-30 tons per day.

The amount of SSO available for a composting or other type of processing facility may be less than these amounts depending on the participation and efficiency of collection. In addition, the residential generation SSO number will be less given the large number of residents that use home composting units for their food waste.

3.6.5 SSO Technology Options

This section introduces the technologies available to manage SSO. The technologies range from more low technology composting to newer proprietary technologies such as in-vessel composting units and anaerobic digestion systems.

Composting is an aerobic process in which organic material is biologically degraded into a stable humus product. Composting facilities control and accelerate the microbiological decomposition of organic waste. The active compost process can involve simple piling and open exposure resulting in natural decay or more active procedures such as physical turning, windrowing, aerating, or other mechanical processing techniques. Heat generated during composting destroys pathogens present in the feedstock material. The compost process also reduces the organic portion of the feedstock by 40-60 percent of its original volume.

Operating concerns regarding composting include leachate management, product quality, and odors. Leachate is liquid released during the composting process. If not managed properly this may impact local groundwater or surface-waters and leachate management should be designed to comply with regulatory requirements. Samples of the compost should be tested in a laboratory for bacterial and heavy metal content. Odors also need to be controlled. The public should be informed of the operation and have a method to address any complaints about animals or bad odors. Other concerns might include zoning and siting requirements.

The three main approaches to composting are static pile, windrows, or in-vessel composting. The following composting descriptions are from the U.S. Environmental Protection Agency.

1) Aerated Static Pile Composting. In aerated static pile composting, organic waste is mixed together in one large pile instead of rows. To aerate the pile, layers of loosely piled bulking agents (e.g., wood chips, shredded newspaper) are added so that air can pass from the bottom to the top of the pile. The piles also can be placed over a network of pipes that deliver air into or draw air out of the pile. Air blowers can be activated using a timer or a temperature sensor.

Aerated static piles are suitable for a relatively homogenous mix of organic waste and work well for larger quantity generators of yard trimmings and compostable municipal solid waste (e.g., food scraps, paper products), which might include local governments, landscapers, or farms. This method, however, does not work well for composting animal byproducts or grease from food processing industries.

Like windrow composting, in a warm, arid climate, aerated static piles are sometimes covered or placed under a shelter to prevent water from evaporating. In the cold, the core of the pile will retain its warm temperature, but aeration might be more difficult in the cold because this method involves passive air flowing rather than active turning. Some aerated static piles are placed indoors with proper ventilation.

Since there is no physical turning, this method requires careful monitoring to ensure that the outside of the pile heats up as much as the core. One way to alleviate bad odors is to apply a thick layer of finished compost over the pile, which can help maintain high temperatures throughout the pile. Another way to manage odor, provided that the air blower draws air out of the pile, is to filter this air through a biofilter made from finished compost.

This method typically requires equipment such as blowers, pipes, sensors, and fans, which might involve significant costs and technical assistance. Having a controlled supply of air enables construction of large piles, which require less land than the windrow method.

This method produces compost relatively quickly—within 3 to 6 months.

2) Aerated (Turned) Windrow Composting. Organic waste is formed into rows of long piles called "windrows" and aerated by turning the pile periodically by either manual or mechanical means. The ideal pile height, which is between 4 and 8 feet, allows for a pile large enough to

generate sufficient heat and maintain temperatures, yet small enough to allow oxygen to flow to the windrow's core. The ideal pile width is between 14 and 16 feet.

This method can accommodate large volumes of diverse wastes, including yard trimmings, grease, liquids, and animal byproducts (such as fish and poultry wastes), but only with frequent turning and careful monitoring. This method is suited for large quantities, such as that generated by entire communities and collected by local governments, and high volume food-processing businesses (e.g., restaurants, cafeterias, packing plants).

In a warm, arid climate, windrows are sometimes covered or placed under a shelter to prevent water from evaporating. In rainy seasons, the shapes of the pile can be adjusted so that water runs off the top of the pile rather than being absorbed into the pile. Also, windrow composting can work in cold climates. Often the outside of the pile might freeze, but in its core, a windrow can reach 140 °F.

Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labor to maintain and operate the facility, and patience to experiment with various materials mixtures and turning frequencies.

This method will yield significant amounts of compost, which might require assistance to market the end-product. Alternatively, local governments can make the compost available to residents for a low or no cost.

3) In-Vessel Composting. Organic materials are fed into a drum, silo, concrete-lined trench, or similar equipment where the environmental conditions—including temperature, moisture, and aeration—are closely controlled. The apparatus usually has a mechanism to turn or agitate the material for proper aeration. In-vessel composters vary in size and capacity.

In-vessel composting can process large amounts of waste without taking up as much space as the windrow method. In addition, it can accommodate virtually any type of organic waste (e.g., meat, animal manure, biosolids, food scraps). Some in-vessel composters can fit into a school or restaurant kitchen while others can be as large as a school bus to accommodate large food processing plants.

In-vessel composting can be used year-round in virtually any climate because the environment is carefully controlled, often by electronic means. This method can even be used in extremely cold weather if the equipment is insulated or the processing takes place indoors.

In-vessel composting produces very little odor and minimal leachate.

In-vessel composters are expensive and might require technical assistance to operate properly, but this method uses much less land and manual labor than windrow composting.

Conversion of organic material to compost can take as little as a few weeks. Once the compost comes out of the vessel, however, it still requires a few more weeks or months for the microbial activity to stabilize and the pile to cool.

One of the successful trends in the aerobic composting industry is the addition of food wastes to the feedstock. However, the nitrogen in meats and fatty materials tends to produce unpleasant odors, so composting is generally restricted to vegetable matter. Even in this case, odors can be generated that are objectionable to some neighbors.

Where co-collection of food and yard wastes is possible, this feedstock has been composted successfully. The addition of food wastes requires pre-screening to remove contaminants, depending upon the extent of public education and awareness. Also, finished compost product may require post-treatment screening to remove contaminants such as film plastics. The benefit of restricting the addition to food waste rather than mixed MSW is that, when co-collected, the addition of food waste can occur without the additional contamination associated with the MSW feedstock. One benefit of adding food wastes to the yard waste collection and composting system is that removal of the wetter food wastes from the remainder of the MSW reduces the contamination of other components in the MSW such as cardboard and paper.

Another potential approach available for processing the SSO fraction is small scale anaerobic digestion. Anaerobic digestion is a common biological process that occurs in digestive systems, marshes, landfills, and septic tanks. Small scale anaerobic digestion systems make use of organic waste such as food scraps that would otherwise go into landfills. Beneficial bacteria break down the organic waste to produce fertilizer and biogas, which is typically two-thirds methane. One area that is receiving significant attention today is the application of this technology to diverting the organic fraction of the municipal waste stream from landfill disposal.

In theory, any organic material can decompose anaerobically, however, some materials work better than others. Manure works very well. Plant material can be used, but attention must be paid to ensuring that acidic matter is avoided.

As indicated in Section 3.6.4, there is an estimated 12 to 15 tons per day of organic waste generated in the City. Vendors currently proposing facilities in several procurements across the country are typically proposing facilities much larger in scale. These include ArrowBio (existing facility in Israel (150 TPD) and Australia (300 TPD)), EcoCorp (Spain 900 TPD) and Dranco (facilities ranging from 55 TPD to 330 TPD). Developing a facility in this size range carries with it the very significant risk related to ensuring sufficient thruput, as the City does not control anywhere near the volume of waste needed to support a medium to large scale facility. Smaller scale digestors are in widespread use in other parts of the world on agricultural and animal farm wastes.

Small scale anaerobic digesters have been used for centuries around the world. Most small scale installations today are found in lesser developed countries, driven in part by the fact that it provides a mechanism for managing wastes generated in regions that do not have other available infrastructure in the form of landfills or sanitary sewers. In the developed world, most existing anaerobic systems are utilized in processing farm waste (manure and/or agricultural biomass) or in treating sewage.

Mass DEP has included small scale anaerobic digestion as one of the emerging technologies that it is very interested in seeing developed in state. It was the subject of the plenary session at the 8th Organics Recycling Summit: The Changing Climate of Composting. In addition, a separate roundtable was held at this summit regarding On-site Management Opportunities for Food Waste: Emerging Technologies, which included a discussion of High-Volume Organic Waste to Liquid Decomposition Systems, Pulping Systems and Small On-Site Anaerobic Digestion.

Interest has also been expressed by the agricultural sector in ensuring that anaerobic digestion technology is recognized in the Green Communities Act as eligible for renewable energy credits. There is at least one ongoing initiative in Massachusetts to combine food waste and animal wastes from several farms to generate electricity through anaerobic digestion. Parties involved in the Massachusetts AGreen Energy LLC includes farms in Hadley, Rutland, Lee, Brookline, South Deerfield, Dracut, Granville and Colrain. In June it was announced that the Department of Agricultural Resources awarded a $34,800 grant that will be used to develop site plans and engineering drawings for farms in Colrain, Deerfield, Hadley, Granville and Rutland. This project managed by SJH and Company of Boston will use the Schmack BioEnergy digester. According to the manufacturer, their units can handle up to 33 tons of food waste per day in addition to the manure it is mixed with.

Potential sources of organic waste in Northampton suitable for processing in a small scale anaerobic digester include food waste from supermarkets, restaurants and large institutions, like schools and hospitals, and source separated residential organics. Northampton currently has a successful yard waste composting program, and food waste disposals in dwelling units are in common use, which does limit the amount of organic materials generated from source separated residential organics that could be available for a small scale anaerobic digester. Potential sites for such a unit include farms in the area, or possibly the Northampton landfill.

3.6.6 Regulatory Summary

There are several sets of state regulations that may apply to SSO composting or other SSO processing technologies such as anaerobic digestion.

DEP regulates facilities under the Site Assignment Regulations for Solid Waste Facilities (310 CMR 16.000) and the Solid Waste Management Regulations (310 CMR 19.000).

Regulatory requirements for composting facilities vary depending on facility type and size. A facility may fall under one of the following three categories.

- **Conditionally Exempt Operations.** Some facilities, such as leaf and yard waste, agricultural and on-site institutional composting sites, are conditionally exempt from DEP site assignment requirements as long as they meet specific performance standards. These municipal and commercial sites must register with DEP, and agricultural sites must register with the Department of Agricultural Resources (330 CMR 25.000). Conditionally exempt operations also need to notify local boards of health when they register with either of those

state agencies. The Northampton landfill and SVHS composting sites are currently registered and conditionally exempt.

Agricultural Waste Composting (310 CMR 16.05(4)(c)). A composting operation for agricultural wastes when located on a farm is conditionally exempt. An on-farm composting operation may utilize compostable materials generated off-site including leaf and yard waste, wood waste, clean newspaper or cardboard, clean compostable shells and clean bones, non-agricultural sources of manures and animal bedding materials, less than 20 cubic yards or less than 10 tons per day of vegetative materials and less than 10 cubic yards or less than five tone of food material.

In addition, Composting on Industrial, Commercial or Institutional Sites or Zoos (310 CMR 16.05(4)(c)) are also conditionally exempt from site assignment as long as less than four cubic yards or less than two tons per week of vegetative materials, food materials, or animal manures that are generated on-site and where DEP and the local board of health is notified as required.

- **Determination of Need (DON).** Other facilities, depending on their feedstock and size, may not require site assignment. In a case like this, the facility must submit a DON application to the appropriate DEP regional office and receive DEP approval before construction. (See 310 CMR 16.05 [6].) DEP provides a 21-day period for the local board of health to comment on a draft DON before it becomes final.

Site Assignment. A facility that does not qualify for a Conditional Exemption or a Determination of Need is required to obtain a site assignment from the local board of health. Larger facilities and those that accept mixed solid waste or sludge generally need to go through this process. A site suitability report issued by DEP is required before the board of health makes its decision. After receiving a site assignment, the applicant also needs to apply for and obtain facility permits from DEP in accordance with the Solid Waste Management Regulations. (See 310 CMR 19.000.) A composting facility may also need to obtain approvals from other local agencies before it begins operations (e.g., conservation commission approval is needed if a facility is located near a wetland). Site assignment regulations provide an opportunity for public comment to ensure that communities and neighbors are notified and provided with information about proposed projects. The process also ensures that potential concerns such as odor, noise, and traffic are addressed before a facility is approved.

3.6.7 SSO Program Considerations

There are many factors for the City to consider relative to the organics portion of the waste stream. These are discussed briefly below.

Focus on Collection: One option is for the City to focus on a food waste collection program for commercial sources. This would be a program similar in some regards to the CET program almost a decade ago (Sections 3.6.2 - 3.6.3). In this scenario, the City would work with restaurants, institutions and haulers to develop a system for food waste collection. Some limited food waste collection is occurring now in Northampton. The goal of this type of program would be to divert as much food waste and organics from the waste stream as possible. The

City of Cambridge embarked on this type of program in 2006 with the assistance of a DEP grant. Reports and other information are available on their website (www.cambridgema.gov/recycling). Program funding may be required for consultant assistance, City staff time including possible additional staff, education and informational resources, collection equipment grants and other program costs. DEP and the City of Cambridge have developed publicity and program materials that may be shared for no cost if Northampton is interested in moving forward with a food waste collection program. Perhaps the most important consideration regarding implementing a SSO collection program is to determine where and how the SSO materials will be managed. SSO facility development and implementation issues are discussed below.

SSO Facility Options:

As discussed earlier in this section there are a limited number of facilities that accept SSO. There is not sufficient facility capacity to manage all the SSO generated in Northampton or all of the SSO generated in the Central Pioneer Valley area.

The DEP is currently still considering a waste disposal ban on commercial food waste. The draft revision to the State Master Plan will be released in the summer of 2009 revealing whether or not a waste ban is forthcoming. A state-wide ban on the disposal of SSO would be a significant driver in getting the private sector to invest in SSO collection and composting or other processing facilities.

If a waste ban is not implemented, one option is for the City to identify local farms that might be interested in composting SSO. This would be similar to the approach used by CET, where decentralized, on-farm composting was used as a means to manage collected food wastes. A critical factor in the success of such an undertaking is ensuring that there is adequate commitment of processing capacity in the region. Preferably, this would be at more than one location to help ensure that loss of any one site for whatever reason (e.g. changes in personnel, modification of site use, etc.) does not preclude continued collection efforts. City staff could provide technical assistance with start-up and operations at farm(s) that state an interest in SSO composting. Depending on revenue availability, the City may be able to offer grant assistance for on-farm compost facilities. The permitting of on-farm composting is straightforward for on-farm compost operations that will take less than 5 tons per day of food waste. Theoretically, only 2 on-farm compost operations would be needed to manage all of the 8.6-9.7 tons per day of commercial SSO in Northampton. Compost operations accepting this amount of SSO would need considerable land for compost operations and would need to be able to manage incoming SSO daily. The benefits to this option are low start-up cost, ease of permitting, and private sector solutions for SSO materials management. Potential benefits for farmers include tip fee revenue from accepting SSO and also revenue for final compost sales.

Another option is for the City to find a site to develop a City-owned SSO composting operation. A city-owned SSO composting facility would likely be designed to manage residential and/or commercial SSO generated within the City limits. A major challenge for this type of project involves finding an appropriate parcel of land of adequate size and characteristics to run a SSO composting facility. In addition, a source of funding for upfront project costs would need to be

determined with costs that may include: land acquisition, design and permitting costs, site preparation costs, equipment costs, staffing and business plan preparation, etc. A facility such as this would need to be designed and programmed to be financially self-sufficient with revenue generated being greater than the cost of start-up and ongoing operations. One challenge with this option is to determine a tip fee for the SSO that is competitive in the market to get the SSO to be delivered to the facility. The City is not in the hauling business, and there is market risk if other privately-owned SSO facilities are constructed and control the flow of SSO through hauling contracts. In terms of permitting, this type of facility would require the preparation of detailed plans and the filing of a Determination of Need with DEP.

A third option is for the City to issue a request for proposals (RFP) for a private company to develop a facility at the landfill site or other site within the City. In this case the financial risk for the project is placed with the private company. The benefit to the developer is that they are provided a suitable site to develop the project.

The DEP is very interested in this project approach where a site that already has a site assignment permit is used to develop a regional SSO processing facility. DEP gave a grant to the Town of Raynham to develop a RFP and seek proposals from private vendors to develop a regional SSO facility. Proposals were received in 2008 from 4 private companies who offered to develop a facility in the range of 4,000 tons per year to 60,000 tons per year. Each company proposed profit sharing arrangements with the Town. Reportedly, the Raynham Board of Selectmen voted not to move ahead with the project citing concerns about truck traffic, technical feasibility, odors and other uncertainties.

Since the Raynham RFP was developed using grant money it is available for modification and use by Northampton. A comparable regional facility at Northampton would be anticipated to accept no more than about 10,000 tons per year based on SSO generation amounts discussed earlier in this section. As the host of the facility, the City would receive some financial benefits as part of the overall contract with the vendor. Alternative procurement methods are explored in more detail in Section 4.

3.7 ZERO WASTE CONCEPTS

3.7.1 Other Material Diversions

One approach to fostering diversion and material reuse is the implementation of material bans from disposal. As previously mentioned, Mass DEP has used this approach for many years. These bans are designed to: (a) conserve capacity at existing disposal facilities; (b) minimize the need for new facility construction; (c) provide recycling markets with large volumes of material on a consistent basis; (d) keep certain toxic substances or materials from adversely affecting our environment when landfilled or incinerated; and (e) promote business and residential recycling efforts.

The current materials banned include recyclable paper, glass containers, metal containers, single resin narrow-necked plastics, leaves & yard waste, lead acid batteries, white goods, whole tires, cathode ray tubes, asphalt pavement, brick, concrete, metal and wood. Mass DEP

is considering adding additional materials to the list of banned materials. Items currently being considered include carpets, gypsum wallboard and commercial generated food waste. There are several criteria that the Mass DEP uses to determine whether or not to implement a ban, including the availability of appropriate management infrastructure and alternatives. Implementation of specific product bans at the local level is not generally recommended. Rather, efforts in this regard are better targeted at the state and federal level.

3.7.2 Technical Assistance

There are a number of sources of technical assistance available through Mass DEP. While the current economic climate may see a reduction in the level of potential support available, historically the types of assistance available have included technical assistance grants, access to regional recycling coordinators, grant funding of targeted program initiatives and revolving load funds. Current programs identified by Mass DEP include the Municipal Sustainability Grants Program, the Recycling Industries Reimbursement Credit (RIRC) grant program, and the Recycling Loan Fund. The Sustainability Grants Program provides municipalities, schools and certain regional government entities with equipment, outreach materials, technical assistance and funding in support of waste reduction, water conservation, household hazardous waste and mercury diversion, and air quality initiatives. Historically grant items have included public area recycling containers, home composting bins & rain barrels, school chemical management and cleanout assistance, collection sheds for end-of-life mercury-added products, idling reduction campaign tool kit, diesel vehicle retrofit equipment and diesel hybrid truck subsidies and technical assistance. The RIRC is intended to address economic barriers to recycling and reuse. The loan fund provides low cost loans to the private sector.

In addition, to technical assistance programs offered by the state, the City could consider more formally offering solid waste related technical assistance to multi-family housing, businesses, and other waste generators within the City. As an example the City could develop a pro-active plan to help businesses prevent waste. Some ideas to implement assistance could include:

- Identify needs of local businesses
- Work with Northampton Chamber of Commerce, Northampton Business Improvement District and other business or trade groups to gather input about waste diversion opportunities
- Market and advertize the availability of City program to work with businesses and other groups
- Set-up an awards and recognition program for local business waste prevention success stories
- Develop publications and other materials to assist the business community to implement waste prevention or source reduction efforts
- If adequate funding is available consider use of grants to provide recycling containers or other waste diversion support for businesses

Given the time demands for this program the City should review staffing needs and consider the addition of additional staff or interns to assist with outreach efforts.

3.7.3 Financial Drivers/incentives

One approach used to help foster waste diversion is the use of price signals to modify consumer behavior. The "pay-as-you-throw" (PAYT) or "volume based pricing" program in place in Northampton is just such a program. Although currently sticker fees are low as disposal costs for residents is subsidized. By providing a price signal at the curb or drop-off site, it helps emphasize the importance of separating out recyclables prior to disposal.

Another approach is the previously described use of separate fees at Resource Recovery Parks. By making access to the recycled materials portions of the site less costly or free, with access to the disposal site costing the user more, a clear incentive is provided to recycle as much as possible.

There are a number of municipalities in the Commonwealth that have implemented variable rate pricing strategies, commonly referred to "pay-as-you-throw" (PAYT) programs. According to MassDEP, as of April 22, 2008, there are 125 communities that have implemented PAYT programs. In addition, 7 additional towns have voted to implement PAYT. Forty-eight (48) of the municipalities provide curbside PAYT collection programs, while 75 offer drop-off PAYT programs. Northampton's sticker fee program for the Locust Street and Northampton Landfill drop-off sites is a PAYT program.

The objective of most PAYT programs is to motivate individuals to reduce waste and increase recycling. Under a typical PAYT program, the residents pay for each bag or barrel of MSW disposed, while recyclables are collected at no separate added cost. This provides a clear financial incentive to the resident to reduce waste through source reduction, recycling and composting.

According to MassDEP, almost all PAYT programs in Massachusetts are based on volume rather than by weight. Most programs require residents to purchase stickers, special bags, wheeled carts or trash barrels.

Curbside Collection PAYT Programs. Under the bag system, residents purchase bags at various store locations in the community. The price of the bag includes the cost of the bag and part or all of the cost of waste collection, transportation, disposal and program administration.

Another curbside approach involves the use of special stickers. Residents buy these stickers and can affix them to trash bags or barrels of their choice prior to setting them at the curb. Using different colored stickers can accommodate different sized containers. In addition, stickers can be used on bulky items as well. Unstickered waste is not collected. As with bags, the residents are required to purchase the stickers at various locations within the community and the cost is established to cover the cost of the stickers and part or all of the cost of providing the waste management services.

A variation on a curbside PAYT system involves a community providing a basic level of service (i.e., collection of a 30 gallon container for MSW per week and collection of recyclables). The resident is required to pay for any waste generated in excess of the basic service level typically through stickers or bag fees. The basic service is funded either through tax revenues or billed separately to the resident, either by the Town or the hauler. Eleven of the 48 municipalities providing for curbside collection in the Commonwealth have elected to provide PAYT using this basic services model, including Longmeadow and East Longmeadow as discussed in the Future Collection Alternatives section of this report (Section 5.3).

Drop-off PAYT Programs. A drop-off alternative, sometimes referred to as the any container approach, is used in some communities whereby residents can bring their waste to a drop-off facility and pay per container. Northampton's drop-off program falls in this category. Rather than using stickers, a bag approach could be used at a drop-off site similar to those used for curbside programs.

A few communities utilize the punch card system. The cards are good for several uses. Each time a resident delivers a container to the drop-off facility, the card is punched. Punch cards can be purchased for different types of containers and/or number of uses.

Funding Solid Waste Management Program. MassDEP recommends a two tiered approach to funding the costs of solid waste management. They recommend that collection and transportation costs are paid out of tax revenues or an annual or monthly fixed fee and that disposal costs (tipping tees) are paid out of bag/sticker revenues to help ensure that fixed and variable system costs are covered.

Another approach is the previously described use of separate fees at Resource Recovery Parks. By making access to the recycled materials portions of the site less costly or free, with access to the disposal site costing the user more, a clear incentive is provided to recycle as much as possible.

There are a number of alternative ways of establishing price signals. The current approach in Northampton of providing drop-off sites for recyclable materials at no additional charge and charging for waste disposal through stickers is one approach. Another option being considered is the use of bags. While either option (sticker or bag) provides a price signal to the consumer supporting separation of recyclables, there are certain advantages and disadvantages of each alternative summarized in Table 3-2 below. One of the major advantages of a bag system is that it can provide a clearer signal to the user in that it is more easily and directly linked to the volume of waste being generated than with the sticker approach, as stickers can be applied to bags of varying capacity.

Table 3-2

Pay as You Throw Options [(a)]

Sticker System	
Advantages	Concerns
Sticker systems are less expensive to implement than bag systems because the cost of producing stickers for sale to residents is lower than for bags. Selling stickers at local retail establishments and municipal offices offers lower distribution, storage, and inventory costs than subscription systems and less resistance from retailers than bags. Stickers can be used to indicate payment for bulky items or white goods. Residents can choose between bags or cans BUT size and type of can or bag still have to be restricted to a specified size/type.	To avoid confusion among residents, the municipality must establish and clearly communicate the size limits allowable for each sticker. It is more difficult for residents to visualize size limits with stickers than with bags. If stickers are sold in municipal offices, extra staff time will need to be committed. Residents might view a requirement to buy and store stickers as an inconvenience. Stickers sometimes do not adhere to containers in rainy or cold weather. Extra time might be needed at the curb for collectors to enforce size limits. Stickers are not as noticeable as bags or other prepaid indicators and may slow down collection.
Bag System	
Advantages	Concerns
Residents find bag systems easy to understand. They just need to buy bags, which they need anyway, instead of a sticker plus a bag. Volume limits are more easily assured with bags than with stickers. Bag systems offer the potential for a stronger waste reduction incentive when small sized bags are used. This flexibility with smaller bag sizes benefits low-volume users, such as senior citizens. Bag collection tends to be faster and more efficient than sticker systems and subscription systems because bags are easy to see and remove. Items that are not in compliance are easily noticed. Bag systems provide the opportunity to offset costs by selling advertising on “official” bags.	Bags are more expensive to produce than stickers. If bags are sold in municipal offices, extra staff time will need to be committed. Residents might view a requirement to buy and store bags as an inconvenience. There may be potential difficulty with retailers who may object to selling the bags and/or insist on a markup. Unlike cans, bags are not reused, adding to the amount of solid waste entering the waste stream. Residents using containers may object to having to switch to bags. The weight of bags after stuffing might be a problem unless weight restrictions are instituted and enforced. Animals can tear bags and scatter trash, or bags can tear during lifting.

(a) Pay-As-You-Throw: An Implementation Guide for Solid Waste Unit-Based Pricing Programs, Mass DEP, January 2004

3.7.4 Virtual SWAP Shop

There are a growing number of material exchange programs being offered on line. These programs essentially work like an electronic swap shop, with parties posting on line descriptions of items for sale, trade, or free. These include Freecycle (www.Freecycle.org) where people post items that are available for free for pick up or Craigslist where people post items for sale, trade or free (westernmass.craigslist.org/zip). Refer to Section 3.5.2 for more detailed information on on-line waste exchange programs.

3.7.5 Resource Recovery Park Concept

The Northampton Landfill and drop-off center is already a Resource Recovery Park that includes drop-off for recyclables, e-waste and bulk waste; leaf composting; and includes landfill gas recovery for electric generation.

The City could consider expanding the Resource Recovery Park features to accommodate more diversion programs and processing (to be provided by the City or through leases to tenants). Similar activities implemented elsewhere include building materials exchange, hardware exchange, arts and media exchange, general store, a last chance mercantile center and salvage. As previously discussed, another possible activity that could be sited at the Northampton Landfill is a small scale anaerobic digestion unit for handling organics generated within the region. The organics fraction would need to be captured from available sources, which include restaurants, institutions, supermarkets and potentially from separately collected source separated residential organics.

4.0 Section 4 - Innovative, Emerging and Other Conversion Technology Options

4.1 OVERVIEW

Zero Waste programs include the use of conversion technologies to divert significant portions of the post-consumer waste stream for landfills. Other factors driving this interest across the country in these technologies include the following:

- Many states and communities adopting greater waste diversion level goals;
- Landfill capacity concerns and increasing costs;
- Favorable economic/political climate (renewable energy, tax credits, etc);
- Climate impacts & Environmental impacts; and
- Some vendors are claiming to offer "risk free" approaches.

This section discusses some of the experience with innovative, emerging and other conversion technologies throughout the world, as well as in Massachusetts. For example, the City of Taunton is in the middle of a procurement process seeking private companies willing to finance and own an emerging technology facility sized at up to up to 1800 tpd to be located on land recently purchased by the City. The City's landfill is expected to reach capacity in 2013 and they are interested in finding a technology to replace the landfill. Technologies being considered include both traditional and emerging technologies; e.g., composting, co-composting, thermal gasification, aerobic and anaerobic digestion, hydrolysis and mechanical means of waste separation into useful products. Landfilling and traditional waste-to-energy technology are not being considered. Sixteen companies submitted expressions of interest in September 2008. Detailed price and technical proposals were due in June 2009.

There are some firms developing conversion technologies being proposed or implemented that treat other waste streams, such as construction and demolition debris. For example, Ze-gen LLC was formed in 2004 to develop and implement facilities that process construction debris into synthetic gas (hydrogen and carbon monoxide) and a small amount of methane by passing construction and demolition debris through a molten metal bath. Zegen, in partnership with New Bedford Waste Services, has developed a demonstration facility in New Bedford, Massachusetts. The demonstration facility can process up to ten tons per day of C& D residual material to generate syngas and slag. It began demonstration operations in November 2007, generating syngas from primarily clean wood at the outset. More recently, the company has conducted tests using other materials. In January, the Company raised an additional $20 million with the intent of moving into commercial operations, reportedly sometime in the latter half of 2010. The discussion below, however, is focused on conversion technologies for post-consumer municipal solid waste similar to the types of waste disposed of in the Northampton Landfill.

Mass DEP is in the process of updating the Solid Waste Master Plan (see Section 1.1). Begun over a year ago, the current schedule is to issue a draft plan sometime during the summer of 2009. Once the draft is issued, DEP will be holding public hearings and a public comment period on the draft plan, with the goal of issuing a final plan in 2010. The overall objective of the revised plan is to shift the emphasis from managing waste at the end of a product's life cycle to reducing waste during the production process and to further foster DEP's preferred hierarchy of reduce, reuse, recover and dispose.

Mass DEP has historically indicated an interest in innovative and emerging technology options. DEP has implemented several initiatives directed at fostering increased source reduction, diversion and increasing the role of alternative technologies such as gasification, pyrolysis and anaerobic digestion. These efforts have included the commissioning of a study prepared by Tellus Institute entitled *Assessment of Materials Management Options for the Massachusetts Solid Waste Master Plan Review*, released in December, 2008. One of the conclusions cited in the report is that ". . . After maximizing diversion through source reduction, recycling and composting, it is appropriate for DEP to continue to monitor developments regarding alternative waste management technologies that produce energy – gasification, pyrolysis, and anaerobic digestion."

City residents and staff have also expressed an interest in examining potential alternative processing and treatment options as potential approaches to expanding the diversion of materials from disposal.

Other communities also investigating potential innovative and emerging technologies include large cities like New York and Los Angeles, medium sized communities like Salinas, California; Ottawa, Canada and, as discussed previously, Taunton, Massachusetts. The technologies under consideration include mechanical pre-processing, thermal treatment and biological treatment.

A review of technologies considered innovative and emerging in the 1970's included mechanical processing; thermal treatment (including mass burn waterwall incineration, refuse derived fuel (RDF), RDF to a dedicated boiler, modular incineration, gasification and pyrolysis); and anaerobic digestion. The list is very similar to that being considered today, i.e., mechanical processing; thermal treatment (including advanced thermal recycling, gasification, pyrolysis, and plasma arc); anaerobic digestion and hydrolysis.

Although the basic principles of mechanical, thermal, biological, and chemical processes have not changed over the past 100 years, the applications and understanding have improved significantly. Today's technologies are not your father's Olds. For example, advanced thermal recycling does not resemble the incinerators of the 50's. It is important to note that of the potential technologies being proposed and in some cases constructed in the 70's, only mass burn thermal treatment, refuse derived fuel in a dedicated boiler and modular incineration continue in operation. A number of major corporations proposed emerging technologies in the 70's and even built multimillion dollar facilities sized up to 3,000 TPD. These corporations included Monsanto, Union Carbide, Devco, Garrett Research and Development (a division of Occidental Petroleum), Hercules, Black-Clawson, Horner-Schiffrin; and Combustion Equipment

Associates. None of these companies are offering solid waste conversion technologies today and none of the facilities that they built are operating today. This is not to say that innovative and emerging technologies should not be pursued, only that they should be pursued carefully.

Therefore, the efficacy of a technology being promoted today and the financial backing provided by the technology supplier are critical to a successful project. In the following paragraphs, the state of development of various innovative and emerging municipal solid waste (MSW) conversion technologies, investigated by HDR over the last few years, are discussed.

HDR engineers personally conducted facility site visits throughout Europe, Asia, the Mid-East and the United States that represented the majority of emerging technologies discussed in this section. HDR has followed-up on these site visits through evaluation and analysis of information and many in-depth rounds of questioning and review of responses from the technology vendors. The evaluations are based on extensive engineering reviews of designs, operating data, and hands on inspections of various facilities. Operators, engineers and local officials were interviewed to obtain their perspectives of the projects toured. The results presented reflect the status of development of these technologies as of December 2008. Estimated average costs are provided in 2008 dollars. Although HDR's review of the technologies it has toured is comprehensive, the evaluations are ongoing and the summary below does not include evaluations of all the technologies being offered by specific companies, vendors, or developers.

The focus of this investigation is on technologies for processing all post-consumer, post-recycling waste, i.e., the type of garbage and trash that is currently being disposed of at the Northampton Landfill. Therefore, the ability of technologies to process a highly variable MSW stream was used as a criterion in the evaluation. Technologies, such a mass-burn combustion and composting (i.e., aerobic digestion), other than in-vessel mixed waste composting, that have been successfully implemented in the United States are not included in this discussion of innovative and emerging technologies.

The following technologies are discussed in this section:

1. Anaerobic digestion
2. Autoclaving
3. Gasification
4. Plasma arc gasification
5. Pyrolysis
6. Hydrolysis
7. In-Vessel Mixed Waste Composting

The descriptions of the technologies are followed by a discussion of alterative ways to procure and finance a conversion technology project.

4.2 ANAEROBIC DIGESTION

Anaerobic Digestion is classified as a "biological" process where biodegradable material (the organic fraction of MSW) is broken down in the absence of oxygen in an enclosed vessel. Anaerobic digestion is currently used extensively for processing wastewater treatment sludge, but it has not been used extensively for treating MSW to date. This technology would typically be applied only to the organic waste components, such as agricultural wastes, yard trimmings, vegetable matter, animal waste, food waste or other cellulose-containing materials, and wastewater treatment sludge, but it would not be applicable to the entire municipal solid waste (MSW) stream.

The anaerobic digestion process produces a low-Btu (British thermal unit) gas, "biogas", which can be either: 1) directly processed on-site to create energy, 2) mixed with natural gas at an existing facility to supplement the fuel that processes the gases into energy, 3) converted into a fuel product, or 4) flared. It also produces a solid product called a "digestate" that is used as a compost end-product. The quality of this product dictates its final use (i.e., agriculture, non-agricultural landscaping, fill material, etc.).

HDR conducted site visits of six (6) MSW anaerobic digestion systems in various states of construction, commissioning or operation. From these site visits and evaluations, HDR has concluded that approximately 35% to 45% diversion from the overall waste stream is a possibility from the anaerobic digestion process. Of this amount, 15% to 20% may be marketable as biogas and digestate materials. Another consideration for proper operations of an anaerobic digestion facility is odor control

In general, the organic fraction needs to be either source separated and collected separately, or the MSW needs to be pre-processed through a mixed waste material recovery facility (MRF) to generate an organic rich fraction for processing. The costs for anaerobic digestion systems are likely to be lower than some of the other emerging technologies under discussion in this section, but would typically be much higher than composting operations.

HDR's general conclusions on the anaerobic digestion processes are:

- European plants are utilizing green waste, also some taking food waste
- Several European plants are utilizing MSW, but many visited by HDR were under construction. For MSW:
    - Significant pre-processing of mixed MSW is important because a small particle size for the waste is required to optimize the anaerobic digestion process
    - There are potential negative impacts: odor, air emissions
    - Physical contaminants in the digestate such as small pieces or shards of glass that leave a glitter in the digestate can be an issue; chemical contaminants can also be an issue, however the digestate will need to be tested regularly according to local regulatory guidelines and these test should detect any potential chemical contaminants
- HDR was unable to obtain long term operational and emission data

- Service fee projected in range of $80 – $150/ton (includes other technologies and equipment to assist in pre and post processing of the materials to prepare the feedstock for digestion by removing the contaminants and other non-biodegradable materials; it also includes screening and other equipment for preparation of by-product materials for market). Some vendors are claiming much lower costs.
- Biological treatment of organic waste materials can result in a potential source of energy and soils amendment by-product and can potentially be an effective component of a multi-faceted integrated waste management program

4.3 AUTOCLAVING

Autoclaving is classified as a "mechanical" process that uses heat and pressure in a mechanical rotating cylinder to separate the cellulosic material, such as paper, green waste and cardboard from other portions of the municipal solid waste stream. Cellulosic materials are derived from a complex carbohydrate that is composed of glucose units that forms the main constituent of the cell wall in most plants; many organic materials such as papers, cardboards, etc. (as described above) are manufactured from this cellulose and are thus called "cellulosic materials". The basic autoclave technology has been in use for sterilization of hospital wastes and equipment and other related applications for many years.

Like anaerobic digestion, autoclaving addresses only a portion of the waste stream, namely the cellulose-fiber-containing portion, which is usually 40% to 50%. However, this technology can also be used as a "front-end" to many of the other emerging technologies such as gasification, anaerobic digestion, or plasma arc gasification using a trommel screen to separate out the various mixes of materials produced from autoclaving (i.e., fine organics stream, bulky organics stream, and overs, such as recyclable glass, metals and plastics). If the goal for the autoclaving technology is recovery for paper production, because the fibers are of such a mixed grade, the main product that can be produced is a lower-grade cardboard.

All of the demonstration projects have been completed on a fairly small scale (less than 300 tpd). HDR conducted a site visit of the Worldwaste autoclave project in Anaheim, California. It was operating at the time of our visit; however, it is currently not operating and has been dismantled due to financial circumstances. HDR also conducted a site visit of the CR3 autoclave in Reno, Nevada. The autoclave unit has now been moved near to Salinas and HDR is currently involved in a program to test other uses of the end product such as anaerobic digestion, ethanol production and composting. No known commercial MSW autoclave operations exist at this time in the U.S. or elsewhere.

The costs for autoclaving are in the middle of the range of technologies we examined. Autoclaves are large pieces of equipment that process from 1 to 25 tons per 2- to 3-hour batch. Operating costs can be high because of the energy required to autoclave the waste and the equipment in the fiber-processing plant. Fiber prices for this grade of cardboard can be volatile, and it is difficult to obtain long-term contracts to sell the materials at stable prices. It is likely that, since the technology is well-defined and there are no commercial facilities, the overall project economics are not favorable. Studies HDR has completed for other locations indicate

that a net tipping fee of at least $65/ton is required, even when the facility is located close to a market for the pulp.

HDR general conclusions on autoclave process are:

- Potential for over 60% reduction in waste volume
- Cellulose recovery has potential to be used as feedstock for
    - Paper production
    - Ethanol production feedstock
    - Compost feedstock
    - Digester feedstock for methane production
- Factual performance, emissions and cost information is lacking
- If and when proven viable on the commercial level, autoclaving can be an important part of a more sustainable waste management system.

4.4 GASIFICATION

Gasification of wood has been practiced successfully on a large scale since World War II, and coal gasification is receiving a lot of attention right now and shows promise of higher production while having lower emissions. Gasification of MSW is limited to a few small-scale operations in the Japan, although several U.S. companies are working aggressively to implement full-scale facilities. A number of projects have been attempted over the years in the U.S. and Europe, but the success rate has been low.

Gasification is classified as a “thermal” technology that utilizes a process to convert carbonaceous material that reacts in the gasifier at high temperatures and pressure in a reducing (oxygen-starved or low-oxygen) environment, into a synthesis gas or “syngas” composed primarily of carbon monoxide and hydrogen. A carbonaceous material is defined as a substance rich in carbon content. The low- to mid-Btu syngas can be used as: 1) a fuel to directly generate electricity and/or steam on-site, 2) be added to a natural gas fuel steam as a supplement for off-site processes, 3) used as a chemical building block for applications in the petrochemical and refining industries or 4) production of a fuel product. Depending on the specific gasifier, the feedstock sometimes needs to be prepared into a refuse-derived fuel with maximum specifications amounts allowed for metals, glass and hazardous wastes.

HDR has visited six (6) gasification facilities, all in Japan and all in operation. Most all were operating at tonnage levels of 100 to 400 tpd, low throughput rates for a commercial facility, using feedstock other than MSW or MSW supplemented with other wastes, such as industrial wastes, with a higher Btu content.

The Ze-gen facility in New Bedford, Massachusetts, discussed previously, is employing a gasification technology process.[2]

[2] HDR has not visited this facility, nor reviewed its operating data.

Economically, units have not fared well. For mixed waste, if significant preprocessing is required, the capital and operating cost for the front-end equipment drives up the facility cost. In general, without proper front-end processing, efficiency and availability have been much lower than for some other technologies. Net average costs range between $180 to over $ 200 per ton. Some vendors are claiming much lower costs.

HDR general conclusions on gasification process are:

- Mostly prevalent in Japan, not prevalent in other countries HDR visited
- Commercial scale operating facilities in Japan are very neat and clean facilities
- Seems to work best with a more uniform and select feedstock (plastics, biomass, industrial waste)
- Ash is melted and vitrified and reportedly rendered non-hazardous, much of which is sold as a slag material
- All air emissions are reported to be well below permit limits at plants visited (at some plants, real time emission data is posted on publicly accessible web sites)
- There is insufficient data on the availability and performance of the facilities to make an informed assessment

4.5 PLASMA ARC GASIFICATION

Plasma arc gasification is classified as a “thermal” technology that uses carbon electrodes to produce a very-high-temperature arc that vaporizes the feedstock. The feedstock can be either unprocessed or pre-processed MSW. However, generally, the feedstock is pre-processed to remove bulky and other undesirable materials. Electricity is passed through the electrodes causing an arc that ionizes the feedstock. With MSW, the organic materials are broken down into basic compounds, such as sulfur and salt, while the inorganic material forms a liquid slag. A syngas can be produced; this fuel can be combusted and the heat recovered in a waste heat boiler, or the syngas can be processed in an engine or gas turbine.

Vendors claim that more electrical power or other energy products can be produced than is consumed in the process. The remaining ash material forms a slag that, when cooled, is an inert granular material that is proposed for use as a construction aggregate. Metals can also be recovered from the system.

Plasma arc technology has been in development in a number of locations in the U.S. and around the world, however, very few verifiable operations exist. One is a small non-commercial level facility located in Ottawa, Canada that uses MSW (that is comparable to US MSW) as a feedstock. There are plasma arc facilities in Japan that claim to be using MSW as a feedstock, but most of these facilities use a large amount of supplemental feed stock from the industrial sector with a high concentration of plastics and in addition, in most cases, data has not been provided to verify their claims. It should also be noted that for the most part, the composition of MSW in Japan is much different than that from the US; Japan separates their waste materials and their MSW tends to contain a higher fraction of plastics in the mix.

HDR recently visited and evaluated the Plasco facility in Ottawa, Canada discussed above that began demonstration operations about a little over a year ago. So far it has been operating at very low availabilities and capacity factors while the vendor is addressing various operating issues that appeared during the demonstration process.

A number of plasma arc facilities are in operation in Japan. Some are reported to be very expensive to operate and have other performance issues. Because Japanese facilities are required to vitrify ash, which requires a lot of energy, these facilities are reported to be net consumers (rather than generators) of power. Low availability due to equipment operating problems with the feedstock has also been reported for some facilities. In some cases, redundant units were installed to provide more consistent facility operations and increased facility availability. Because of the paucity of data on the Japanese facilities, HDR, at this time, is not able to determine the actual amounts of MSW used or verify the reported operating conditions.

Costs (based on the limited data available) are typically in the $180 to over $ 200 per ton range. Some vendors are claiming much lower costs.

HDR general conclusions on plasma arc gasification process are:

- Some operational issues due to the fuel feed system used to process/prepare and deliver the waste or feedstock to the system are still being worked out
- No extensive operation at full load to date
- No long duration test runs completed to date
- No stack testing data released to date
- System may be viable, but needs more demonstration at full load for longer operating cycles with engines and all systems operating.

4.6 PYROLYSIS

Generally pyrolysis is defined as the process of heating MSW in an oxygen deprived (no oxygen) environment to produce a combustible gaseous or liquid product and a carbon-rich solid residue. This is similar to what is done to produce coke from coal or charcoal from wood. The feedstock can be the entire municipal waste stream, but, in some cases, pre-sorting or processing is used to obtain a refuse-derived fuel. Generally, pyrolysis occurs at a lower temperature than gasification, although the processes are very similar.

Several attempts to commercialize large-scale MSW processing systems in the U.S. in the 1980s failed. Of particular note were large-scale pyrolysis plants built near Baltimore and San Diego. They were scaled up from pilot projects and were never able to function at a commercial level. Today several pilot projects in the US are currently at various stages of development. Some vendors claim that an activated carbon byproduct is marketable, but this has not been demonstrated.

In Germany, at least one pyrolysis facility is operating. It was built in the mid-1980s and is reportedly operating today. It is a smaller-capacity facility and has not been replicated on a larger scale. At least one other larger-scale project was attempted in the mid-1990s in Germany using another technology, but operational problems forced its closure after a short time.

At this time there is insufficient data to provide any insight on the potential of pyrolysis for processing MSW

4.7 HYDROLYSIS

In general, hydrolysis is a chemical reaction that involves utilizing water with acids or enzymes to create a sugar-based material that can be fermented into alcohol and distilled to produce ethanol. Potential products from generated from a hydrolysis process of MSW (which has been pre-processed to remove the in-organic fraction prior to the hydrolysis process) include fuel products and inert process residues (i.e., metals, glass). This technology would likely be combined with other technologies such as a MRF to remove the non-cellulose fraction of the waste stream.

Very few pilot-scale hydrolysis facilities have been tested. Most research has been done in the laboratory and these have focused on the use of corn stover and other biomass materials for ethanol production. Tests with mixed waste or even paper feedstock have been limited. HDR is unaware of any commercial facilities that process mixed waste.

Among several companies researching and developing the technology for MSW are Masada, Blue Fire Ethanol, and Bioengineering Resources, Inc. Blue Fire received a $40 million grant from the US Department of Energy (DOE) to develop a commercial scale cellulosic ethanol plant, however, the feedstock is planned to include mostly green and wood waste with some MRF residuals. The U.S. Department of Agriculture is currently testing various waste materials processed through the CR3 autoclave system in Salinas in their laboratory using various hydrolysis techniques.

The use of hydrolysis technologies to process MSW is still in the early development stage.

4.8 IN-VESSEL MIXED WASTE COMPOSTING

The composting of yard trimmings and biosolids are well established processes with readily marketable products. In the 1990's many communities tried to increase the diversion of waste from landfills by composting mixed municipal solid waste. Many of these facilities are now closed due to excessive odor problems, technical difficulties, poor product quality, or poor economics. Product quality was negatively affected by the presence of contaminants (broken glass, plastics, etc.) in the finished compost.

A brief overview of in-vessel composting, taken from the US Environmental Protection Agency internet site, follows:

> **In-Vessel Composting.** Organic materials are fed into a drum, silo, concrete-lined trench, or similar equipment where the environmental conditions—including

temperature, moisture, and aeration—are closely controlled. The apparatus usually has a mechanism to turn or agitate the material for proper aeration. In-vessel composters vary in size and capacity.

In-vessel composting can process large amounts of waste without taking up as much space as the windrow method. In addition, it can accommodate virtually any type of organic waste (e.g., meat, animal manure, biosolids, food scraps). Some in-vessel composters can fit into a school or restaurant kitchen while others can be as large as a school bus to accommodate large food processing plants.

In-vessel composting can be used year-round in virtually any climate because the environment is carefully controlled, often by electronic means. This method can even be used in extremely cold weather if the equipment is insulated or the processing takes place indoors.

In-vessel composting produces very little odor and minimal leachate.

In-vessel composters are expensive and might require technical assistance to operate properly, but this method uses much less land and manual labor than windrow composting.

Conversion of organic material to compost can take as little as a few weeks. Once the compost comes out of the vessel, however, it still requires a few more weeks or months for the microbial activity to stabilize and the pile to cool.

Mixed MSW composting typically results in elevated levels of plastics, metals and glass in the compost that reduce its quality. Significant post-process screening is typically required to improve the compost quality to a marketability level. Mixed Waste composting can reduce the residential waste stream currently being landfilled by 5% to 10%.

BioCycle, in its November 2008 issue, identified 13 mixed MSW composting facilities still operating in the U.S. These projects use technologies supplied by Bedminster, Conporec, Herhof, Engineered Compost Systems, and Z-Best. Two of these 13 facilities are located in Marlborough and Nantucket Massachusetts and each uses the Bedminster rotary drum in-vessel mixed waste composting technology. The following are excerpts from the BioCycle article.[3]

Marlborough, Massachusetts. WeCare Environmental LLC owns and operates the composting facility in Marlborough. The facility is processing approximately

[3] BioCycle November 2008, Vol. 49, No. 11, p. 21

1,500 to 2,000 tons/month of source separated organics, biosolids and residential mixed MSW from the city's curbside trash collection program.

Chris Ravenscroft, President of WeCare Environmental, says that there have not been any major changes at the plant, and that they are "following operational and processing practices developed over the last five years since the company acquired the facility." Approximately 20,000 cubic yards/year of compost are produced, and sold for as much as $8/cy. Approximately 20 to 25 percent of feedstocks entering the composting system are removed as residue.

Nantucket, Massachusetts. The Nantucket solid waste management complex includes a cocomposting plant, MRF, C&D processing facility, yard waste composting and a landfill. Due to the seasonal nature of the Nantucket Island population, the throughput of the compost facility, which is owned and operated by Waste Options, Inc., ranges from 100 tons/day in summer, to a low of 15 tons/day in winter. Biosolids are cocomposted with the MSW.

Nathan Widell, plant manager for Waste Options, reports that in 2008 the facility underwent a maintenance overhaul of major systems and is "running better than ever." Approximately 15,000 tons/year of screened finished compost are produced, half of which is sold for $15/cy for on-island landscape and garden uses. The balance is used for landfill capping and facility landscaping. The final screening system includes a BiviTec vibrating deck, Forsberg destoners and an air classification system to remove light plastic.

Film plastics are the primary residual from the process. Widell reports that the Nantucket facility - including recycling, compost and reuse - has a diversion rate of approximately 85 percent. "Fortunately, the Nantucket Island waste stream is very high in organics due to the exceptional level of recycling participation by the citizenry," he adds. "However, even more up front recycling, to reduce the amount of screenings, as well as mandatory use of biodegradable bags would be nice."

When asked about the future of MSW composting, he answers: "The future of mixed waste composting is marginal at best. Except for situations such as Nantucket, which has a high rate of recycling, mixed waste composting is complex and expensive due to the requirements to screen the end product appropriately."

[MSW is supplied to both facilities pursuant to long term contracts with each municipality.] The tipping fees for the contract MSW being delivered to the two facilities is currently above $100 per ton. The Marlborough facility, in addition to accepting City's MSW and biosolids, also receives food waste from several supermarkets in the region at an estimated fee of $55 per ton.

4.9 PROCURING AND FINANCING OF CONVERSION TECHNOLOGIES

Alternative procurement approaches include Design/Bid/Build (DBB), Design/Build (DB), and Design/Build/Operate (DBO) along with various public and private financing options. The DBB approach is the traditional means of procuring public works projects, whereby an engineering firm is hired to design the project and help prepare a bid package. Construction is awarded to lowest responsive bidder. The DBB approach has not, however, been very successful for the public procurement of emerging solid waste management processing technologies. The primary reason for the limited success of the DBB approach in implementing emerging technology projects is that almost all the technical and economic risks are borne by the community.

There is very little experience with the Design/Build (DB) approach for public works projects. For this approach a single firm is responsible for designing and constructing a project, usually for a guaranteed price and schedule. A study conducted at Penn State University comparing alternative project delivery systems, concludes that the primary benefits of the DB approach is to reduce the schedule for implementing projects.[4] It has little cost benefits and the transfer of risks to a technology supplier is minimal.

In the late 1970's and early 1980's the most successful procurement approach for implementing emerging solid waste projects was Design/Build/Operate (DBO) whereby a single firm is responsible for the design, construction, and operation of the facility over a defined period, typically 20 years. Many of the projects developed during this time period are nearing the end of the initial term and communities are in the process of procuring or negotiating follow-on agreements. A principle benefit of the DBO approach for implementing emerging technologies is the ability to transfer technical risk to the private firm providing the technology and obtaining guaranteed construction costs and service fees.

Even in cases where the projects failed technically, such as the pyrolysis project in Baltimore, the community did not bear all the risk of this failure. The Springfield waste-to-energy facility on Bondi's Island, is a good local example of the risk transfer benefits of the DBO approach. After the project was completed, the original operator and supplier of the technology for the facility went bankrupt. The project, however, was guaranteed by Fluor Daniels, the firm responsible for building the facility. Fluor Daniels took over the ownership and operation of the facility. The facility was eventually sold to Energy Answers, who in-turn sold it to Covanta, the current owner and operator. Even with all these changes, continual waste disposal service and electricity sales have occurred for almost 20-years.

In addition to alternative means to procure a project there are alternative ways to finance them. These include the communities issuing bonds backed by the full-faith and credit pledge to repay the debt. This is often referred to as general obligation (GO) financing and is the way most public works project have been financed. Revenue Bond financing, where the revenues, such as tip fees, energy sales, and material sales are pledged to pay the debt service, was the principal means to finance the emerging technology projects in the 1970's and 80's. When a

[4] Sanvido, Victor and Mark Konchar, *Selecting Project Delivery Systems* - Comparing Design-Build, Design-Bid-Build and Construction Management at Risk, The Project Delivery Institute, State College, PA, 1999.

private firm either owns or operates the facility, these bonds are referred to as Industrial Development Bonds. Under certain circumstance IDBs can qualify as tax-exempt bonds. Finally, some facilities are financed with private equity and debt.

Both IDBs and privately placed debt are likely to be the best alternatives for financing an emerging technology project.

In addition to the efficacy of the technology and the financial backing provided by the technology supplier to successfully procure and finance a project involving one of these emerging technologies, the project sponsor or developer needs to:

- Locate a politically suitable site for the project;
- Acquire waste supply commitments;
- Develop energy and material sales approaches and agreements;
- Arrange for residue disposal; and
- Obtain permits to construct and operate the project.

Assuming the Northampton Landfill site is suitable for locating a facility (both politically and technically) and remains open for the disposal of MSW generated in excess of the facility capacity, non-processible waste, and process residue, then a critical aspect for implementing a project is arranging for sufficient waste.

Approximately 66.7 tons per day (based on 365 days per year) of municipal solid waste, including amounts that can be recycled, is generated within Northampton from residential and commercial sources. Assuming 32.6% of this is recycled from both residential and commercial generators, then a total of approximately 45.0 tons per day of mixed municipal solid waste is generated within Northampton could be processed at a conversion technology project.

The City, however, currently only “controls” the residential tonnage brought to the drop-off centers, or approximately 8.5 tons per day. Since use of the drop off site is voluntary, even this quantity of waste that might be controlled by the City is uncertain.

The City has no control over residential waste collected through subscription service or commercial waste generated within Northampton. If the City owns a new conversion facility, it may be able to obtain control over the entire 66.7 tons per day generated within the City through a flow control ordinance, but not any of the regional waste could be brought to a new conversion facility.

The City provides disposal at the Northampton Landfill at market based tip fees sufficient to attract the larger private haulers to the landfill. This means the tipping fees will need to be competitive in order to implement any conversion technology. In calendar years 2007 and 2008 the average net tip fee for trash paid by all commercial customers was approximately $65.00/ton and $68.07/ton, respectively.

As indicated in the review above, there is limited commercial experience with the emerging technologies reflecting significant risk of performance and economic viability. Even if a

financially strong company is willing to guarantee the performance and costs for an emerging technology it is promoting, a community that is thinking of procuring such a system, even as a demonstration project, should consider the following:

- What impact will it have on the balance of the solid waste management system?
- If the new system does not work, is there an alternative location, both in the short- and long-run to process/dispose of the waste?
- If there are odor or other environmental problems that cannot be mitigated, is there a way to terminate the operation of the facility?
- If the project does not succeed, will the company be responsible for razing the facility and returning a clean site? What other obligations will the company have?
- What are the obligations of the community if the project does succeed?

4.10 CONCLUSIONS

In general, the conclusions of these assessments are:

- Emerging technologies are becoming a more interesting option for communities to consider
- Factual performance, emissions and cost information is difficult to obtain, but is necessary in order to make an informed decision prior to implementing any of these technologies on a commercial scale
- More pilot and demonstration projects are needed
- If and when proven commercially feasible, these emerging technologies may be an important part of the solution for more sustainable waste management
- Biological treatment of the organic fraction of the waste stream can create a potential source of energy and a soil amendment by-product that can potentially be an effective component of a multi-faceted integrated waste management program in Northampton. Numerous barriers to successfully implementing such a program are discussed in Section 3.
- At this point, the ability of these emerging technologies to provide a long term commercially viable treatment and disposal option for the City is not proven. In addition to the fact that a) the likely net cost of an emerging or other conversion technology will be above $65/ton, and b) the minimum amount of waste necessary for a successful project would likely exceed the tonnage currently controlled by the City, there remains technical risk. It is unlikely that Northampton would be able to develop on its own a successful conversion technology project. Rather it is likely that such a project would have to serve the region and the City would have to enact some form of “flow control” regulations; franchise collection services; or provide economic subsidies to ensure sufficient tonnage of MSW is available.

5.0 Section 5 - Waste Collection and Hauling

This section summarizes the current methods of waste collection for residential solid waste and recyclables. A discussion of residential collection alternatives is presented and cost considerations are introduced. Information regarding waste collection from the commercial and institutional sectors was described in Section 2. Generally, these establishments arrange for waste collection from a number of private haulers.

5.1 CURRENT RESIDENTIAL WASTE COLLECTION SYSTEM – DROP-OFF

Currently, Northampton residents have two types of waste collection services available. First, they may chose to use the two waste and recycling drop-off areas provided by the City on Locust St and on Glendale Road. Secondly, they can contract with a waste hauler for curbside collection (i.e. subscription service).

In order to access these facilities residents must annually purchase a vehicle permit at a cost of $25/vehicle or $5/vehicle for senior citizens. Based on City records for calendar year 2008, a total of 6,155 vehicle permits were sold (4,287 resident vehicles and 1,868 senior citizens vehicle permits). The current number of households in the City is 11,800. The number of vehicle permits sold indicates that a reasonable estimate for the percentage of the community that relies on the drop off centers for waste disposal and recycling is about 50 percent.

The total annual cost for City residents that use the drop off centers is a function of the amount of waste disposed. For illustrative purposes the following examples are provided depicting the annual cost for a variety of drop-off users.

<u>Example 1: Senior Citizen Household</u>

Vehicle Permit - $5
Waste Disposal Cost – Assume 40 gallons disposed per month
Bag Sticker Costs - $1.00 x 12 months = $12/year
Total Annual Cost = $17

<u>Example 2: Family of 2</u>

Vehicle Permit - $25
Waste Disposal Cost – Assume 140 gallons/month
Bag Sticker Costs - $3.50 x 12 months = $42/year
Total Annual Cost = $67

Example 3: Family of 4

Vehicle Permit - $25
Waste Disposal Cost – Assume 80 gallons/week
Bag Sticker Costs - $2 x 52 weeks = $104
Total Annual Cost = $129

Based on these examples the annual cost for use of the City's drop off facilities can be expected to be in the range of about $15-$130. As stated above about 50 percent of City residents are paying in this range for solid waste and recycling collection services.[5]

5.2 CURRENT RESIDENTIAL WASTE COLLECTION SYSTEM – SUBSCRIPTION CURBSIDE SERVICE

The second option that residents have for waste collection is to contract with a private waste hauler for curbside collection of solid waste and/or recyclables. There are several local haulers that provide subscription service to City residents including Pedal People, Duseau Trucking, Alternative Recycling Services, Allied Waste Services and others. Collection can be scheduled for weekly, bi-weekly or monthly. Options are available for bulky waste, recyclables and organics collection. The cost for subscription service includes the costs of collection, hauling and disposal. Most or all of the waste collected curbside within the City is disposed at the Northampton Landfill.

A survey of local haulers was completed on June 9, 2009, to approximate costs for subscription curbside service. For illustrative purposes, the following examples depict annual costs for a variety of subscription services using the same assumptions as the drop off scenarios above.

Example 1: Senior Citizen Household

Assume 40 gallons disposed every month plus recyclables
Bi-weekly Pick-Up Cost Ranges from $20.00/month to $29.33/month or $240-$352/year

Example 2: Family of 2

Assume 140 gallons/month disposed plus recyclables
Bi-weekly pick-up cost ranges from $25.00-$29.33/month or $300-$352/year

Example 3: Family of 4

Assume 80 gallons/week disposed plus recyclables
Weekly pick up option cost $31.00/month - $36.00/month or $372-$432/year
Bi-weekly pick-up option cost ranges from $26.00-$29.33/month or $312-352/year

[5] These costs do not include any incremental transportation costs to deliver the waste to the drop-off sites, nor the value of the time of the individuals using the sites.

Based on these examples the range of cost for curbside collection can be expected to be in the range of about $240-$350 annually. Therefore, about 50 percent of City residents are paying for curbside collection in these amounts.[6]

5.3 FUTURE COLLECTION ALTERNATIVES

As part of the evaluation of various solid waste management options in Section 8, three types of collection alternatives are considered. The first option is to continue with the current system of waste collection based on a hybrid system of private collection and a City drop off center. The second option for waste collection that will be evaluated includes closing the drop off centers and requiring all residents to directly contract with a private hauler for waste and recyclables collection. Alternately, the City could institute Citywide curbside collection program for single family residences. Such a Citywide curbside program would likely be funded through some type of user fee.

As background information, a review was completed of recycling practices in Massachusetts for communities ranging in population from 20,000-40,000, comparable in size to Northampton. A total of 60 communities were identified and 50 of those, or about 83 percent, have curbside collection programs. See Appendix 5-1 for this summary of collection methods.

The data for Citywide collection costs used in Section 8 for the financial analysis of options, was primarily obtained from a telephone survey conducted by Stantec/HDR from May 5, 2008 through May 16, 2008 of communities in western Massachusetts that either contract for citywide collection or provide citywide collection with a public workforce. A summary of the residential solid waste collection practices in Franklin, Hamden, Hampshire, and Berkshire counties is provided in Appendix 5-2 of this report.

Nineteen of the 69 communities in the tri-county area provide citywide curbside collection services. Stantec/HDR received information from 7 of the 19 communities providing citywide curbside collection services. Of the 7 communities, 5 have a contract with a private hauler to collect trash, recyclables, yard waste, bulky waste, and/or electronic waste. Springfield and Holyoke use a public workforce for collection. In 2005 the City of Springfield conducted a "managed competition" for citywide collection services whereby private firms competed against the City's workforce. The Springfield workforce won the managed competition and is currently providing the curbside collection services in the City.

All of the communities surveyed contract for weekly curbside pick ups for both trash and recyclables. Some programs include seasonal collection of leaves and periodic bulk waste collection. Service is provided to all 1-4 family dwellings. Disposal costs are not included in the price paid for the citywide collection service in the surveyed communities. All the communities in the survey have their waste disposed of at the Covanta waste-to-energy facility in Agawam. The communities pay disposal fees to Covanta under a separate contact. None of the communities, or companies, bill the homeowners directly for this service, the haulers are paid directly by the City/Town.

[6] These costs include the cost of collection and disposal, while the City picks up the cost of disposal for waste brought to the drop-off site.

In all cases there is no limit on the number of cans of trash that each household can place on the curb. Longmeadow and East Longmeadow have implemented a pay-as-you-throw system where each household is allowed one 35 gallon can/bag (maximum of 40 pounds) per week. Residents can buy extra trash bags at local grocery stores for $1.75 each. DEP has reported that Longmeadow sells approximately 55,000 bags a year and East Longmeadow sells approximately 60,000 bags a year.

Another consideration is how Citywide curbside collection will impact the cost that each resident pays for collection versus their current costs. Generally, competitive bidding for Citywide waste and recycling collection may result in a lower cost/household for those residents that are already paying for curb-side collection. However, the cost for collection will be significantly increased for those residents that use the drop off centers only. This concept will also be discussed in Section 8.

In addition to cost, there are many other factors to consider relative to a curb-side collection program. For example, under a Citywide curbside collection program recycling participation rates may increase due to the added convenience of recycling, as well as the opportunity to monitor participation and to enforce the City's mandatory recycling ordinance.

The current system of drop-off use and direct subscription services between residents and haulers have some apparent disincentives for recycling participation rates. For those residents that use the drop off centers, recycling is not as convenient as it would be for a resident that has a subscription service with curbside recycling collection.

If the City chooses to implement a curb-side collection for solid waste, the City could issue one contract for collection and disposal or alternately could sign separate contracts for disposal and for collection services. It may be more cost effective to have separate contracts since one contract for disposal and collection would weigh in favor of large companies that own the disposal facilities. Having a separate contract for collection only opens up the potential field of bidders to smaller haulers.

Issuing a Request for Proposals for curbside collection also requires that the City determine what specific services are to be requested. Some factors to be considered would include:

- Frequency of waste and recycling collection
- Definition of households and the number. Include pick-up for single family households, multifamily with four units or less, etc.
- Allowable hours for pick-up
- Collection schedule, holidays etc
- Specifications for waste and recycling containers, use automated equipment and new totes
- Determine and include pay-as-you-throw requirements
- Include municipal buildings, schools, parks, downtown, etc. Determine frequency and dumpster container size requirements
- Customer service provisions to address customer complaints, missed pick-ups, recycling questions etc

- Recycling educational materials
- Definition of waste to be picked up
- Definition of recyclables to be picked up
- Include leaf and yard waste collection, number of weeks
- Christmas tree collection
- Bulky items and white goods

6.0 Section 6 - Alternative Haul, Transfer and Disposal Options

Three of the five alternative options considered in the study involve closing the Northampton landfill. If the Northampton landfill is closed then trash can be directly hauled in the collection vehicles to a transfer station, waste-to-energy facility, or another landfill. If the waste is brought to a transfer station, then it will be loaded into larger transfer vehicles for transport to more remote disposal sites. The approach used to estimate the cost of hauling trash to and disposing of trash at an alternative disposal sites is presented below.

Table 6-1 shows the current and planned transfer station, waste-to-energy and landfill options available in central and western Massachusetts as reported in May 2009 by the Massachusetts Department of Environmental Protection.[7] If the Northampton landfill is closed they represent the most likely options available to haulers collecting trash in Northampton. Note, that the South Hadley Landfill is in the process of obtaining a permit for a vertical expansion to add 2 years to the site life as well as planning on a 21 acre horizontal expansion that would add 13 years of capacity at that landfill.

There is potential for increased capacity by adding a fourth unit to Covanta's waste-to-energy facility on Bondi's Island in Agawam. However, the statewide moratorium on waste-to-energy would have to be lifted before this facility could be expanded. Currently, there is also 500 tons per day of transfer capacity at this facility. The DEP is considering lifting of the ban on waste-to-energy capacity as part of their updating of the Solid Waste Master Plan.

Other transfer options include a 650 tons per day permitted transfer station, with rail access, in Springfield that is owned and operated by Allied Waste Services and a 250 tons per day permitted, but currently inactive, transfer station in Northampton that is owned by P. Allen and Sons.

The Town of West Springfield transfer station (closed) has a permitted capacity of 250 tons per day and was recently put out to bid for a private lease. According to the West Springfield Public Works Director[8], TWL Industries is preparing to sign a 20 year lease with the Town for the site to replace the existing transfer station with a new facility with a capacity of up to 1,000 tpd and no less than 750 tpd. The DPW Director noted that TWL intends to the modify the station to add a spur line to the nearby main track for rail access for convenient out-of-state disposal capacity. A private developer is also trying to permit a rail accessible new transfer station in Holyoke. The addition of these two new transfer stations to the region could open up a significant long term capacity for the region.

The average one-way distance of those sites with likely capacity from FY2010 to FY2029 is approximately 30 miles, while the average one-way distance for local options (i.e., excluding the Westminster and Barre landfills) is approximately 20 miles.

[7] Massachusetts Department of Environmental Protection (MassDEP) web site, mass.gov/dep.
[8] Telephone conversation with Jack Dowd, W. Springfield DPW Director, June 22, 2009

6.1 HAUL COSTS

As **Figure 6-1** illustrates, it becomes increasingly expensive to haul waste as the distance to a transfer station, waste-to-energy facility, or landfill increases. If the collection crew can "dump on shift" there typically are no incremental labor costs. On the other hand, if the increased travel time results in overtime there will be an incremental labor cost. The "dump on overtime" case in **Figure 6-1** assumes a single crew member drives the truck and is paid 1.5 times his/her hourly wage for the time it takes to drive round trip to the transfer station, waste-to-energy facility or landfill.

Assuming $3.00/gallon cost of diesel fuel9; 6.5 tons/load, 40 miles/hour average speed, one person crew for hauling, and straight time hourly wage of $16.35, the average costs for a one-way haul of 30 miles are approximately $3.77 per ton for the dump-on-shift case, and $11.11 per ton for the dump-on-overtime case, with the average cost being $7.44/ton. For a one-way haul of 20 miles, the average costs are approximately $2.51 per ton for the dump-on-shift case and $7.92 per ton for the dump-on-overtime case, with the average cost being $5.22/ton. On a per ton-mile basis the haul costs for one-way travel distance between 20 and 30 miles is approximately $0.25/ton-mile.

Table 6-1

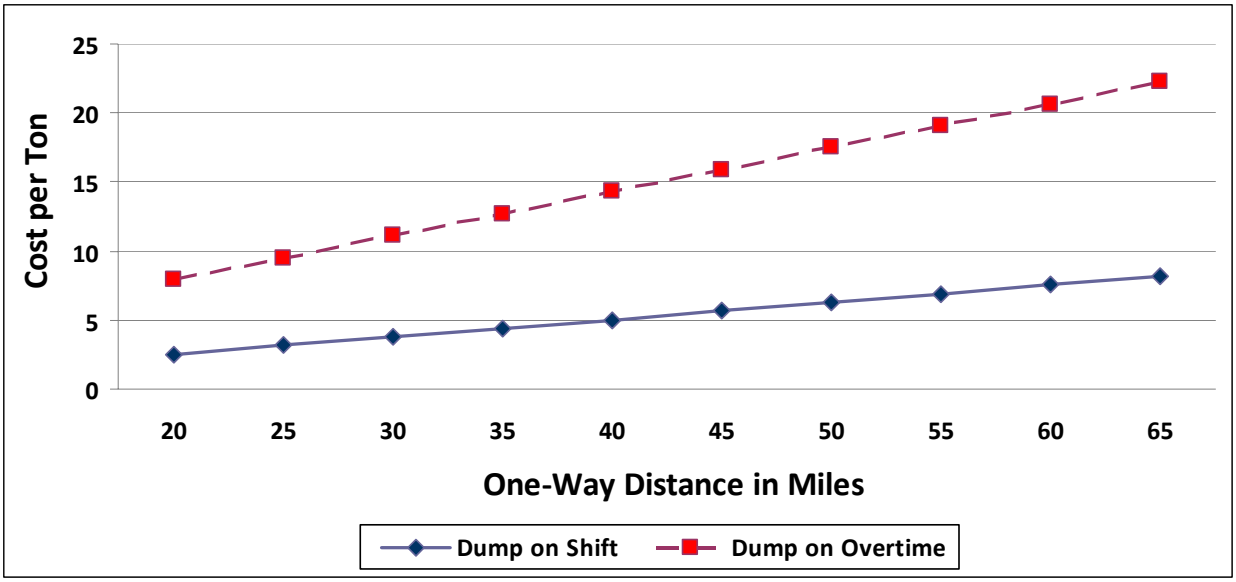
Transfer Station, Waste-to-Energy and Landfills in Western and Central Mass.

Town	Distance Miles[(a)]	Permit Tons/Day	Annual Tons (2007)	Owner Type	Owner	Scheduled Closing
Landfills						
Northampton	4	275	49,442	Municipal	City of Northampton	12/31/2010
South Hadley	12	500	151,715	Municipal	Town of South Hadley (IWS Operator)	12/31/2010 [(b)]
Granby	17	400	119,262	Private	Holyoke Sanitary Landfill, Inc. (WMI)	12/31/2011
Chicopee	18	1200	187,735	Private	CT Valley Waste Disposal (WMI)	12/31/2013
Barre	43	300	37,913	Private	Resource Control Inc. (WMI)	12/31/2010
Westminster	62	1425	267,282	Private	WMI (Formerly owned by City of Fitchburg)	12/31/2017
Waste to Energy						
Agawam	23	408	116,099	Private	Covanta Springfield LLC	
		4,508	929,448			
Transfer Stations						
Northampton	4	250	NA	Private	P. Allen & Sons - closed	
Holyoke	12		NA	Private	Being developed	
West Springfield	18	250		Municipal	Town of West Springfield - closed	
Springfield	20	650		Private	Allied Waste Services of MA LLC	
Agawam	23	500		Private	Covanta Springfield LLC	

(a) Approximate one-way haul distance from Northampton
(b) South Hadley is in the process of permitting a vertical expansion of their current landfill to extend its life through 2013 and plan on expanding the site with a 21 acre horizontal expansion to extend its life through 2026.

9 U.S. Department of Energy reports that the average on-road diesel fuel price in New England averaged $4.567 in May 2008 and $2.397 in May 2009.

Figure 6-1
Estimated Packer Truck Haul Costs (a)



(a) Assumes $3.00/gallon cost of diesel fuel; 6.5 tons/load, 40 miles/hour average speed, one person crew for hauling, and straight time hourly wage of $16.35.

6.2 TRANSFER AND DISPOSAL COSTS

Northampton's landfill represents approximately 4.9% of the permitted capacity in western and central Massachusetts and is the only landfill that is publicly controlled. Although the South Hadley landfill is publicly owned, it's operated by Interstate Waste Services as if it were a privately owned facility. South Hadley receives host fees from Interstate Waste Services for the right to run the landfill. As noted above, South Hadley is currently in the process of permitting a vertical expansion to the current landfill that will provide the site with another 2 years of life through 2013. In addition, South Hadley is planning on adding a 21 acre horizontal expansion to the site that will provide another 13 years of capacity to extend the site life through 2026.

If the Northampton landfill is closed, the remaining 7 active disposal facilities in western/central Massachusetts with expected available capacity after 2010[10] (4 landfills, 1 WTE plant and 2 transfer stations) are likely to be used by Northampton trash haulers. Of these seven disposal facilities with a combined capacity of around 5,100 tpd, Waste Management owns and/or controls 59.5% of the permitted capacity, Covanta 17.9%, Allied Services 12.8%, and Interstate Waste Services 9.8%. Considering only the permitted capacity in western Massachusetts (i.e. excluding the WMI Westminster landfill) , Waste Management owns and/or controls 43.7%,

[10] As indicated earlier the Barre landfill is likely to have limited or no capacity after 2010.

Covanta 24.8%, Allied 17.8% and Interstate Waste Services 13.7% of the currently permitted "local" private transfer, waste-to-energy and landfill capacity.

In March of 2009, the City raised the tipping at the Northampton landfill from $70.00/ton to $72.50/ton.[12] The City, however, has a "tiered discount" program whereby the larger commercial customers can receive a quantity discount based on the tonnage the firm delivers in a month and prompt payment of its bills. Since March of 2008, the average net tip fee for trash paid by all commercial customers was approximately $68.07/ton.

Tip fees at the Westminster landfill in September 2008 were $120/ton. Lower rates may be negotiated for contract waste. [13]

As of September 2008, tip fees at the Covanta waste-to-energy facility for most to the 16 contract communities are approximately $78/ton. Holyoke was paying $84.60/ton since it joined later, but has been offered a comparable rate with the other communities if it enters into a new contract with Covanta.[14]

If the Northampton landfill is closed, the availability of local transfer station capacity is important because it provides reasonable access to landfill capacity in upstate New York and Pennsylvania via transfer trailers and to landfills in Virginia, South Carolina, Ohio and elsewhere by rail.

Municipal solid waste out-of-state transfer, haul, and disposal costs provided in Appendix G of the State of Connecticut Solid Waste Plan, Amended 2006 (Plan) were used to estimate the costs of transferring, transporting, and disposing of MSW to landfills in Pennsylvania and New York.

These estimated transfer, transport, and disposal costs were adjusted to reflect the one-way travel distance from Northampton to each landfill. Assuming $3.00/gallon for diesel fuel, the FY08 transfer, transport and disposal costs to export waste to New York and Pennsylvania ranges from $85/ton to $100/ton.

Boston, New York City and other East Coast communities are currently exporting waste by rail. In 2008, average costs to transfer, transport, and haul waste by rail from the Northeast range from $90/ton to $120/ton. Also, shown in Table 6-2, DEP has compiled the following information that illustrates the out-of-state locations that waste is being sent by truck or rail for disposal. According to DEP the 2007 exports represent about 18 percent of the waste generated in Massachusetts.

[12] Fee Schedule for the Northampton Landfill, Effective for all Commercial & Residential Customers, March 1, 2009.
[13] Telephone call to Board of Health, Fitchburg, Ma., 5/14.2008.
[14] Meeting with William Fuqua, Public Works director, 4/30/2008 and 2007 Municipal Recycling & Diversion Data Sheet.

Table 6-2

Tons of MSW Exported by Massachusetts to Other States: 2005-2007

	2005	2006	2007
CT	38,236	29,493	60,108
ME	238,415	207,627	218,445
MI	136	3,879	10,270
NH	281,375	171,570	162,707
NY	224,456	191,616	198,061
OH	85,092	12,255	67,307
PA	4,045	722	
Quebec	0	90	383
RI	6,304	5,684	
SC	479,496	380,266	366,054
VA	1,996	1,554	8,100
VT	4,195		2,145
TOTAL	**1,363,746**	**1,004,756**	**1,093,580**

Recently New York City enacted a new Solid Waste Management Plan that requires export of waste via rail or barge. This means that residential waste collected in New York City (approximately 11,500 tons per day) that is currently going to Northeast landfills, such as those in upstate New York and Pennsylvania, will be exported to Virginia, South Carolina, Ohio and other locations accessible by rail or barge. New York City recently entered into two 20-year long-term contracts that will divert approximately 3,000 tons per day of waste from landfills in the Northeast. This is relevant to Northampton because it is likely that landfill capacity accessible by transfer trailer from western Massachusetts to New York and Pennsylvania will become available over the next 20 years.

If the Northampton landfill is closed, it appears that an FY10 market price of $75-$100/ton, depending on diesel fuel prices, for transfer, transport and disposal services is reasonable in western Massachusetts. This is consistent with Covanta's current fees and is equal to the low end for transferring, hauling, and disposing of waste in upstate New York and Pennsylvania.

The results presented in this report assume a FY10 diesel fuel price of $3.00/gallon that escalates at 3.00% per year. Stantec/HDR conducted different model runs assuming other diesel fuel prices. Although the absolute value, or magnitudes, of the incremental costs of each option change, the conclusions do not change.

These hauling and disposal factors were used in the analyses are presented in Section 8.

7.0 Section 7 – Phase 5 Landfill Expansion Sensitivity Analysis

This section reviews the financial feasibility of the Phase 5 landfill and evaluates the financial sensitivity to the incoming waste tonnage and corresponding tip fee revenue. The main objectives of the analysis are to determine whether the Phase 5 landfill is financially feasible and to determine the waste tonnage requirements to satisfy revenue needs for financing.

The financial model developed will be used to determine if the landfill expansion is viable if it only accepts wastes generated within Northampton. The analysis is also used to determine whether the continuation of a 50,000 tons per year (tpy) landfill operation is the correct waste quantity from a financial standpoint. A break-even tonnage analysis is performed to determine the minimum tonnage required to break even financially.

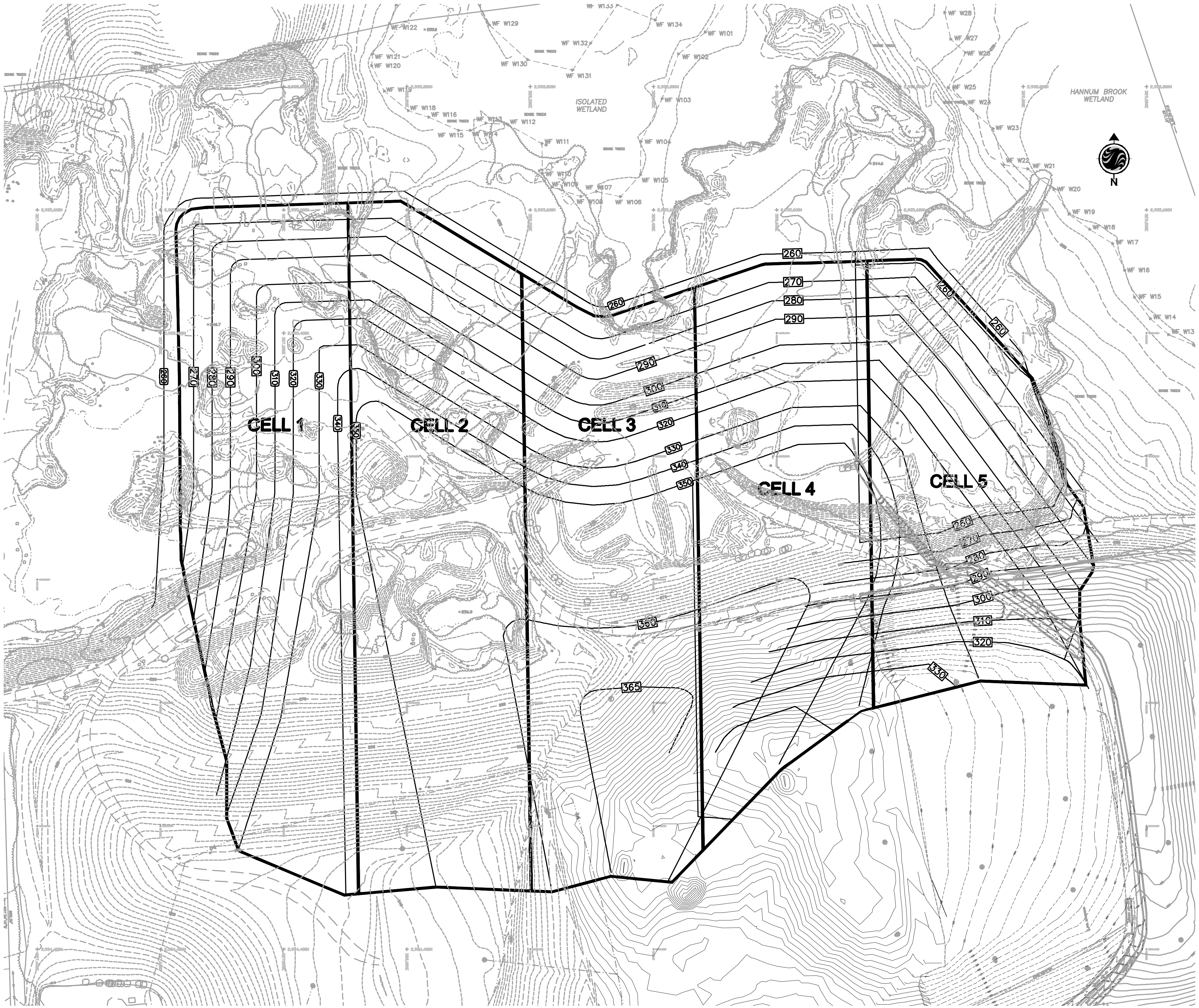
The financial model provides context to understand the apparent conflict between the City's desire to reduce waste and maximize diversion while also requiring a minimum amount of waste tonnage at the landfill to meet the facility's financing requirements. Currently, it seems that the City's efforts for waste minimization are for no apparent purpose since the current landfill operation is managed to accept the maximum permitted waste tonnage of 50.000 tons. For every ton of City waste diverted a ton of commercial waste is accepted. From a resource conservation and management standpoint waste minimization should theoretically provide the benefit of expanded disposal capacity and landfill life.

This section also discusses the issues surrounding tip fee revenue projections for the Phase 5 landfill from a security of revenue standpoint. Currently, the City has no contractual control over the incoming waste stream and the associated tip fee revenues. The facility generates tip fee revenue by maintaining competitive tip fees and by providing a disposal facility convenient for local waste haulers to use. Options are considered to better secure the long term revenue stream including the use of disposal contracts as well as the consideration of forming a regional solid waste district.

7.1 OVERVIEW OF COST AND REVENUE FACTORS

In order to develop a financial model for the proposed Phase 5 landfill the various cost and revenues over the life of the facility need to be estimated. This section summarizes these factors and identifies the assumptions made.

The proposed Phase 5 Landfill Expansion is located north of the existing landfill and incorporates a total footprint area of 29.2 acres. The Phase 5 expansion would be developed in a series of 5 cells and would provide disposal capacity of around 1.41 million tons which equates to approximately 28 years of life at the current permit limit of 50,000 tpy. Figure 7-1 shows the conceptual final grading for the Phase 5 landfill expansion.



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Consultants

Legend

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: Cells June 2009.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

CITY OF NORTHAMPTON
DEPARTMENT OF PUBLIC WORKS

NORTHAMPTON LANDFILL
PHASE 5 EXPANSION
Northampton, Massachusetts

Title

Conceptual Grading Plan
Figure 7-1

Project No.	**Scale**
195111079	AS NOTED
Drawing No.	**Sheet**	**Revision**
	1 of 1	

Cost Factors

A detailed cost estimate for the Phase 5 landfill expansion was prepared including the following cost factors:

- Site infrastructure, roads, scale, stormwater and related facilities
- Liner Construction
- Leachate and Landfill Gas Systems Construction
- Permitting and Engineering
- Construction Management and Quality Control
- Operations and Maintenance
- Closure and Capping
- Post-closure Maintenance

Appendix **7-1** includes tables for these estimated construction costs. The construction cost for the first lined cell also includes site development costs including a new scale and scale house, leachate pumping systems, main access road, and stormwater management (drainage system and detention ponds). The cost of the landfill liner and leachate collection systems are based on designs meeting current regulatory standards.

Capital costs for landfill gas collection systems were included. The landfill gas collection system consists of horizontal collector trenches in active filling areas, wellheads and laterals, gas headers and valves, condensate traps, and vertical wells for areas at or near final grade. Unit costs for the landfill construction components are based on bid prices from 2007 and 2008 adjusted with appropriate costs indices. A contingency of 10% has been added to the subtotal of the estimated construction costs.

Engineering and permitting costs are based on an allowance of 7% of the total estimated construction costs. An additional allowance of $90,000 per acre of footprint area (2007$) escalated at 3.5% per year is made for construction management, Quality Assurance / Quality Control (QA/QC), surveying and record drawings.

Projected operations and maintenance costs for the Phase 5 Landfill expansion were based on the City's Landfill Enterprise Fund actual amounts from the 2008 fiscal year, revised as appropriate. Refer to Appendix **7-2** and the table entitled Variable Cost Factors. Cost factors included in the landfill operations budget include:

- Labor (personnel services)
- Ordinary Maintenance
- Capital Outlay
- Direct and Indirect Expenses.

Labor costs are for personnel directly associated with the landfill as well as an apportioned amount of the full time equivalent labor costs for positions ancillary to the landfill such as the solid waste coordinator and leachate treatment operator. The annual contract for landfill operations (currently with Solid Waste Solutions) is included under the Ordinary Maintenance

cost item. Other ordinary maintenance items include utilities, repairs, equipment and supplies, and rents / leases. Capital outlay costs are primarily related to construction costs affiliated with the on-going landfill operations such as improvements to the gas control system, cell capping, and infrastructure replacement. Direct and indirect expenses include costs beyond the direct landfill related costs that are incurred by the City in managing the solid waste related activities such as allocated DPW Department costs, allocated DPW employee labor and benefits, insurance, and payment in lieu of taxes (PILOT) costs. Operations and maintenance cost items, other than Direct and Indirect Expenses, are estimated to increase at a rate of 3.5% per year. Direct and indirect costs are estimated to increase at a rate of 2.5% per year.

Conceptual final grading plans were prepared for each cell of the proposed Phase 5 landfill. These grading plans are located in Appendix **7-3** and were used to determine the approximate acreage of capping for each cell. Projected closure and capping costs of the Phase 5 Landfill Expansion are based on the actual cost bid for the capping of the Phase 3A cell of the existing landfill, equal to $194,000 per acre in 2008. Projected closure and capping costs include an allowance of $20,000 per acre for project management, construction management and QA/QC oversight based on the actual per acre costs incurred for these services with the Phase 3A capping in 2008. Capping and closure costs are escalated at 3.5% per year.

Post closure maintenance costs cover a period of 30 years after the landfill has closed and include: routine site monitoring and engineering services per regulatory requirements estimated at $50,000/yr., maintenance of the cap estimated at $25,000/yr., and flare operation costs estimated at $10,000/yr for a total of $85,000/yr or $2.55 million over 30 years. In accordance with the DEP Financial Assurance Mechanism (FAM) regulations, annual set-aside is required over the active life of the landfill to cover the post-closure period of 30 years. At 50,000 tpy with a useful life of 28 years, the annual set-aside amount is around $91,000.

Revenue Factors

The primary revenue generated by the landfill is through tipping fees charged for waste disposal. The current tipping rate assessed at the Northampton Landfill is $72.50 per ton which was raised recently from its previous rate of $70.00 per ton. In FY2008, tipping fees amounted to around $3.0 million. Other sources of revenue for the Landfill Enterprise Fund include the following:

- Alternative Daily Cover Revenue
- Gas Sales to Landfill Gas to Energy Facility
- Closure Fund Interest Income
- Cell Tower Lease Payments

Note, revenues, as well as costs, associated with vehicle permit and bag sticker fees and with recycling are excluded from this analysis since the operation of the drop off centers is considered to be independent of the landfill expansion.

The landfill accepts DEP approved alternative daily cover (ADC) materials. These ADC materials are most typically contaminated soils that meet DEP criteria for use at lined landfills. For financial modeling purposes, it is assumed that alternative daily cover accounts for around one-half of the volume of daily cover and amounts to around 7,500 tons per year. The estimated market fee for alternative daily cover is about $8.00 per ton. ADC tipping fees are expected to generate around $60,000 per year. The City currently has a revenue sharing agreement with Solid Waste Solutions where the City receives up to $4.00 per ton for contaminated soils accepted at the landfill. It is anticipated that this revenue sharing formula will change if Phase 5 landfill is constructed.

The City receives royalties from landfill gas sales to Ameresco-Northampton, LLC for operation of their Landfill Gas to Energy (LFGTE) facility at the Northampton Landfill. The City has a long-term agreement with Ameresco for rights to the landfill gas including landfill gas generated from the Phase 5 landfill. The agreement sets a payment rate by Ameresco to the City of $0.35 per million Btu's (mmBtu) of landfill gas consumed by the LFGTE plant to produce electricity. The gas sales payment rate of $0.35 per mmBtu applies to the Phase 5 landfill. Based on the projected landfill gas generation rate and capacity of the LFGTE facility, the annual revenue from gas sales payments to the City is estimated at around $40,000 per year. The spreadsheet table for landfill gas revenues is located in Appendix **7-2**.

Funds are set-aside each year toward the cost of closing each landfill cell and are placed in an interest bearing trust account. Interest income on the balance in the trust account is added as revenue to the Landfill Enterprise Fund. In accordance with the DEP Financial Assurance Requirements for closure funding (CMR 19.051) each year of the active operation of a new cell, an amount equal to the estimated total costs to close and cap the cell divided by the number of years of capacity of the individual cell, less one, is to be placed in an approved Financial Assurance Mechanism (FAM).

A cell tower is located on the Northampton Landfill site in the vicinity of the leachate treatment facility. The City has a long term lease agreement with the cellular telephone carrier company which pays the City around $40,000 per year.

Pro Forma Analysis

The cost and revenue factors for the Phase 5 Landfill Expansion were compiled into several tables each representing a different landfill operating size ranging from the current permitted level of 50,000 tpy (base case) incrementally reduced to a minimum of 10,000 tpy. Another scenario of increasing the permitted maximum annual landfill disposal rate to 75,000 tpy was also developed for the financial analysis. The landfill expansion sensitivity analysis for the base case and various alternate operating sizes extends from calendar year 2012 (the expected date for the Phase 5 Landfill to be in operation if approved by the City) and 30 years into the future to CY2042. The financial analysis starts 2 years in advance in 2010 to account for final design, permitting and construction of the first cell of Phase 5 plus the overall site supporting infrastructure and facilities. A complete compilation of the 6 pro forma spreadsheets along with accompanying backup information on the cost and revenue factors and assumptions applied can be found in Appendix **7-2.**

The cost and revenue factors detailed above were adjusted for future years applying appropriate escalation factors. An inflation rate of 3.5% was applied to construction and operations based costs excluding "Direct and Indirect Expenses" under the Landfill Operations category where assumed annual increases were limited to 2.5%. Bonding for capital outlays, such as new landfill cell construction, was assumed at an interest rate of 5% over the term of the bond. Operations and maintenance engineering costs was assumed to increase at a rate of 3.0% per year. Interest on funds set-aside under the Financial Assurance Mechanism (FAM) for closure of each cell was assumed at 4% per year. The tipping fee rate is assumed to increase an average of 1.5% per year based on a starting value of $75.00 in 2012.

The pro forma analyses shows that the 50,000 tpy scenario has revenues exceeding costs in the first year of operation (2012) by over $740,000 and remaining consistently positive through the 22nd year operation in 2033. In some of the latter years, the analysis shows the landfill will run at an annual deficit of no more than $250,000 (2009$). However, from a cash flow perspective including free-cash carryover from preceding years, the analysis indicates the Landfill Enterprise Fund for the 50,000 tpy scenario will maintain a positive balance. In comparison, at an operating capacity of 40,000 tpy, after the first 2 years of operation, the Enterprise Fund cash flow commonly runs a deficit in the range of $100,000 to $200,000 a year (2009$) in the earlier years and exceeding $0.5 million in the latter years. For the remaining lower increment annual tonnage cases, losses occur each year of the projection of generally between $400,000 to upwards of $1.0 million per year. Conversely, increasing the annual permitted tonnage to 75,000 tpy would provide a positive cash flow each year of operation of up to $1.9 million per year (2009$).

In order to understand the sensitivity of the assumed tipping fee escalation, a second economic model was run applying an average annual increase of 3.0% instead of the base assumption of 1.5%. The financial impact of increasing the tip fee escalation to 3.0% is significant. The net present value of the pro forma cash flow over the 28 year life of the landfill expansion at 50,000 tons per year is over $19.8 million as compared to around $6.3 million with a 1.5% assumed tip fee escalation rate.

7.2 BREAKEVEN TONNAGE ANALYSIS

Based on the results of the sensitivity analysis at a tip fee escalation rate of 1.5% per year, the breakeven tonnage (revenues balance costs) for the operating size of the Phase 5 Landfill Expansion falls between the current permitted limit of 50,000 tpy and a reduced operating capacity of 40,000 tpy. Through the 28 year operating life year of the Phase 5 Landfill at 50,000 tpy (2012 - 2039), the cumulative net present value (NPV) of annual cash flow is around $6.3 million in revenue. In comparison for the same 28-year period of time, the cumulative NPV for the 40,000 tpy case is around a deficit of -$3.0 million. Through interpolation, the breakeven tonnage would be around 43,000 tpy. Similarly, the calculated breakeven tonnage at an assumed tip fee escalation rate of 3.0% is around 33,000 tpy.

As discussed in Section 2.2, the total amount of residential and commercial waste in the entire City of Northampton requiring disposal is in the range of 14,800 to 16,550 tons per year. As the break even analyses shows, the City generates far less waste than the 43,000 tpy (1.5% tip fee

escalation rate) or 33,000 tpy (3.0% tip fee escalation rate) required to operate under the break-even scenario, meaning that a City-only landfill facility is not financially feasible.

7.2.1 Revenue Factors

There are several factors related to revenue assumptions in the financial model that need to be considered when discussing the potential to move forward with construction of the Phase 5 landfill.

One factor is related to the quantity of incoming waste and tip fee revenue. Historically, the landfill has operated at 50,000 tons per year and has successfully generated tip fee revenue from this amount of waste. This amount of incoming waste has been consistent through the years without maintaining any contracts with municipalities or commercial waste haulers. Essentially, the City has no flow control over the incoming waste stream, other than from the drop-off centers, and relies on a competitive tip fee and market forces for incoming waste.

This reliance on market forces presents a potential risk to tip fee revenue. If it is found that the tip fee charged at the landfill is not competitive at some point in the future, commercial waste haulers may chose to use another disposal facility. This could leave the City with debt service costs and inadequate revenue to cover those costs. A similar problem could occur if one or more of the larger commercial waste haulers decided to rely on another disposal facility.

The other revenue related issue is determining the appropriate tip fee escalator for the financial model. Without a disposal contract there is no way to systematically apply a Consumer Price Index (CPI) increase to the tip fee. As the financial pro forma shows, there are inflation and other escalators on all of the categories of capital and operational costs. Most of the cost escalator factors used are greater than the 1.5% tip fee escalator. This has the effect of reducing profit margins as the life of the facility extends. An assumption of 1.5% increase in tip fees was made for the financial analyses, but there is currently no contractual means to annually increase the tip fee. Historically, the City has periodically increased the tip fee based on market conditions. This increase has averaged about 2.0 percent over the last fifteen years, making the assumption of 1.5% escalation a conservative one based on past data.

One approach to reduce the revenue risk and to be able to use a CPI-increase on the tip fee is for the City to make major users of the landfill sign disposal agreements. Rather than having municipalities sign a memorandum of understanding (MOU) as is the current practice, the City could require that a formal contract be agreed to that sets the tip fee and an escalator. In a similar fashion, the City could approach all the major commercial haulers about signing a disposal agreement. These disposal Agreements may be from one to several years in duration. There are indications that local private haulers would consider signing such agreements. Note, that even with the use of disposal agreements, these agreements may not include “put-or-pay” provisions that would guarantee a minimum amount of solid waste being delivered to the landfill on an annual basis.

One interesting approach to using landfill disposal contracts at a publically-owned landfill has been developed by the Greater New Bedford Regional Refuse Management District (Greater New Bedford). Greater New Bedford consists of the City of New Bedford and the Town of

Dartmouth. They own the Crapo Hill Landfill in Dartmouth that is permitted to accept up to 115,000 tpy, of which about 50 percent is residential waste from District communities and 50 percent is commercial waste generated within the District. Every two years Greater New Bedford bids out a pre-determined portion of the "commercial' capacity available to haulers. They establish a "floor price" and bidders can bid the floor price or offer to pay more to secure capacity at the landfill. The disposal agreements stipulate the minimum tonnage that must be paid ("put or pay" provision) for by the bidders that are awarded capacity. This provides revenue security from the commercial users of the landfill. The haulers must also certify the origin of each waste load delivered to the landfill to ensure that the commercial waste is from either Dartmouth or New Bedford. Currently, the "floor price" at Crapo Hill Landfill is $71/ton for those with a disposal agreement and $91/ton for the spot market gate rate. Reportedly, the tip fee revenue generated from the commercial sector has the effect of maintaining low solid waste management costs for district communities.

If the Phase 5 landfill is developed the City could consider bidding capacity in a similar manner. If Northampton does not implement City-wide curbside solid waste collection in the future, the bidding of "commercial' capacity could potentially result in one or two haulers successfully bidding for a large portion of the available capacity, which may result in increased costs to city residents that use subscription curbside services. Bidding capacity in this manner may have the effect of reducing collection competition if the bid process and disposal contract design is not managed carefully. The City would have to determine the amount of capacity to bid and then maintain a certain amount of capacity at a higher gate rate to provide the incentive necessary for commercial haulers to bid on the commercial capacity.

7.2.2 Regional Solid Waste District Option

A different approach to landfill facility development would be to implement a solid waste district. A solid waste district is formed when two or more communities elect to join in an entity for long term management of solid waste and whose operations and finances are separate from the individual municipalities. The formation, powers, duties and obligations of a Solid Waste District are contained under the provisions of State laws pursuant to MGL Chapter 40 – Sections 44A – 44E.

One benefit of forming a solid waste district is that flow control could be instituted in the District communities that would require all residential waste (and possibly commercial waste) be delivered to the Phase 5 landfill. By controlling waste flows the District would also control the revenue needed to finance the proposed landfill expansion. To control flow of residential waste it would be necessary to implement a City-wide (District-wide) curbside collection program for solid waste and recycling.

The main difficulty with this approach is that attempts to form solid waste districts in Massachusetts have been met with limited success, particularly when the District plans to finance and own large capital facilities. The Greater New Bedford Regional Refuse Management District, consisting of the Town of Dartmouth and the City of New Bedford, is the only solid waste district in Massachusetts that owns a disposal facility. Generally, the independent nature of Massachusetts communities makes the formation of a solid waste district

a formidable challenge to organize. The political challenge of forming a solid waste district increases as the number of communities involved increases. In this case, the City could look to partner with one or several other area communities to enter into a solid waste district with the goal to develop the landfill to secure cost effective, environmentally sound, long term disposal capacity. The District would need to have a waste shed of about 50,000 tons per year, to meet the required break-even revenue. For discussion purposes a summary of residential waste tonnage for neighboring communities is presented in Table 7-1. In order to secure about 50,000 tpy of residential solid waste the City would need to form a District with all of the communities listed in the Table located in Franklin and Hampshire Counties – a total of 39 communities. An alternate approach to secure the "break-even" tonnage would be to combine with one or more larger communities in Hampden County. The number of communities required to establish a District poses a significant hurdle to this approach of providing residential waste only to support a District landfill.

Another alternative would be to consider the current Greater New Bedford approach that provides residential waste disposal capacity in addition to some commercial capacity to support District facilities. This would effectively reduce the total number of communities required to establish a District. In addition, to the political difficulties of establishing a District, Towns such as Amherst and Easthampton do not currently have town-wide curbside collection, meaning that waste collection methods would need to be changed if those communities entered into a District arrangement.

Typically, the structure of the Solid Waste District is comprised of a Board with one appointed representative from each community and an Executive Director who oversees and manages the day-to-day functions of the district. In addition to the Executive Director position, the Solid Waste District may have support staff including a Program Director and Administrative Assistant to perform technical and administrative tasks. The purpose of the Solid Waste District is to manage all aspects of solid waste for the member communities including refuse, recyclables, organics, hazardous waste, and other landfill diversion products (i.e., waste oil, bulky items, CRTs, etc.). Each participating community pays an annual administrative assessment to pay for the District's administrative operating expenses plus a fee-for-service amount that varies with the annual quantity of solid waste managed from each community and degree of participation in the District's programs.

Administrative functions of a Solid Waste District may include:

- Tracking and reporting on quantities of MSW, recyclables, bulky items, scrap metal, household hazardous waste, and other waste ban materials that is used to prepare required annual reports to DEP and provides useful information for communities during the budget cycle.
- Coordinating and operating special programs such as household hazardous waste collection, annual collection of tires, electronics, appliances and bulky wastes, distribution of compost and recycling bins, and collection of sharps and mercury containing products.
- Technical assistance to residents, businesses, schools and Town departments on composting, recycling, waste disposal and hazardous waste management.

- Preparation of applications for grants from the State and Federal government related to solid waste initiatives and programs.
- Provide representation at regional, state, and national forums for input on legislation, regulations, new programs and planning efforts that could impact on the member communities.

In addition to providing better control of the flow of waste within the waste shed, the value of a Solid Waste District is in bringing together the interests of the participating communities to implement solid waste management programs that best serve the region and individual municipalities more cost-effectively than each community on its own. A District with its combined volume of solid waste also has greater clout in negotiating favorable contracts, seeking state and federal grants and influencing legislation on solid waste management policies and regulations.

8.0 Section 8 – Assessment of Solid Waste Alternatives

8.1 OPTIONS CONSIDERED

To assist the City in its decision concerning the landfill expansion, a team of professionals from Stantec and HDR was asked to assess budget/cost impacts of the following five waste disposal options:

Option 1: Current Collection System – Expanded Landfill

- The City continues to operate drop-off centers for municipal solid waste[15] and recyclables located at Locust Street and the Northampton Landfill.
- Households continue to individually arrange for curbside collection services for solid waste and/or recyclables, with local haulers, i.e., collection subscription service.
- The City proceeds with the Phase 5 expansion of the landfill with continued regional operations.

Option 2: Current Collection System – Close Landfill and Adjacent Drop-Off Site

- The City continues operating one drop-off center for solid waste and recyclables at Locust Street.
- Households continue to individually arrange for curbside collection services for solid waste and/or recyclables with local haulers, i.e., collection subscription service.
- The City closes the landfill and Glendale Road drop-off center. Waste collected in the City is hauled to out-of-city disposal facilities.

Option 3: Citywide Collection Serving Single-Family Homes - Expand the Landfill

- For families living in multi-family residences, the City continues operating drop-off centers for solid waste and recyclables at the Locust Street and Northampton Landfill.
- The City contracts with a private hauler for citywide curbside collection of trash and recyclables from all single-family households.[16]
    - The City proceeds with the Phase 5 expansion of the landfill with continued regional operations.

[15] Solid waste, or waste, as used in this report refers to trash that requires disposals at a landfill or waste-to-energy facility.
[16] Citywide curbside collection programs in other communities include collection of multi-family residences with 2, 3 or 4 units. Although this analysis assumed the Northampton program would apply only to single-family households, the City may choose to include other small multi-family dwellings, such a duplexes, if this option is implemented.

Option 4: Citywide Collection Serving Single-Family Homes – Close Landfill and Adjacent Drop-Off Site

- For families living in multi-family residences, the City continues operating a drop-off center for solid waste and recyclables at Locust Street.
- The City contracts with a private hauler for citywide curbside collection of trash and recyclables from all single-family households.
- The City closes the landfill and Glendale Road drop-off center. Waste collected in the City is hauled to out-of-city disposal facilities.

Option 5: Provide No Services – Close Landfill and Both Drop-Off Sites

- The City closes the drop-off center for solid waste and recyclables at Locust Street.
- All households individually arrange for waste management services with local haulers, i.e., collection subscription service.
- The City closes the landfill and Glendale Road drop-off center. Waste collected in the city is hauled to out-of-city disposal facilities.

Because the analysis projects cost and revenues for 28 year starting in FY12, the analysis assumes pre-recession pricing. Therefore, most of the baseline cost and revenue data reflect FY08 price levels. Any short-term price adjustments caused by the recession are not considered.

8.2 RESULTS OF THE ANALYSIS

Option 1: Expand the Landfill and Make No Changes to the Collection System, was used as the baseline to determine economic savings or costs of the other alternatives. These savings or costs are the option's estimated cost decreases or increases compared to the baseline. This approach simplified the analysis because estimates of costs or programs not affected by the options analyzed did not have to be calculated. For example, landfill closure and post-closure costs for Phase 4 were not included because funds will be set aside for these activities and none of the options analyzed will affect or be affected by these costs.

Under each option, Stantec/HDR estimated the budget/cost impacts for the Solid Waste Enterprise Fund, the City General Fund and individual households. Stantec/HDR estimated the annual costs for each option from fiscal year 2012 to 2039 (FY12-FY39) as well as the net present value (i.e., life-cycle costs). This is the expected useful life of the landfill assuming disposal of 50,000 ton per year. Calculating the net present value is similar in principle to figuring the effect of investment earnings into your retirement planning. Because you can invest a dollar today and earn interest, the value of a dollar today is greater than the value of a dollar next year. Therefore, future costs and benefits need to be discounted to today's dollar amounts to derive the equivalent current value or net present value. In this analysis the net present value (NPV) was calculated for FY12, the first year of the analysis. All annual benefits and costs were escalated and expressed in future dollar amounts.

Tables 8-1a and 8-1b summarize the results of the comparison of the 5 options with waste disposal tipping fees escalating at 1.5% per year and 3.0% per year, respectively. The basic assumptions used in the analysis are provided in **Appendix 8-1**. The pro formas of revenue and cost projections for Options 1 through 5 are presented in **Appendix 8-2**.

The results of the financial assessment of the 5 solid waste management options summarized in Tables 8-1a and 8-1b are shown for the net present value over period of 28 years, corresponding to the useful life of the Phase 5 landfill expansion at 50,000 tpy as well as on an annual basis for the first, middle and last years of the operating period. Under each option, net revenues (or expenses) are reported for the Solid Waste Enterprise Fund, the General Fund, and total for all the households in the City (for hauling and disposal). The average annual benefit (cost) per household is also shown under each option.

Option 1, corresponding to the current collection system and expansion of the landfill, is the base alternative from which the other 4 options are compared financially in terms of incrementally benefiting or costing the City and residents. The incremental benefit or cost of Options 2 through 5 are provided on the basis of the City only (Enterprise and General Funds) and as a whole including household costs as Citywide incremental benefit or cost over Option 1. The incremental benefit or cost to the City finances for Options 2 through 5 is calculated by subtracting the combined revenues of the Enterprise and General Funds under Option 1 from the combined revenues (expenses) of the Enterprise and General Funds of the particular option. Similarly, the incremental benefit or cost on a Citywide economic basis (including household based solid waste hauling and disposal costs) is calculated by subtracting the combined revenues of the Enterprise and General Funds plus household costs under Option 1 from the combined revenues (expenses) of the Enterprise and General Funds plus household costs of the particular option.

Table 8-1a

Solid Waste Disposal Options Economic Assessment: Summary of Results (1.5% Tip Fee Escalation)

Option	NPV [a]	Annual Net Revenue (Expense)		
		FY12	FY25	FY39
	($M)		(dollars)	
Option 1: Current Collection System - Expand Landfill				
Solid Waste Enterprise Fund	$0.5	$247,600	$519,600	$304,500
General Fund	$9.7	483,500	586,800	722,800
Households	($53)	(2,276,600)	(3,222,300)	(5,022,700)
Net Citywide Revenue (Expense)	($43)	($1,545,400)	($2,115,900)	($3,995,500)
Average Annual Benefit (Cost) per Household		($130)	($178)	($336)
Option 2: Current Collection System - Close Landfill and Adjacent Drop-Off Site				
Solid Waste Enterprise Fund	($4.7)	($61,800)	($240,800)	($583,000)
General Fund	($10.2)	($394,200)	($616,600)	($998,100)
Households	($59)	($2,381,800)	($3,580,900)	($5,603,100)
Net Citywide Revenue (Expense)	($74)	($2,837,800)	($4,438,200)	($7,184,200)
Average Annual Benefit (Cost) per Household		($239)	($374)	($605)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($25)	($1,187,200)	($1,963,800)	($2,608,300)
Incremental Benefit (Cost) - Citywide [b]	($31)	($1,292,500)	($2,322,400)	($3,188,700)
Average Annual Incremental Benefit (Cost) per Household		($109)	($195)	($268)
Option 3: Citywide Collection Serving Single-Family Homes - Expand Landfill				
Solid Waste Enterprise Fund	($2.4)	$119,600	$340,600	$43,100
General Fund	$9.7	$483,500	$586,800	$722,800
Households	($46)	($1,845,000)	($2,762,500)	($4,306,900)
Net Citywide Revenue (Expense)	($38)	($1,241,900)	($1,835,200)	($3,541,000)
Average Annual Benefit (Cost) per Household		($105)	($154)	($298)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($3)	($128,100)	($179,100)	($261,400)
Incremental Benefit (Cost) - Citywide [b]	$4.7	$303,500	$280,700	$454,400
Average Annual Incremental Benefit (Cost) per Household		$26	$24	$38
Option 4: Citywide Collection Serving Single-Family Homes - Close Landfill and Adjacent Drop-Off Site				
Solid Waste Enterprise Fund	($3.5)	($98,300)	($166,800)	($287,500)
General Fund	($10.2)	($394,200)	($616,600)	($998,100)
Households	($48)	($1,950,200)	($2,927,100)	($4,573,300)
Net Citywide Revenue (Expense)	($62)	($2,442,800)	($3,710,500)	($5,858,900)
Average Annual Benefit (Cost) per Household		($206)	($312)	($493)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($24)	($1,223,700)	($1,889,800)	($2,312,800)
Incremental Benefit (Cost) - Citywide [b]	($19)	($897,400)	($1,594,600)	($1,863,400)
Average Annual Incremental Benefit (Cost) per Household		($76)	($134)	($157)
Option 5: Provide No Services - Close Landfill and All Drop-Off Sites				
Solid Waste Enterprise Fund	$0.0	$0	$0	$0
General Fund	($10.2)	($394,200)	($616,600)	($998,100)
Households	($105)	($4,065,800)	($6,358,700)	($10,292,800)
Net Citywide Revenue (Expense)	($115)	($4,460,000)	($6,975,300)	($11,290,900)
Average Annual Benefit (Cost) per Household		($375)	($587)	($950)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($20)	($1,125,400)	($1,723,000)	($2,025,300)
Incremental Benefit (Cost) - Citywide [b]	($72)	($2,914,600)	($4,859,400)	($7,295,400)
Average Annual Incremental Benefit (Cost) per Household		($245)	($409)	($614)

(a) Net Present Value calculated with discount rate of 4.0%. NPV presented in FY12 dollars. Results are presented in millions of dollars.

(b) Change in cost relative to Option 1

Table 8-1b

Solid Waste Disposal Options Economic Assessment: Summary of Results (3.0% Tip Fee Escalation)

Option	NPV [a]	Annual Net Revenue (Expense)		
		FY12	FY25	FY39
	($M)		(dollars)	
Option 1: Current Collection System - Expand Landfill				
Solid Waste Enterprise Fund	$16.7	$253,100	$1,678,200	$3,574,900
General Fund	$8.7	483,500	586,800	722,800
Households	($46)	(2,258,600)	(3,161,100)	(4,781,400)
Net Citywide Revenue (Expense)	($21)	($1,521,900)	($896,100)	($483,800)
Average Annual Benefit (Cost) per Household		($128)	($75)	($41)
Option 2: Current Collection System - Close Landfill and Adjacent Drop-Off Site				
Solid Waste Enterprise Fund	($1.7)	($52,700)	($77,400)	($117,100)
General Fund	($8.3)	($386,700)	($567,900)	($858,900)
Households	($50)	($2,362,800)	($3,469,900)	($5,248,500)
Net Citywide Revenue (Expense)	($60)	($2,802,200)	($4,115,100)	($6,224,500)
Average Annual Benefit (Cost) per Household		($236)	($346)	($524)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($35)	($1,176,100)	($2,910,300)	($5,273,700)
Incremental Benefit (Cost) - Citywide [b]	($40)	($1,280,300)	($3,219,000)	($5,740,700)
Average Annual Incremental Benefit (Cost) per Household		($108)	($271)	($483)
Option 3: Citywide Collection Serving Single-Family Homes - Expand Landfill				
Solid Waste Enterprise Fund	$13.9	$123,500	$1,487,900	$3,287,000
General Fund	$8.7	$483,500	$586,800	$722,800
Households	($39)	($1,827,800)	($2,684,100)	($4,060,000)
Net Citywide Revenue (Expense)	($16)	($1,220,700)	($609,400)	($50,200)
Average Annual Benefit (Cost) per Household		($103)	($51)	($4)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($3)	($129,600)	($190,300)	($287,900)
Incremental Benefit (Cost) - Citywide [b]	$4.3	$301,200	$286,700	$433,600
Average Annual Incremental Benefit (Cost) per Household		$25	$24	$36
Option 4: Citywide Collection Serving Single-Family Homes - Close Landfill and Adjacent Drop-Off Site				
Solid Waste Enterprise Fund	($2.6)	($94,000)	($138,000)	($208,700)
General Fund	($8.3)	($386,700)	($567,900)	($858,900)
Households	($41)	($1,932,000)	($2,837,200)	($4,291,500)
Net Citywide Revenue (Expense)	($52)	($2,412,600)	($3,543,000)	($5,359,100)
Average Annual Benefit (Cost) per Household		($203)	($298)	($451)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($36)	($1,217,300)	($2,970,800)	($5,365,300)
Incremental Benefit (Cost) - Citywide [b]	($31)	($890,700)	($2,646,900)	($4,875,400)
Average Annual Incremental Benefit (Cost) per Household		($75)	($223)	($410)
Option 5: Provide No Services - Close Landfill and All Drop-Off Sites				
Solid Waste Enterprise Fund	$0.0	$0	$0	$0
General Fund	($8.3)	($386,700)	($567,900)	($858,900)
Households	($86)	($4,026,600)	($5,913,200)	($8,944,200)
Net Citywide Revenue (Expense)	($94)	($4,413,300)	($6,481,000)	($9,803,200)
Average Annual Benefit (Cost) per Household		($371)	($546)	($825)
Incremental Benefit (Cost) - Enterprise & General Fund Only [b]	($34)	($1,123,300)	($2,832,800)	($5,156,600)
Incremental Benefit (Cost) - Citywide [b]	($74)	($2,891,400)	($5,584,900)	($9,319,400)
Average Annual Incremental Benefit (Cost) per Household		($243)	($470)	($784)

(a) Net Present Value calculated with discount rate of 5.0%. NPV presented in FY12 dollars. Results are presented in millions of dollars.

(b) Change in cost relative to Option 1

The following subsection discusses key study results that are summarized in Table 8.1.

Closing the Northampton Landfill

Closing the Northampton Landfill could result in an approximately $31 to $40 million life cycle cost increase to the service recipients and taxpayers of Northampton, depending upon the assumed tip fee escalation rate (compare Option 1 and Option 2). This represents an average estimated cost increase of approximately $109 per household in FY12 and $268 per household in FY39 for the 1.5% tip fee escalation scenario and $108 per household in FY12 and $483 per household in FY39 for the 3.0% tip fee escalation scenario. The majority of this cost increase is attributable to the loss of revenues received from communities other than Northampton and private haulers that use the landfill, and the increased cost to residents who arrange for subscription collection services.

The increased cost to dispose of "exempt waste" accounts for roughly 13% of this amount. For example, all public schools and Smith Vocational High School are not currently paying for container rental, collection services, recycling services, hazardous waste disposal, waste generated by special projects such as construction and demolition waste generated from renovations, or residuals from compost screenings. In addition, the Department of Public Works' Streets Division does not pay for the disposal of street sweepings and catch basin cleanings.

Other City exempt entities that use the Northampton Landfill for free include:

• Childs Park	• Department of Public Works cemetery, recreation, wastewater treatment plant divisions and general operations
• Housing Authority	• Look Park
• Parking Division/downtown barrels	• City Hall
• Municipal Annex	• Memorial Hall

Increased costs also will be incurred by waste being transported further and disposed of at higher fees. Since most, if not all haulers providing collection subscription services in Northampton dispose of waste collected in Northampton at the Northampton Landfill, households would experience an increase in subscription services prices to cover the increased cost of haul and disposal to these haulers.

Implementing a Citywide Curbside Collection Program

Implementing a citywide curbside collection program could reduce costs by approximately $4.7 million. (Compare Option 1 and Option 3.) This represents an average estimated savings of approximately $26 per household in FY12 and $38 per household in FY39. Although the implementation of a citywide curbside collection program is estimated to result in an aggregated savings for City residents, savings will accrue to those who currently use subscription collection services while increased costs will be incurred by residents who exclusively use the drop-off centers. For example, the citywide curbside program for a one-person senior citizen household

that currently uses a drop-off site would incur increased costs of approximately $108 per year (i.e., $124 minus $17/year), while a family of four that uses a subscription service would realize a decrease in costs of approximately $278/year (i.e., $402 minus $124/year).

The analysis, however, did not include estimated out-of-pocket costs, such as the cost of gasoline, or the value of travel time incurred by residents using the drop-off centers. If these costs were included in the analysis, the increased cost of a citywide curbside collection program to residents who use the drop-off center would be less and may even result in savings.

The analysis assumes the City would procure the services of a single hauler to provide a broad range of collection services for all single-family homes in the City. These services would include collection of trash, recyclables, yard waste, bulk waste, and e-waste. Either the City or the selected firm could bill each homeowner for this service. The cost of this billing service was not included in the analysis.

One possible reason for the economic benefits of a citywide collection program is the efficiency gained from having one hauler collect from all single-family households rather than having multiple haulers in each neighborhood. Stantec/HDR's experience in other communities and a comparison of the subscription service costs in Northampton with curbside collection programs implemented by other communities in western Massachusetts support this assertion.

The ultimate citywide savings realized will depend on the competitive nature of the process implemented. The availability of local independent and relatively inexpensive disposal options, such as the Northampton Landfill and the Covanta waste-to-energy facility, increases competition for collection services. The number of independent haulers competing with international vertically integrated firms such as Waste Management and Allied Services in western Massachusetts is illustrative of increased competition for either subscription or citywide collection services, which helps keep prices down.

Benefit of the Department of Public Works Solid Waste Programs

The current Department of Public Works solid waste management program has an approximate $61 to $72 million life cycle benefit to the service recipients and taxpayers of Northampton depending upon the assumed tip fee escalation rate (compare Option 1 and Option 5). This represents an average estimated benefit of approximately $259 per household in FY12 and $620 per household in FY39 for the 1.5% tip fee escalation scenario and $259 per household in FY12 and $821 per household in FY39 for the 3.0% tip fee escalation scenario.

In addition to the landfill's economic benefits discussed above, the Locust Street transfer station and drop-off site at the Northampton Landfill reduce collection costs to residents who take advantage of these facilities and is currently generating revenues from the sale of recyclables. The benefit of these programs represents approximately half of the $33 million life cycle benefits (compare Options 2 and 5).

Advantages and Disadvantages of Each Option

Table 8.2 lists some potential advantages and disadvantages of each option. This list is not meant to be exhaustive.

Table 8-2
Potential Advantages and Disadvantages of Each Option

Option	Potential Advantages	Potential Disadvantages
Option 1: Current Collection System - Expand Landfill		
	1. Provides revenues for the General Fund 2. No system changes to residents 3. City controls disposal system 4. Flexibility for households to use either drop-off or subscription services 5. Enhances competition for collection services	1. Nuisance for residents living near the landfill (e.g., noise, truck traffic, potential odors) 2. Inefficiencies in collection resulting in increased truck miles traveled and emissions
Option 2: Current Collection System - Close Landfill and Adjacent Drop-Off Site		
	1. If landfill is closed rather than sold - decreased nuisance for residents living near the landfill (e.g., noise, truck traffic, odors) 2. Flexibility for households to use either drop-off or subscriptions services	1. Disposal costs not controlled by City 2. More distant disposal will result in increased truck miles traveled by hauler collecting in Northampton 3. Inefficiencies in collection resulting in increased truck miles traveled and emissions 4. Potential decrease in competition for collection services 5. Increased costs to households and commercial establishments 6. Reduces revenues for the General Fund
Option 3: Citywide Collection Serving Single-Family Homes - Expand Landfill		
	1. Lowest estimated costs 2. Increased Recycling 3. Provides revenues for the General Fund 4. More efficient collection within the City 5. City can control disposal system costs	1. Nuisance for residents living near the landfill (e.g., noise, truck traffic, potential odors) 2. Potential hauler opposition 3. Single-family household will lose flexibility of using either drop-off or subscription services. 4. Single-family households that used the drop-off site may incur increased costs. 5. Unless an exception is made, would eliminate green option of single-family homes use of Pedal People hauling
Option 4: Citywide Collection Serving Single-Family Homes - Close Landfill and Adjacent Drop-Off Site		
	1. If landfill is closed rather than sold - decreased nuisance for residents living near the landfill (e.g., noise, truck traffic, odors) 2. More efficient collection within the City 3. Increased recycling	1. Potential hauler opposition 2. Single-family households will lose flexibility of using either drop-off or subscription services. 3. Single-family households that used the drop-off site may incur increased costs. 4. Unless an exception is made, would eliminate green option of single-family homes use of Pedal People 5. Disposal is not controlled by City 6. More distant disposal will result in increased truck miles traveled by hauler collecting in Northampton 7. Potential decrease in competition for collection services 8. Increased cost 9. No revenue for the General Fund
Option 5: Provide No Services - Close Landfill and All Drop-Off Sites		
	1. If landfill is closed - decreased nuisance for residents living near the landfill (e.g., noise, truck traffic, odors)	1. More distant disposal will result in increased truck miles traveled by hauler collecting in Northampton 2. Inefficiencies in collection resulting in increased truck miles traveled and emissions 3. Potential decrease in competition for collection services 4. Would eliminate green option of using Pedal People 5. No revenue for the General Fund

Conclusion

The City of Northampton faces a decision on how to manage its solid waste for the long term. With the Northampton regional sanitary landfill nearing capacity, the choice is whether to expand it or close it, and what level of additional services, if any, to provide. From a City financial perspective, the most economically favorable option for solid waste management is to expand the landfill and conduct business as usual (Option 1), where residents choose to transport their own trash and recyclables or subscribe to a private curbside collection service. On a Citywide financial basis, including average annual costs to households, Option 1 is the second least expensive option to implement. The least expensive option including the household costs is with citywide curbside collection program and landfill expansion (Option 3). However, the additional benefit from a citywide collection program primarily benefits residents who currently contract for subscription collections services at the expense of those who use the drop-off sites.

8.3 COMMERCIAL WASTE COLLECTION AND DISPOSAL

Although the primary purpose of this report was to estimate the incremental costs associated with Options 1 through 5 above, Stantec and HDR were also asked to approximate the economic impacts to commercial establishments in Northampton of closing the Northampton Landfill.

Commercial establishments in Northampton arrange for their own collection and disposal services. The availability of a local publicly owned disposal option benefits local businesses by providing a low-cost disposal option and by increasing competition among haulers. If the Northampton Landfill is closed, then using the same assumptions for households, waste haul and disposal costs are estimated to increase from between $20 to $30 per ton, over current rates.

There isn't a good estimate of the number of tons generated by commercial establishments in Northampton. The U.S. Environmental Protection Agency estimates that approximately 0.84 tons (i.e., 4.6 pound per person per year) of MSW (trash, recyclables, bulky waste, etc.) from both residences and commercial establishments are generated per person per year.[17] Assuming 0.38 tons comes from residences, then approximately 0.46 tons per person, or 13,300 tons per year, is generated from commercial establishments in Northampton. Closing the landfill, therefore, will increase the annual cost of disposing commercial waste by approximately $270,000 to $400,000. This does not include the cost of disposing of construction and demolition waste currently disposed of at the Northampton Landfill.

[17] "Municipal Solid Waste Generation, Recycling, and Disposal: Facts and Figures for 2006," U.S. Environmental Protection Agency, EPA-530-F-07-030, November 2007.

9.0 Section 9 – Appraisal Value of Phase 5 Landfill

The City of Northampton owns two large parcels of land off Glendale Road that currently serve as the City's landfill site. The current landfill, consisting of the original unlined landfill and lined landfill cells 1 – 4, primarily occupy the first parcel on the southerly half of the property and designated on the City Assessor's map as Parcel 42-089 comprised of 52.0 acres. The second parcel (Parcel 42-079) on the northerly half is comprised of a total of 50.0 acres and is the location of the proposed Phase 5 Landfill expansion. Both parcels fall under the Zoning Use Code E-903, which is a designation for Municipal Public Service Properties. The landfill parcels are within the Northampton Suburban Residential zoning district.

The City is considering whether to expand the existing Northampton Landfill by permitting and constructing the Phase 5 expansion. Important permitting steps have already been completed for the Phase 5 expansion including completion of the Massachusetts Environmental Policy Act (MEPA) process and the issuance of a Site Assignment Permit from the Northampton Board of Health and DEP. The completion of these steps has indicated that the Phase 5 expansion site has been determined to be suitable and permittable as a solid waste landfill. This being the case, this parcel of land with a Site Assignment permit represents an asset with a real value that the City may or may not chose to use. The key permits that remain are an Authorization to Construct permit that would be issued by DEP and a City of Northampton Heavy Public Use permit that would be issued by the City Council.

The section presents information about how to appraise the market value of these parcels of land for landfill use. Information contained in Section 7, the sensitivity analyses, provided some information relative to the value of the landfill if it was owned by the City. This section further explores the potential appraised value of the property from the view point of the private sector.

9.1 APPROACH OF APPRAISAL

There are two approaches to appraising the value of the Phase 5 Landfill Expansion for solid waste disposal. The first approach is to calculate the net present value (NPV) of the disposal capacity for the City to own and operate the landfill considering all related economic factors of the Phase 5 Landfill Expansion including infrastructure capital investments for development of the site and on-going improvements, operational costs, closure / post-closure costs and offsetting revenues from tip fees and other sources. The second approach is to determine the current market value of the landfill "air rights" to the private sector if the site were to be leased by the City to a waste management company who would be responsible for designing, building, operating, and capping the landfill (i.e., privatizing the landfill air rights).

The first approach has essentially been completed through the Landfill Sensitivity Analysis presented in Section 7.0 of this study in which a complete assessment was made of the costs

[19] Special legislation may need to be enacted to implement this procurement approach in Massachusetts. A legal assessment, which is beyond the scope of this study, would be required to determine the need, substance and form of any such special legislation.

and revenues to the City for continuing with the Phase 5 Landfill Expansion. As noted in Section 7.0, the net present value to the City for the Phase 5 Landfill Expansion was calculated as approximately $7.15 million over the 28 year life of the site (50,000 tpy scenario). Determining the value of the landfill asset to the private sector involves a similar cost and revenue analysis as was done in Section 7.0 for the City case but taking into account other factors for private businesses such as overhead and profit, tax implications, insurance coverage, risk management and labor contracts.

9.2 SALE OF PHASE 5 LANDFILL EXPANSION AIR RIGHTS

As an option to the City taking on the responsibility of developing and operating the Phase 5 Landfill Expansion, Northampton could solicit proposals from private waste management companies to purchase the rights to the volume that would become available if the expansion is permitted, also known as the landfill "Air Rights". Project implementation using this method is commonly called Design-Build-Operate (D/B/O). Under this option, the private waste management company would be fully responsible for designing, constructing, operating, capping and ultimately post-closure maintenance and monitoring of the Phase 5 Expansion Landfill. The City would retain the ownership of the land area and the environmental and financial liability of the property. Upon entering an agreement with the purchaser of the "Air Rights", the City would be paid either an upfront lump sum for the air rights or, more likely, an annual payment based on a negotiated fee structure over the active life of the landfill expansion. The Air Rights agreement could include other financial provisions for the City such as free or reduced cost of disposal for Northampton residents, although this would be factored into the economic assessment by the purchaser of the air rights and would be offset by a reduced value received by the City.

Determining the asset value of the landfill air rights to a private waste management company can be approached in two ways. First, a private sector economic model, similar to that developed for the Landfill Sensitivity Analysis of Section 7 of this study, could be compiled to determine the Net Present Value (NPV) of the available volume considering the capital investment for development, operational costs, closure/post-closure costs and tip fee revenues over the operating life of Phase 5. However, unlike the municipal case, the private sector landfill economic model would need to include such factors as overhead and profit, return on investment goals, tax implications, risk management and liabilities, insurance coverage, labor contracts, etc. The second approach to establishing the asset value of the privatized air rights is determining the per ton current market value for landfill capacity at private sector sites in the region and beyond, taking into account the loss of value for hauling to more distant sites. The haul distance adjusted per ton market rate is then applied to the available capacity to derive the monetized value of the air rights from which all costs and a target private sector profit margin is deducted to yield the net asset value to the City. The results from the two approaches would be balanced to provide a final estimate of the Phase 5 Landfill Expansion asset value.

9.2.1 Costs to Private Landfill Owner and Potential Market Value of the Phase 5 Air Rights

Preliminary costs to a private landfill owner for the long term operation of the Phase 5 expansion area of the landfill have been developed including cost factors for:

1. New cell permitting and construction;
2. Annual O&M costs; and
3. Capping, closure and long term monitoring.

The potential costs to a private landfill owner for the long-term operation of the site, were based on the capital and operating cost assumptions that have been developed for the project, allocated to reflect the roles and responsibilities of both the private contractor and the City over the long-term.

Table 9-1 presents an outline of the allocation of the assumed roles and responsibilities for the private contractor and the City over the operating period for the Phase 5 expansion. The assumptions made below were made to maximize the resulting cash value to the City. For example, the City could request that the waste management company staff and operate the City's drop-off centers or provide other waste management services such as household hazardous waste collection. But adding services would reduce the apparent cash value of the expansion.

Table 9-1

Allocation of Northampton Landfill Responsibilities for Sale of Air Rights

Activity **For Design/Build/Operate of Phase 5 Landfill Expansion**	**Contractor**	**City**
Obtain Authorization to Construct Permit	Yes	
Detailed design and construction of Phase 5	Yes	
Construction preparation of new cells in Phase 5 of the Landfill as landfilling progresses	Yes	
Operate and maintain Phase 5 of the Landfill including; o Receive, spread and compact waste; o Strip daily and interim cover; o Place soil cover or Alternative Daily Cover ("ADC") approved by the City over the o waste each day; o Provide Alternative Daily Cover (ADC).	Yes	
Maintain all on-site roads	Yes	
Procure daily and intermediate cover (No on-site source available)	Yes	
Stockpile cover material received from off-site sources	Yes	

Activity **For Design/Build/Operate of Phase 5 Landfill Expansion**	**Contractor**	**City**
Litter management	Yes	
Receive direct hauled materials from Municipal operations, including grit, catch basin cleanings, street sweepings and other municipal materials at the Landfill and landfill same	Yes	
Build new access roads at the Site as needed	Yes	
Maintain the internal roads at the Landfill including snowplowing and sanding	Yes	
Administer all facets of the Site, including management of the Contract staff	Yes	
Maintenance of the equipment on Site	Yes	
Maintain landscaping (for Phase 5 of the Site) including grass cutting and weed removal	Yes	
Control of birds, vermin, and vectors	Yes	
Odor control and suppression	Yes	
Supply, maintain and clean permanent, semi-permanent and mobile litter fencing	Yes	
Manage and direct stormwater discharges from the Phase 5 expansion area	Yes	
Installation and maintenance of the LFG collection system in the Phase 5 expansion area	Yes	
Installation and maintenance of the leachate collection system in the Phase 5 expansion area	Yes	
Liaise with the Municipal Contract Administrator when required	Yes	
Liaise with the Landfill neighbors and community as required, including complaints management	Yes	
Site health and safety activities	Yes	
Site Security (maintaining fencing, gates and any other on-site security measures)	Yes	
Potentially coordinating haulage operations with the haulage Contractors (for existing municipal drop-off centers and/or collection Contractors (pending municipal decision on method of providing for waste disposal/collection services to City residents)	Yes	
Report on these activities to the Municipal Contract Administrator as required	Yes	
Operation of the drop-off site in compliance with the applicable permits		Yes
Receiving waste and recyclable materials delivered by the public and commercial, and customers		Yes
Directing the waste and other materials to the appropriate areas, i.e. bins; bunkers		Yes
Handling and storing the materials		Yes

Activity **For Design/Build/Operate of Phase 5 Landfill Expansion**	**Contractor**	**City**
Maintaining the drop-off center to ensure that the process is: (i) Safe to workers and visitors; (ii) Operated efficiently; and (iii) Clean and orderly to the satisfaction of the Municipal Contract Administrator		Yes
Administering all facets of the drop-off center operations, including personnel management, maintenance of any equipment and buildings, directing materials, and loading of materials		Yes
Liaising with the Municipal Contract Administrator as required		Yes
Shipping waste materials to designated recycling or disposal facilities including: (i) Trash to the Landfill; (ii) Bulky materials to the Landfill; (iii) Yard wastes to processors; (iv) Electronic waste to processors; (v) Recyclable materials to End Markets or processors		Yes
Operation of the new automated weigh scales	Yes	
Weigh scale maintenance and recalibration	Yes	
Site rehabilitation upon cell and/or phase closure of existing fill area (Phases 1 to 4) including placement of final cover and seeding		Yes
Operation of leachate pumping stations at the Site, and costs for leachate disposal/treatment		Yes
The existing storm water management system (managing storm water from Phases 1 to 4 of the Site)		Yes
Maintenance of the existing leachate collection system (managing leachate generated from Phases 1 to 4 of the Site)		Yes
Landfill gas well field and flare/electricity generation (under separate contract)		Yes
Monitoring for surface, groundwater, leachate and gas monitoring (divided by Phases) and annual reporting	Yes	Yes
Annual overall Site survey (annual assessment of rate of fill)		Yes

To develop the projections for the Private Sector costs associated with the design/build and operation of the Phase 5 landfill, some key adjustments were required to the capital and operating cost assumptions that have been developed for the project as follows:

- It was assumed that the Private Sector costs for major capital elements of the Phase 5 expansion (including cell development, cell closure and installation of the landfill gas system) would be 15% lower than the cost to the City, since construction can be completed outside of the Prevailing Wage Rate laws.

- In regards to the tipping face for the Phase 5 expansion area, rather than the City's current tipping face contract costs, it was assumed that the Private Sector would purchase new heavy equipment and hire appropriate operating staff to manage the tipping face. The annual cost to manage the tipping face were developed from first principles assuming:
    - Hiring of three operating staff;
    - Initial capital purchase and financing of four pieces of heavy equipment and set aside for equipment replacement costs after 20 years;
    - Provisions for materials and supplies, contractual services, maintenance and fuel costs;
    - Revenues based on interest earned from the capital replacement fund and sale of used equipment.
- Provisions were included for Private Sector costs required to maintain performance surety over the contract period. The annual value of the performance surety was assumed to be equivalent to the average annual City expenses to construct and operate the Landfill of $4.5 million over the 28-year operating period, at a cost of 1% of the total value of the performance bond.
- The City's internal direct and indirect cost allocation associated with the allocation of the cost of City services (accounting, human resources etc.) to the landfill site was not included. Rather a reduced Private Sector administration cost was assumed.

The potential market value of the Phase 5 expansion area that could be paid to the City is based on:

- The per ton Market Price considering local, regional and long haul competition, less the Net Present Value per ton for all Private Sector costs associated with the design/build and operation as well as closure of the Phase 5 area, which would equal the potential profit margin per ton over the planning period.
- The potential value paid to the City for the Phase 5 airspace under a contract with the Private Sector would be based on a portion of that profit margin, reflecting both reasonable rate of return for both parties, allocation of long-term liability and the City's own costs associated with the portion of the Site for which it would retain responsibility over the contract period.

Based on the allocation of roles/responsibilities noted above, analysis was completed to determine the NPV for the landfill operations, for the following scenarios:

1. 50,000 tpy, Contractor retaining revenues equivalent to a 15% rate of return on expenditures for the site, over the 28 year operating period, and charging a tip rate of $75/ton.
2. 50,000 tpy, Contractor retaining revenues equivalent to a 15% rate of return on expenditures for the site, over the 28 year operating period, and charging a tip rate of $80/ton (which would be a reasonable rate based on the average of current tip rates for disposal facilities in reasonable proximity to Northampton.

Table 9-2 presents a summary of this analysis and the potential value of the Phase 5 expansion area that could be paid to the City. Details of the derivation of the Phase 5 Landfill Expansion Air Rights Sale are presented in Appendix 9-1.

Table 9-2

Preliminary Assessment of Sale of Phase 5 Air Rights

Scenario	Contractor Net Costs (NPV considering Costs and Revenue Share) ($Mil)	NPV, Value of Phase 5 Expansion Paid to City ($Mil)	City Net Costs (NPV considering City Costs and Potential Annual Payment) ($Mil)
50,000 tpy, Contractor 15% rate of return, Tip Fee $75/ton	Contractor Cost ($53) Contractor Revenue $64 Contractor Net $11.5	$ 7.8 over 28 years $0.28 annually	City Cost ($0.15) Incremental Benefit $7.6 over planning period
50,000 tpy, Contractor 15% rate of return, Tip Fee $80/ton	Contractor Cost ($53) Contractor Revenue $61.7 Contractor Net $8.7	$ 12.3 over 28 years $0.44 annually	City Cost ($0.15) Incremental Benefit $12.2 over planning period.

Overall the findings (for the 50,000 tpy scenario) are that:

- Assuming the private sector capital and operation and maintenance costs are comparable with the City budget estimates and the private sector assumes a reasonable rate of return of 15% above cost and charges on average $75/ton, then there would be a reasonable payment to the City of around $280,000 annually which equates to a net present value of approximately $7.8 million over the planning period. The net present value of the City costs for its share of the responsibility of the Phase 5 Landfill Expansion is around $150,000. Therefore, the net incremental benefit to the City for the sale of the Phase 5 landfill air rights is an NPV of around $7.6 million over the 28 year useful life.

- Assuming the private sector capital and operation and maintenance costs are comparable with the City budget estimates, the private sector assumes a reasonable rate of return of 15% above cost and charges on average $80/ton (through active marketing of the air rights) then the 28 year NPV of the payments to the City would increase from the previous case by about $4.5 million to $12.3 million and the NPV of the net incremental benefit of the landfill air rights to the City would be around $12.2 million. Increasing in the tipping fee by $5/ton resulted in the City gaining an NPV of $4.6 million over the 28 year useful life including setting the Contractor rate of return at

15%. It is possible, that the private sector would want to recover more than a 15% rate of return on their capital and operating cost outlay. Should this be the case, the value of the payments to the City would decrease accordingly, unless the Contractor were to be successful in setting a higher tipping fee for use of the Phase 5 capacity.

9.2.2 Preliminary Review of Tip Fee Data and Potential Market Price for Phase 5 Air Rights

Tip fee data for disposal sites (Landfill and Waste to Energy) has been reviewed on a preliminary basis to establish an estimated range for the market value per ton that could be charged by a private owner of the Phase 5 capacity at the Northampton Landfill and to assist in calculating the present market value of the available landfill air space.

In order to gain a full perspective of the market for disposal capacity, the market was assessed from three perspectives:

- Local tip fee data (landfill sites, transfer stations), including the current tipping fee for the Northampton landfill of $72.50/ton;
- Regional/State-wide tip fee data (landfills, transfer stations, WTE);
- Out-of-State costs for disposal options, considering transfer/haul/disposal.

In regards to local tip fee data, the current average tip fee (2009$) for facilities in reasonable proximity to Northampton (South Hadley, Westminster, Agawam) is over $91/ton, ranging from $77 to $120/ton. It should be noted that this tip fee range is based on posted “gate rates” for disposal without any pre-arranged negotiated price between the facility and hauler. In reality, the effective tip fee will be lower than the average gate rate since most haulers will have special rates negotiated with the disposal facility owner based on their annual disposal tonnage and commitment to use the particular facility. Accordingly, the current market price for local landfill capacity is believed to be consistent with the current tip fee for the Northampton landfill of $72.50 and supports running the analysis of the potential value of the Phase 5 expansion area on an escalated tip rate starting in 2012 of $75 per ton.

The 2007 Solid Waste Data update issued by the Mass DEP (May 2009) indicates that there is a potential decline in in-state disposal capacity for MSW as well as a potential lack of in-state disposal capacity for WTE ash. While the amount of waste exported out-of-state has remained relatively static over the past three years, this does not appear to be a reasonable long-term assumption, and therefore the value of the airspace in the Phase 5 expansion area could escalate (particularly when considering trends in haul costs). Current projections regarding the potential for export out-of-state are somewhat contingent on the potential for increases in recycling rates across the state, with a predicted increase in exports for 2009 onwards up to 2.8 million tons per year if higher diversion rates are not achieved.

While the analysis of the potential value of the Phase 5 expansion area has been undertaken based on assuming a potential tip fee of both $75 and $80/ton, further analysis should be undertaken to determine the most appropriate range of tip fees that would reflect future market conditions prior to any future endeavor to issue an RFP for D/B/O of the Phase 5 area to set the appropriate range within which the expected annual value for the payments to the City should fall.

9.2.3 Options to Phase 5 Landfill Air Rights Private Sector Entity Cash Payments

The assessment of the sale of the Phase 5 landfill expansion air rights to a private sector entity determined a net present value of payments to the City of around $7.8 million over a 28 year operating life. As an option to the City receiving the total value of the annual cash payments from the private sector solid waste management entity, the City may wish to consider monetary value in other forms that would provide a greater overall benefit. For example, the City could include in a negotiated D/B/O agreement that the contractor provide collection and disposal of the waste generated by City based operations (on the order of 600 tons per year). The reduction in the amount of the annual payment from private entity could be lower than the City's cost of performing this same service. Similarly, the private entity for the Phase 5 landfill, who would be responsible for post-closure maintenance of the Phase 5 capped cells, could provide these services for Phases 1 – 4 concurrently at a lower cost than the City itself due to economy-of-scale factors.

The specific details on any additional services by the Phase 5 landfill private sector entity in return for reduced cash payments to the City would need to be negotiated and spelled out in the terms and conditions of the D/B/O agreement.

9.2.4 Non-monetary Issues Associated with Selling the Phase 5 Air Rights

This section provides a preliminary identification and discussion of non-monetary issues associated with the D/B/O option involves selling the landfill expansion air rights to a private solid waste management company. Non-monetary issues include liability and risk allocation between the City and private developer, environmental quality characteristics of the existing Landfill and the Phase 5 Landfill Expansion, loss of City staff positions and oversight of activities at the site associated with privatizing.

Based on discussion with City staff, these issues were compiled in Table 9-1, allocation of roles and responsibilities. There are monetary implications for some of these items (such as continuation of certain City costs notwithstanding that the landfill may be operated by the private sector) that have been addressed in the financial evaluation of Sale of Phase 5 Air Rights, through the identification of City Costs that would be incurred over the operating period for Phase 5.

The allocation of short and long term liabilities for the Northampton Landfill generally reflects the allocation of D/B/O responsibilities noted above. The allocation of liabilities should be addressed in the RFP/Contract provisions with the private sector contractor. Note: the use of the term 'short-term' in the table below is intended to reflect the contract period for D/B/O of the

Phase 5 expansion area (20 to 30 years pending determination of rate of fill), while 'long-term' is intended to reflect the post closure period for the site as a whole.

Various contract provisions will be required to protect the City's interest at the site, along with a schedule of liquidated damages that would be applied during the contract period in order to ensure that the contractor is held accountable for their operation of the Phase 5 expansion area. While this would potentially 'increase' the annual operating cost for the site, as the contractor would maintain bonding and/or appropriate insurance and may also have to pay penalties to the City, this is necessary to protect the City's interest in the site.

Table 9-3 below addresses allocation of short and long-term liabilities during the contract period between the contractor and the City.

Table 9-3

Allocation of Short and Long Term Landfill Liabilities

Potential Liabilities	**Contractor**	**City**
Short-term (for D/B/O of Phase 5 Expansion)		
Compliance with Authorization to Construct Permit	Yes	
Construction in Compliance with Design	Yes	
Design and/or Construction Failures (Phase 5 expansion area)	Yes	
Compliance with Design and Operations Plans	Yes	
Fires and/or Emergencies associated with operations in the Phase 5 fill area	Yes	
Ensuring adequate daily, intermediate and final cover are available and applied as per permit	Yes	
Claims regarding Blowing Litter	Yes	
Design and/or Construction Failures in regards to new access roads at the Site as needed	Yes	
Site Access (issues associated with maintenance of the internal roads at the Landfill)	Yes	
Claims regarding control of birds, vermin, and vectors	Yes	
Claims regarding odor control and suppression	Yes	
Non-compliance with stormwater management requirements for the Phase 5 expansion area	Yes	
Failure of the LFG collection system in the Phase 5 expansion area during the contract period	Yes	
Non-compliance with leachate collection requirements in the Phase 5 expansion area	Yes	
Complaints management	Yes	
Unauthorized access to the site during the Phase 5 operations period.	Yes	
Any delays experienced by haulage operators, resulting	Yes	

Potential Liabilities	Contractor	City
from operations issues at the Site		
Short-term Liability for the Drop-off Site adjacent to the Landfill		
Operation and maintenance of the drop-off site in compliance with the applicable permits		Yes
Quality of materials shipped to designated recycling or disposal facilities		Yes
Compliance with Health and Safety requirements to protect workers and visitors		Yes
Short-term Liability for Remainder of Site (Areas Filled in Phases 1 through 4 and Buffer areas)		
Compliance with Permits that address Phase 1 to 4 fill areas		Yes
Maintenance of Final Cover		Yes
Maintenance of Leachate Collection and Pumping Systems		Yes
Compliance with Leachate treatment and management requirements		Yes
Remediation of Leachate seeps/breakouts in closed landfill areas		Yes
Maintenance and remediation of any issues associated with the Landfill gas well field and flare/electricity generation (electricity generation under separate contract)		Yes
Compliance with stormwater management provisions for stormwater generated in Phases 1 to 4 (maintenance, treatment, remediation)		Yes
Monitoring and annual reporting for the Landfill (may delegate monitoring activity to private sector, but actual liability/responsibility associated with monitoring and reporting should still be vested with City)		Yes
Claims associated with off-site impacts from closed landfill areas		Yes
Long-term Liability for the Northampton Landfill (Phases 1-4 = City and Phase 5 = Contractor)		
Compliance with Permits/Documentation that address post-closure period for Site	Yes	Yes
Maintenance of Final Cover	Yes	Yes
Maintenance of Leachate Collection and Pumping Systems	Yes	Yes
Compliance with Leachate treatment and management requirements	Yes	Yes
Remediation of Leachate seeps/breakouts in closed landfill areas	Yes	Yes
Maintenance and remediation of any issues associated with the Landfill gas well field and flare/electricity generation (electricity generation under separate contract)	Yes	Yes
Compliance with stormwater management provisions for	Yes	Yes

Potential Liabilities	Contractor	City
stormwater (maintenance, treatment, remediation)		
Monitoring and annual reporting for the Landfill	Yes	Yes
Claims associated with off-site impacts from closed landfill areas	Yes	Yes

While the above noted allocation of short and longer term liabilities has been presented as a 'non-monetary' issue, in that it does not directly affect the majority of the financial assumptions for appraising the value of the Phase 5 expansion area, there is some effect as noted previously on the annual operating cost assumptions.

In order to ensure that a Private Sector contractor awarded a D/B/O contract for the Phase 5 expansion area is held appropriately accountable under contract to the City for these services, provisions were included for Private Sector costs required to maintain performance surety over the contract period. The annual value of the performance surety was assumed to be equivalent to the average annual City expenses to construct and operate the Landfill of $4.5 million over the 28-year operating period, at a cost of 1% of the total value of the performance bond. Essentially, the purpose of this performance surety would be to address the cost potentially incurred by the City in a given year, should the contractor not perform as required under the contract thus requiring the City to directly undertake the D/B/O activity in that year prior to a new contractor being retained.

While the table notes a split in responsibilities for the long-term, the City would be responsible for the costs incurred during the post-closure period for Phases 1-4 (the existing landfill) and the D/B/O contractor would be responsible for the costs incurred during the post-closure period for the Phase 5 landfill. The City already has money set-aside for 30 years of post-closure monitoring and maintenance of the landfill Phases1-4. City financing of the long-term post-closure costs for the landfill from reserves set aside for this purpose, is the more reasonable approach to address this long-term liability as:

- The City owns the landfill site and is ultimately responsible from an environmental liability standpoint.
- If the contractor were to be responsible for setting aside financial provisions to address long term liability (essentially post-closure and maintenance costs for the Phase 5 landfill area), this would affect the potential payment to the City for the airspace. Instead, the City could set aside an annual amount from the payment made to the City, hold and control these funds, and would benefit from interest earned. On an NPV basis, this would be of benefit to the City.
- Under this suggested model for allocation of long-term post-closure costs, a contractual mechanism should be put in place to hold the contractor accountable for any circumstances in the Phase 5 area where there are post-closure care issues that can be attributed to negligence on the part of the contractor. Consideration could be given to the contractor holding bonding, or providing a letter of credit for the first 10 years (or more) of the post-closure period to address any such issues that may arise.

9.2.5 Alternative Project Delivery

As an alternative to selling the Northampton Landfill, as discussed in subsection 9.3.1, the City could hire a private firm to complete the landfill expansion project under a D/B/O scenario. The scope of service could also include the capping and care of the closed sections of the landfill for the duration of the contract. Subject to prevailing procurement laws,[19] the City could issue a Request for Proposals (RFP) using the Design, Build, Operate (D/B/O) alternative procurement approach. For the purposes of this presentation, it is assumed that the landfill would be leased to a private firm.[20]

This transaction may involve multiple pricing variables including lease payments and possibly waste disposal services over an extended period of time. These pricing variables are not independent of each other, for example, higher lease payments would typically result in higher disposal fees. Because of the relationship between lease payments and fees, a critical initial decision for the City to make is whether it wants to just lease the landfill and let the private firm set disposal fees based on market conditions or include contractually defined disposal fees for City residences and/or businesses. If the City desires to both lease the landfill and procure solid waste disposal services, then an RFP process, rather than a traditional bid, may be more appropriate. An advantage of an RFP is that it can deal will multiple pricing variables and how they affect the life-cycle cost (or benefits) to the City over a long period of time, e.g., 20 to 30 years.

Typically an RFP for such a transaction will include the following sections:

I. Introduction
II. Landfill Description
III. Procurement Rules
IV. Qualification Requirements
V. Scope of Services
VI. Draft Lease or Lease Principles
VII. Instruction for Submitting Proposals
VIII. Technical Requirements

Proposals may be comprised of multiple volumes including executive summary, qualifications, technical proposal, business proposal, and price proposal. The City may wish to pre-qualify firms using a two-step process.

[20] The transaction could also be structured as a "management contract," as defined by the U.S. Internal Revenue Service. Given the fact that the City does not have control over the wastestream it is likely that the transaction will difficult to structure as a management contract whereby the capital costs for developing and closing the landfill will qualify for tax-exempt bond financing pursuant to IRS Revenue Procedure 97-13 that sets " forth conditions under which a management contract does not result in private business use under § 141(b) of the Internal Revenue Code of 1986. This revenue procedure also applies to determinations of whether a management contract causes the test in § 145(a)(2)(B) of the 1986 Code to be met for qualified 501(c)(3) bonds." The City would need to consult a tax attorney to determine if a transaction can be reasonably structured as a management contract.

Table 9-4 below lists some of the issues that should be considered when developing the RFP, including the scope of work and lease term. They are presented in annotated outline form. The issues discussed are not meant to be exhaustive, but rather to illustrate the types and complexity of the issues that need to be addressed. The annotations are provided to facilitate further discussion and do not reflect any suggested course of action or recommendations.

Table 9-4
Issues to Consider for the Landfill Alternative Project Delivery RFP

Terms and Conditions	Example Options
Length of the lease	
Initial term	1. Specified Term; 2. Indeterminate, ends when capacity of expansion is full; 3. Indeterminate – may allow Company to expand capacity and lease until the certain specified conditions are satisfied.
Renewal term	1. City option; 2. Company option; 3. By mutual agreement; 4. None.
Landfill Development Requirements and Options	
Allowable Expansions	1. Current/Proposed plan only; 2. Allow vertical expansion; 3. Allow horizontal expansion.
Allowable Annual and Daily Tonnage Limits	1. Based on current permit and experience, i.e., maximum of 50,000 tpy; 2. Give Company right to increase permit limits up to defined maximum; 3. Give Company the right to increase permits limits without defining any maximum.
Financing	1. Company using taxable debt and equity; 2. Company with option to use tax-exempt private activity bonds; 3. City.
Closure and Post-Closure Monitoring	

Terms and Conditions	Example Options
Post-Closure Monitoring of Existing Closed Cells	1. Company responsibility during lease term – City responsibility after lease terminates; 2. City responsibility – may pay Company as a separate fee.
Capping New Cells	1. Company responsibility for all cells closed during the lease term; 2. Company responsible for closing last cell prior to the end of the lease term (this option may depends on how lease term is determined); 3. Company contributes to closure fund that City will use after the end of the lease term to pay for closing of any active cells when the lease is terminated
Post-Closure Monitoring of New Cells	1. Company pay cost during the lease term; 2. Company contributes to a post-closure monitoring fund that the City can use after the end of the lease for any active cells when the lease is terminated.
Extended Obligations	1. City may seek Company indemnity for any latent problems caused by the Companies misuse of the landfill
If Lease Includes Disposal Service - City Waste Delivery and Company Acceptance Obligations	
Obligation of City to Deliver Waste	1. "Put-or-Pay" of minimum quantity (may be applicable if City implements Citywide collection program); 2. Obligation to deliver all waste from the Drop-off sites – no minimum; 3. None

Terms and Conditions	Example Options
Obligations of Company to Accept Waste	1. Company must accept all waste delivered from the drop-off sites for an agreed-to price; 2. Company must accept all waste collected within the City, without any limits, for an agreed-to price; 3. Same as 1 & 2 above, but with maximum tonnage limits (may be difficult to implement); 4. Company provides first right of use of the landfill capacity for City and haulers collecting waste in the City for Company determined market price; 5. Company given right to sell capacity to anyone at market rates.
Operation of the Glendale Drop-Off Site	
Obligation of City to Deliver Waste	1. Company must offer similar or enhanced service to City residents; 2. City continues to provide services; 3. The drop-off site is closed.
If Company Provided Service - Cost & Revenue Sharing	1. Company provides the service free of charge and retains all revenues; 2. Company is paid a fee for this additional service and revenues for recovered materials shared between the City and Company.
Landfill Gas Recovery	
Interface with Current Operation	1. Lease needs to address rights and obligations of the City related to current landfill gas recovery operation
Landfill Gas Revenues	1. City retains its share of revenues; 2. Company gets City's share of revenues.
Other Performance Obligations	
Hours of Operation Rights	1. City limits hours of operation to specified times in the lease; 2. Subject only to permit limits

Terms and Conditions	Example Options
City Priority	1. City get priority on the use of the landfill capacity
Environmental Performance	1. Company will be obligated to comply with all applicable laws and regulations, including all permit conditions; 2. Does City want to set more stringent standards; 3. May want special language for nuisances (odor, debris, housekeeping, vectors)
Special Wastes	1. Company not allowed to accept special waste even if permitted to do so; 2. Company is allowed to accept specified special wastes, subject to City approval
Responsibility for Inadvertently Deliver of Unacceptable Waste (including Hazardous Waste)	1. If inadvertently delivered by the City, then (a) it can be rejected by the Company; (b) if dumped, then option for (i) City to remove and dispose, or (ii) Company to remove and dispose at City expense; 2. Company obligation to properly manage and dispose of any Unacceptable Waste inadvertently delivered by others.
Pricing	

Terms and Conditions	Example Options
Tipping Fees	1. For a put-or-pay commitment, the City will pay the agreed-to tip fee ($/ton) plus any tipping fee shortfall if it fails to meet minimum commitment (most likely only relevant if City implements a citywide curbside collection program; 2. If no put-or-pay then the City will only pay agreed-to tip fee for all the waste delivered; 3. Company will have to bid and/or contract for waste, including waste collected in the City – City and haulers will pay market prices
Escalation Provisions	1. Based on agreed to index, e.g., 100% increase in CPI; 2. Based on agreed-to $/ton annual increase (applicable for shorter-term agreements) 3. Remains fixed until next bid (applicable for shorter term agreements)
Pass Through Costs and Taxes or Other Price Adjustments	1. None 2. May include changes in energy costs, insurance, taxes, or other negotiated expenses. Benefit of including some passthoughs or adjustments is that they usually exclude profit and reduce the initial tipping fee.
Uncontrollable Circumstance risk sharing	

Terms and Conditions	Example Options
General Principal	1. Not necessary for short term disposal contracts; 2. Typically required for long-term disposal contract (i.e., greater than 5 years) 3. Affected party relieved of performance; 4. May be reason for price adjustments 5. It is possible that a UCC event may decrease costs; 6. Other than Changes-in-Law, most UCC risks are insurable.
Definition	1. Generally defined as events beyond the reasonable control of the party; 2. Definition may include specific inclusions and exclusions; 3. Usually highly negotiated; 4. An event must materially and adversely affect the party; 5. Includes Change-in-Law and Act of God.
Special termination rights	Under extreme UCC conditions either party may terminate the lease and/or service.
Lease Payments	
Fixed Lease Payments	1. Upfront lump sum payment; 2. Annual lease payment – may include annual adjustment based on changes in an agreed-to index 3. These lease payment are not a function of tonnage 4. The fixed lease payments may be an unconditional obligation of the Company

Terms and Conditions	Example Options
Variable Lease Payments	1. All or a portion of the lease payment may be based on the tonnage disposed of at the landfill; 2. May be adjusted annually based changes in an agreed-to index
Use of Facility by Others	
Favored Nations provisions	1. As the host community and landlord, tip fee charges to the City and local haulers will always be the lowest charged any customer 2. An exception may be made for spot waste
Restrict Use of Landfill by Others	1. May want to restrict use to waste generated in a defined region; 2. For City waste, may want to restrict use to specific haulers that collect waste in the City and are approved by the City (this may be needed if collection within the City is franchised);
Capital Improvements	
Major Capital Investments	1. Company is responsible – subject to City approval 2. Company has unfettered right to modify and expand the landfill provided it obtains the appropriate legal approvals and pays for the improvements
Required by a UCC	1. Costs, net of insurance proceeds, are shared on a pro rata basis: (a) based on capacity and/or (b) based on actual tonnage; 2. The amount of deductibles and who pays them is an issue - see Required Insurance.
Security of performance	

Terms and Conditions	Example Options
Required insurance	1. Need to negotiate type of insurance, amount, and deductibles; 2. Company may have corporate policies; 3. Company should cover costs to the extent it fails to buy the Required Insurance or self-insures; 4. Company may seek some relief for excessive insurance premiums; 5. As owner, Company may ask City to buy some insurance.
Performance bonds	1. Often preferred by private firms; 2. May not the best option for the City – may not cover environmental liabilities.
Parent company guaranty	1. Parents often set up project companies to execute leases and provide services; 2. Other than the Lease, a project company may have no other assets; 3. A project company assets can be moved easily; 4. City should consider seeking ultimate parent company guaranty.
Financial Strength of Guarantor	1. The failure to properly operate and maintain the landfill can be costly to the City without a strong corporate guarantee to cover these costs; 2. The reliability of the lease payments will depend on the financial strength of the Guarantor;
Limits of liability	
Dollar limit	1. Needs to be sufficient to be meaningful; 2. Company may need a dollar limit for accounting reasons; 3. City may try to get lease that does not include a stated limit of liability.

Terms and Conditions	Example Options
Excluded items	1. Limit of liability should be for damages (actual or liquidated); 2. Exclude operating losses, any third party payments (e.g., resulting from indemnities situations)
Termination rights and obligations	
Special termination	1. There may be circumstance were either party may want to terminate the lease prior to it full term; 2. Impacts of UCC such as a total loss
Default terminations	1. Brightline termination for specified event such as bankruptcy; 2. Uncured breaches.
Dispute resolution	
Arbitration	1. Often preferred by private firms
Non-binding Mediation	1. Useful for smaller (say less than $25,000) disputes; 2. Sometimes used for technical disputes
Litigation	1. Often preferred by communities

10.0 Section 10 – Summary

10.1 SUMMARY

The following presents a summary of the findings and resulting conclusions from the Northampton Solid Waste Management Alternatives Study:

Introduction

- The Northampton Sanitary Landfill is nearing its permitted capacity and is scheduled to close in June 2011.

- The Northampton Landfill serves the solid waste disposal needs of the City, its Departments, Northampton residents, local businesses and institutions, as well as accepts MSW collected from sixteen municipalities that have signed MOUs with Northampton.

- In 2008, approximately 49,400 tons of MSW was disposed at the Northampton Landfill from all sources of which 3,925 tons (7.9%) was local municipal waste from the two drop-off centers and City departments.

Waste Generation and Composition

- It is estimated that MSW generated within Northampton and requiring disposal (post-recycling and waste ban diversion) is about 14,800 tons per year.

- Based on the Eastern Hampshire Regional Refuse District Waste Stream Composition Study, the composition of the Northampton waste shed MSW is about 74 percent organics (paper, yard wastes, food waste and other organics) and 26 percent non-organic materials that are recyclable or require disposal.

Zero Waste Planning – Materials Diversion

- "Zero Waste" policies and programs are gaining increasing support from manufacturers, consumers, businesses and municipalities as a means of reducing the amount of waste generated at the source and diverting waste from the landfill through increased reuse and recycling. Zero waste should be thought of as a goal, the realization of which will depend on technical, economic and political considerations.

- Comprehensive zero waste plans have been implemented in major waste sheds such as the City of Los Angeles where over 80 separate initiatives in product creation, produce use and product disposal have been developed. Although many of the zero waste initiatives the Los Angeles plan may not be suitable to a smaller community like Northampton, there are upstream elements that focus on product stewardship,

manufacturer responsibility, "green" design, and product bans as well as downstream elements that focus on things within the City's direct control, like purchasing practices, recycling, composting and disposal activities, mandatory diversion, and technical assistance and education that could be implemented locally.

- Resource Recovery Parks are designed to accept all market categories of materials from the public and encourage diversion of materials from disposal by co-locating recycling, reuse and composting capabilities with the disposal facility. The Northampton Landfill Drop-off and Recycling Center is essentially a resource recovery park with its wide range of materials it accepts for recycling and reuse.

- There are opportunities for developing and implementing a Source Separated Organics (SSO) program for food wastes and other organics within Northampton. The DEP Solid Waste Master Plan: 2006 Plan Revision identified food waste and organics as an important part of their waste reduction strategy.

- The quantities of SSO being generated in Northampton are on the order of about 4.8 tons per day from residential sources and in the range of 8.6 to 9.7 tons per day from commercial/institutional sources.

- Several SSO technology options were assessed by the study for potential use in Northampton including:

    - Aerated Static Pile Composting
    - Aerated Windrow Composting
    - In-Vessel Composting
    - Small Scale Anaerobic Digestion

- Composting of source separated organics (open or in-vessel) is a viable means of managing SSO, however, there are inherent limitations which may include large land area requirements, control of odors, ability to operate in very cold climates, variable quality of finished compost product depending upon contaminants present.

- Small scale anaerobic digestion of source separated organics is an emerging technology that is receiving favorable attention from the regulatory and agricultural communities as a means of effectively and efficiently managing SSO while providing a valuable source of renewable energy.

- Potential sources of SSO for small scale anaerobic digestion include food waste from supermarkets, restaurants, and large institutions as well as source separated residential organics.

- The MA DEP is considering a ban on commercial food waste disposal in landfills which would be a significant driver for development of SSO collection and composting facilities by the private sector and diversion of organics from landfilling.

- In the event the food waste ban is not implemented, the City has other options for SSO including working with local farms expressing an interest in SSO composting, developing a City owned SSO composting operation, or issuing an RFP for a private company to develop a local facility.

- "Pay as you throw" (PAYT) as currently practiced in Northampton for solid waste disposal serves as a financial disincentive to use of the landfill and an incentive to reduce waste and increasing recycling. The Northampton PAYT program requires residents to purchase an annual permit for use of one of the 2 drop-off centers and to buy stickers to be placed on bags for disposal. If Citywide curbside collection is implemented in Northampton, the City has the option of staying with the sticker approach for PAYT or changing to a "bag system" where residents purchase standard specified size bags at various locations throughout the City for placement of MSW to be disposed.

Innovative, Emerging and Other Conversion Technology Options

- The trend toward diverting wastes from landfills and finding methods for recovering renewable energy has led to development of several innovative, emerging and other MSW conversion technologies. The Mass DEP has indicated an interest in innovative and emerging technologies and has implemented several initiatives directed at increasing the role of alternative technologies such as gasification, pyrolysis and anaerobic digestion. A study entitled "Assessment of Materials Management Options for the Massachusetts Solid Waste Master Plan Review" commissioned by the DEP and released in December 2008 concluded that "….After maximizing diversion through source reduction, recycling and composting, it is appropriate for DEP to continue to monitor developments regarding alternative waste management technologies that produce energy – gasification, pyrolysis, and anaerobic digestion."

- This study reviewed seven (7) innovative and emerging technologies for solid waste conversion that could be applicable to Northampton including:

    - Anaerobic digestion
    - Autoclaving
    - Gasification
    - Plasma arc gasification
    - Pyrolysis

- Hydrolysis
- In-vessel mixed waste composting

- It was concluded that only two (2) of the 7 innovative and emerging technologies, including anaerobic digestion and in-vessel composting, have sufficient operating experience and track record of reliability at a commercial scale to be considered further for Northampton. The other technologies have insufficient operating experience, factual performance, reliability records, emissions data or cost information to be proven viable on a long-term commercial operating scale for use in converting MSW.

- Biological treatment of the organic fraction of the waste stream (anaerobic digestion or in-vessel composting) can create a potential source of energy and a soil amendment by-product that can be an effective component of a multi-faceted integrated waste management program for Northampton. However, numerous barriers to successfully implementing such a program must be overcome.

- At this point, the ability of these emerging technologies to provide a long term commercially viable treatment and disposal option for the City is not proven. In addition to the fact that a) the likely net cost of an emerging or other conversion technology will be above $65/ton, and b) the minimum amount of waste necessary for a successful project would likely exceed the tonnage currently controlled by the City, there remains technical risk. It is unlikely that Northampton would be able to develop on its own a successful conversion technology project. Rather it is likely that such a project would have to serve the region and the City would have to enact some form of “flow control” regulations; franchise collection services; or provide economic subsidies to ensure sufficient tonnage of MSW is available.

Waste Collection and Hauling

- The residents of Northampton have the choice of two (2) waste collection services: self haul to one of the City’s 2 drop-off centers or contract with a local hauler for subscription curbside collection. For a typical family of 4, the total annual cost for the drop-off option is around $130/year (including vehicle permit and bag sticker costs). In comparison, the total annual cost for a family of 4 using subscription curbside collection with weekly pickup is around $400/year.

- Going forward, the City has three (3) options of collection of residential MSW:
  - Continue with the current hybrid system of the drop-off centers and subscription service
  - Close the drop-off centers and require residents to directly contract with a private hauler

  - Institute a Citywide curbside collection program for residential users funded through some type of user fee.

- Nineteen of the 69 communities in the Franklin, Hamden and Hampshire Counties provide citywide curbside collection services for dwellings with 1 to 4 family units. Curbside pick includes both trash and recyclables. Some programs include seasonal yard waste pickup and periodic bulk waste collection.

- Implementing citywide curbside collection would generally result in residents currently making use of the drop-off centers paying more while those who have curbside subscription service paying less.

- Recycling participation rates would be expected to increase with Citywide curbside collection due to the added convenience of not having to haul recyclables to the drop-off center.

Alternative Haul, Transport and Disposal Options

- If the Northampton Landfill were to close instead of being expanded, MSW generated in the City would need to be disposed at another facility outside Northampton. A review was made of disposal capacities and remaining permitted lives for existing landfills, transfer stations and waste-to-energy facilities in the region which represent the most likely options available to haulers collecting MSW in Northampton. Potential landfills with capacity beyond 2010 that could accept waste from Northampton include landfills in South Hadley (in the process of permitting vertical and horizontal expansions), Granby, Chicopee and Westminster. The Covanta waste-to-energy facility in Agawam would require expansion to meet Northampton's disposal needs which is constrained by the state's current moratorium on new waste-to-energy capacity. In addition to local disposal, there are five transfer stations in the area (active and inactive) that provide potential options for long haul transporting to out-of-state facilities.

- The one-way direct haul distance from Northampton to one of the local alternate disposal facilities (excluding the Westminster Landfill) is less than 30 miles in all cases. The estimated packer truck costs for a 30 mile one way haul for range from $3.77 per ton to $11.11 per ton, depending upon if dumping occurs during the normal shift time or is during overtime.

- Based on a review of tipping fees for several local disposal facilities and factoring in hauling costs, the expected current market price for out of town disposal ranges from $75 - $100/ton. Disposal at an out-of-state facility via transfer could add $20 - $30/ton to the local disposal cost.

Phase 5 Landfill Expansion Sensitivity Analysis

- The Phase 5 Landfill Expansion would be developed in a series of 5 cells and would provide disposal capacity of around 1.41 million tons which equates to approximately 28 years of life at the current permitted limit of 50,000 tpy.

- Financing of the construction, operation, maintenance, closure and post-closure maintenance of the Phase 5 Landfill Expansion would be managed through a self-supporting Enterprise Fund, as is currently the case for the existing landfill.

- Cost factors include:

    - Site infrastructure, roads, scale, stormwater and related facilities
    - Liner Construction
    - Leachate and Landfill Gas Systems Construction
    - Permitting and Engineering
    - Construction Management and Quality Control
    - Operations and Maintenance
    - Closure and Capping
    - Post-closure Maintenance

- Revenue factors include:

    - Waste Disposal Tip Fees
    - Alternative Daily Cover Revenue
    - Gas Sales to Landfill Gas to Energy Facility
    - Closure Fund Interest Income
    - Cell Tower Lease Payments

- The assumed tip fee for the first year of operation of the Phase 5 Landfill was $75.00/ton. In comparison, the current tip fee at the Northampton Landfill is $72.50/ton. Historically, the Northampton Landfill tip fee has escalated at an average of around 2.0 percent per year. For purposes of being conservative on projecting revenues for the Phase 5 Landfill Expansion, tip fees in the Landfill Sensitivity Analysis were escalated at 1.5 percent per year.

- The pro forma analysis of the Phase 5 Landfill Expansion operating at a capacity of 50,000 tpy shows a positive cash flow for the entire 28 year life of the landfill, including

prior year free cash carryover amounts. The cumulative net present value (NPV) of the annual cash flow for the 50,000 tpy scenario is over $6.3 million of revenue with a tip fee escalation rate of 1.5% and over $19.8 million with a tip fee escalation rate of 3.0%. In comparison for the same 28-year period of time, the cumulative NPV for the 40,000 tpy case is around a deficit of -$3.0 million with a 1.5% tip fee escalation rate and a net revenue of around $7.8 million with a 3.0% tip fee escalation rate. Through interpolation, the breakeven tonnage would be around 43,000 tpy with a 1.5% tip fee escalation rate and 33,000 tpy with a 3.0% tip fee escalation rate.

- As the break even analyses shows, the City generates far less waste than the 33,000 tpy to 43,000 tpy required to operate under the break-even scenario, meaning that a City-only landfill facility is not financially feasible.

- The financial viability for expanding the landfill relies primarily on the revenue from the quantity of waste disposal and associated tip fees. The City does not have control over the flow of waste coming to the site and instead relies upon having a competitive tip fee to maintain an adequate incoming waste stream.

- This reliance on market forces presents a potential risk to tip fee revenue. If it is found that the tip fee charged at the landfill is not competitive at some point in the future, commercial waste haulers may chose to use another disposal facility. This could leave the City with debt service costs and inadequate revenue to cover those costs. A similar problem could occur if one or more of the larger commercial waste haulers decided to rely on another disposal facility.

- The other revenue related issue is determining the appropriate tip fee escalator for the financial model. Disposal contracts are needed to systematically apply a Consumer Price Index (CPI) increase to the tip fee.

- In order to implement a CPI increase on tip fees, the City could make major users of the landfill sign disposal agreements. Rather than having municipalities sign a memorandum of understanding (MOU) as is the current practice, the City could require that a formal contract be agreed to that sets the tip fee and an escalator.

- A different approach to landfill facility development would be to implement a solid waste district. One benefit of forming a solid waste district is that flow control could be instituted in the District communities that would require all residential waste (and possibly commercial waste) be delivered to the Phase 5 landfill. By controlling waste flows the District would also control the revenue needed to finance the landfill expansion. The main difficulty with this approach is that attempts to form solid waste districts in Massachusetts have been met with limited success, particularly when the District plans to finance and own large capital facilities.

Assessment of Solid Waste Alternatives

- To assist the City in its decision concerning the landfill expansion, five solid waste management alternatives were assessed including:
    - Option 1 – Current collection system and expansion of the landfill
    - Option 2 – Current collection system and close the landfill and adjacent drop-off center
    - Option 3 – Institute citywide curbside collection and expand the landfill
    - Option 4 – Institute citywide curbside collection and close the landfill and adjacent drop-off center
    - Option 5 – Provide no solid waste management services and close the landfill and both drop-off sites
- Closing the Northampton Landfill could result in an approximately $28 to $39 million life cycle cost increase to service recipients and taxpayers of Northampton (comparing Option 1 to Option 2)
- Implementing a curbside collection program could reduce costs by approximately $4.3 million (comparing Option 1 to Option 3)
- The current Department of Public Works solid waste management program has an approximate $61 to $72 million life cycle benefit to the service recipients and taxpayers of Northampton, depending upon the assumed tip fee escalation rate (comparing Option 1 to Option 5)
- Option 2, instituting curbside collection and expanding the landfill, is the least expensive alternative for solid waste management from an overall financial perspective of the City and residents. The second least expensive alternative is staying with the current collection system mode and expanding the landfill (Option 1)
- Each of the 5 solid waste management alternatives has potential monetary and non-monetary advantages and disadvantages as summarized in Table 8-2, that should be taken into consideration in the decision making process
- The estimated financial impact to the commercial establishments in Northampton with the closure of the landfill is an increase in their waste haul and disposal costs from between $20 to $30 per ton over current rates. Based on the estimated annual solid waste generation of around 13,300 tons per year from commercial establishments in Northampton, the cost of disposal will increase by approximately $270,000 to $400,000 per year.

Appraisal Value of Phase 5 Landfill

- As an option to the City developing and operating the Phase 5 Landfill Expansion, Northampton could solicit proposals from private waste management companies to purchase the rights to the volume that would become available if the expansion is permitted, also known as the landfill "Air Rights".

- The potential market value of the Phase 5 expansion area that could be paid to the City is based on:

    - The per ton Market Price considering local, regional and long haul competition, less the Net Present Value per ton for all Private Sector costs associated with the design/build and operation as well as closure of the Phase 5 area, which would equal the potential profit margin per ton over the planning period

    - The potential value paid to the City for the Phase 5 airspace under a contract with the Private Sector would be based on a portion of that profit margin, reflecting both reasonable rate of return for both parties, allocation of long-term liability and the City's own costs associated with the portion of the Site for which it would retain responsibility over the contract period

- The estimated net present value (NPV) to Northampton (after deducting City borne landfill related costs) of the air rights sale to a private waste management company for the 28 year operational life of the Phase 5 Landfill at 50,000 tpy and a starting tip fee of $75/ton in 2012 is $7.6 million or approximately $272,000 per year (2009$)

- The current average posted tip fee (2009$) for facilities in reasonable proximity to Northampton (South Hadley, Westminster, Agawam) is over $91/ton, ranging from $77 to $120/ton. The estimated effective average tip fee for local facilities, considering negotiated reduced rates for under hauler agreements, is believed to be consistent with the current Northampton Landfill tip fee of $72.50/ton and supports the use of $75/ton in the appraisal of the landfill sale value.

- In conjunction with the sale of the landfill air rights, there are several non-monetary issues that need to be considered before a decision to proceed is made such as:

    - Liability and risk allocation between the City and private developer

    - Environmental quality characteristics of the existing Landfill and the Phase 5 Landfill Expansion

    - Loss of City staff positions

    - Oversight of activities at the site associated with privatizing

- Liability and risk allocation would need to be addressed under a design/build/operate (D/B/O) contract with a private entity.