8.1 Overview

Zero waste is a comprehensive approach to waste management with the ultimate goal of eliminating all types of waste including solid and hazardous waste and any emissions to the air, soil and water. It is a management philosophy applicable to the next generation of solid waste management systems. It includes "recycling," but goes beyond recycling by taking a "whole system" approach to the vast flow of resources and waste through human society. The philosophy behind the zero waste movement is that all wastes generated are potential residual resources.

Nationwide, waste generation per person continues to increase each year, making it difficult to increase diversion rates. Recycling alone will not increase diversion significantly. As a result, the concept of zero waste is gaining in popularity in an attempt to maximize recycling, minimize waste generation, reduce consumption, and ensure that products are made to be reused, repaired, or recycled back into nature or the marketplace.[1]

Zero waste is just one part of a growing environmental movement that also includes product stewardship, sustainability and green building, as described below.

8.1.1 Product Stewardship

Product stewardship is a product-centered approach to environmental protection. It calls on everyone involved in the product life cycle – manufacturers, retailers and consumers – to share responsibility for reducing the environmental impact of products at the end of their useful life. Manufacturers are encouraged to design products that require less harmful materials and that are made from recycled material. In addition, manufacturers are asked to design products that are more durable and that can be reused and recycled. Retailers and consumers are asked to take an active role in the proper disposal or recycling of the products.

8.1.2 Sustainability

Sustainability provides for current needs without sacrificing the needs of future generations. Sustainable practices require that we evaluate how today's decisions will affect the environment, economy and society in the future. Sustainability acknowledges that everything depends on healthy functioning societies, economies

[1] Source: GrassRoots Recycling Network.

and ecosystems. Some key sustainability principles include reducing our reliance on non-renewable energy sources and limited raw materials as well as reducing waste, reusing materials and goods, and recycling.

8.1.3 Green Building

Green or sustainable building is the practice of creating healthier and more resource-efficient models of building construction, renovation, operation, maintenance and demolition. Research and experience demonstrate that when buildings are designed and operated with their life cycle impacts in mind, they can provide environmental, economic and social benefits. Elements of green building include: energy efficiency and renewable energy; water stewardship; environmentally preferred building materials and specifications; waste reduction; indoor environment; and smart growth and sustainable development.

One of the more recognizable organizations promoting green building is the U.S. Green Building Council (USGBC) with its Leadership in Energy and Environmental Design (LEED) program. LEED is a certification system that measures how well a building performs related to energy savings, water efficiency, carbon dioxide emissions reduction, indoor environmental quality and stewardship of resources.[2]

Other green building organizations include Green Globes, BRE Environmental Assessment Method (BREEAM), and the World Green Building Council. Links to these organizations are provided in Section 8.13 of this paper.

Another effort in the environmental movement not described here is environmentally preferable purchasing (EPP), a topic on which R. W. Beck provided detailed information to Broome County (County) in Issue Paper #1 – EPP and Recycled-Content Procurement Policies.

8.2 Life Cycle Analysis

Zero waste strategies consider the entire life-cycle of products, processes and systems in the context of a comprehensive systems understanding of our interactions with nature and search for inefficiencies at all stages. With this understanding, wastes can be prevented through designs based on full life-cycle thinking.[3]

Life cycle analysis or assessment (LCA) as applied to municipal solid waste (MSW) management systems is a technique for assessing the environmental inputs and outputs associated with production, use and end-of-life management for products. Household, business and institutional consumption of products results in discards of unused or consumed materials. These discards, including construction and demolition (C&D) debris, compose the MSW stream.

The diagram in Figure 8-1 portrays basic environmental flows in terms of energy and material inputs and energy and pollution outputs (to air, water and land). The typical

[2] Source: USGBC website. http://www.usgbc.org/Default.aspx
[3] Source: Zero Waste Alliance.

product's life cycle involves extracting raw materials from nature's ecosystems, refining those virgin resources into industrial feedstocks, manufacturing the product from these feedstock, using the product, discarding the product at the end of its useful life, and/or disposing of the product discards by reuse, recycling, recovery or disposal.

The resource extraction, refining and product manufacturing phases together are often termed the "upstream phase" of the product life cycle. The feedback loops in the diagram indicate how reuse and recycling short circuit the upstream phase, thereby conserving energy and reducing releases of waste and pollutants in the production of goods and services. Most of the environmental value for recycling and composting comes from pollution reductions in the manufacture of new products made possible by the replacement of virgin raw materials with recycled materials and the replacement of synthetic petroleum-based fertilizers with compost, typically measured in reduction of greenhouse gas emissions.

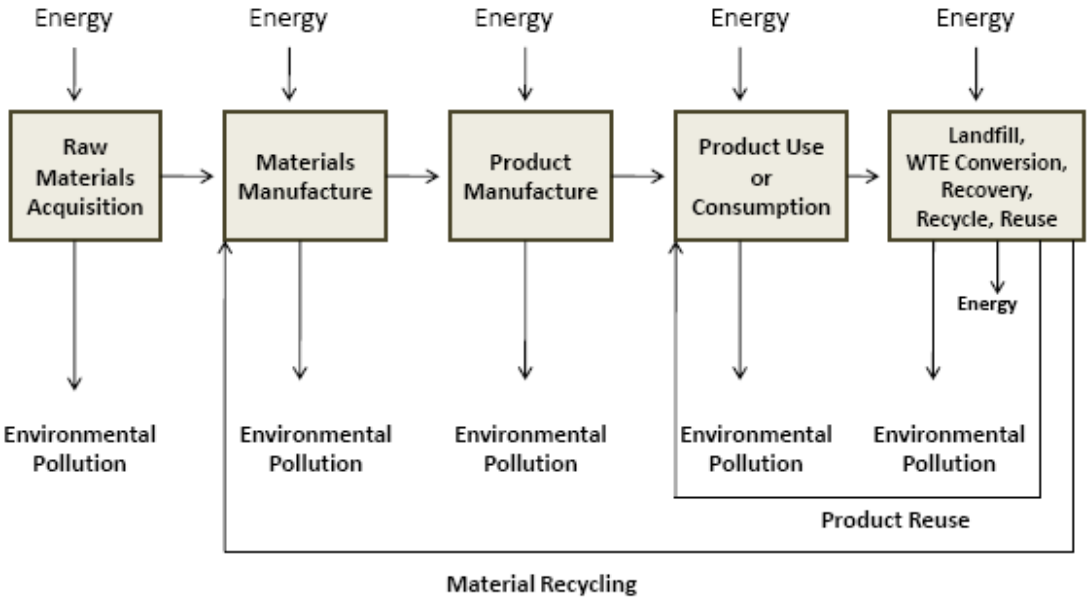

Figure 8-1. Schematic Depiction of the Phases in a Product's Life Cycle

To estimate environmental emissions of waste management methods, a number of environmental life cycle inventory and assessment models have been created. They include, but are not limited to:

- U.S. Environmental Protection Agency's (EPA) waste reduction model (WARM) life cycle inventory spreadsheet calculator for greenhouse gas (GHG) emissions;[4]
- EPA's MSW Decision Support Tool and database;[5]

[4] Source: EPA. http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html
[5] Source: EPA and Research Triangle Institute.
http://www.epa.gov/ord/NRMRL/scienceforum/thorneloe_s.htm

- Carnegie Mellon University Green Design Institute's Economic Input-Output Life Cycle Assessment model;[6]
- National Institute of Standards and Technology's BEES model;[7] and
- EPA's TRACI model.[8]

The models enable the user to express the quantity of pollutant releases in terms of a single indicator quantity for other categories of environmental damage. Each category encompasses a particular type of potential environmental impact. The impact categories used in an LCA may include, among others:

- Global warming
- Acidification
- Eutrophication
- Human health impacts (for example, air pollutants, cancer and non-cancer illness)
- Ecosystem toxicity
- Ozone depletion
- Smog formation
- Habitat alteration
- Resource depletion
- Water consumption

If the County were to implement a zero waste plan, one of the first tasks would be to determine the environmental impacts of the County's current solid waste system using a life cycle assessment model. This baseline could then be used as a comparison in the future to determine the effects of zero waste activities.

One of the easier models to use is the U.S. EPA's WARM model. The WARM model is designed to estimate GHG emission reductions from several different waste management practices. The model is based on unique assumptions tailored for 34 different material types. Inputs to the model include the scenarios to be compared (e.g., the amount of each material type and the method used to manage it including recycling, landfilling, composting or combustion), the average shipping distance of recyclable materials to market, and whether or not the landfill has a landfill gas collection and control system.

To determine the "tons landfilled" for each material type to be input into the model, the County could either conduct a waste characterization of the Broome County Landfill or, as an alternative, estimate the tons of each material type landfilled by

http://www.rti.org/page.cfm?objectid=D73EE9A3-C4B1-4E28-B47E8764292D2EF4

[6] Source: Carnegie Mellon University. http://www.eiolca.net

[7] Source: Building and Fire Research Laboratory. http://www.bfrl.nist.gov/oae/software/bees/model.html

[8] Source: EPA. http://www.epa.gov/nrmrl/std/sab/traci/

applying waste characterization study results from another community to the Landfill's annual tonnage.

As part of the County's Local Solid Waste Management Plan update, R. W. Beck assessed the County's waste stream for future diversion potential. R. W. Beck identified recent waste characterization studies completed for communities with demographics and solid waste management systems similar to those of Broome County. Together, the County and R. W. Beck selected the 2005 composition results for Cedar Rapids/Linn County, Iowa from the Iowa Statewide Waste Characterization Study as an appropriate comparison. Table 8-1 lists the estimated quantities of material in Broome County's MSW that were calculated by applying the County's 2007 MSW landfill tonnage (148,904 tons)[9] to the composition results from the Cedar Rapids/Linn County waste characterization. These estimates, along with additional Landfill tonnage data for materials other than MSW, could then be input into the WARM or other life cycle assessment model to estimate environmental emissions of the County's solid waste management methods.

Table 8-1
Cedar Rapids/Linn County, Iowa MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Paper	Compostable Paper	7.10%	10,541.23
Paper	High Grade Office	1.60%	2,372.95
Paper	Magazines	1.00%	1,506.76
Paper	Mixed Recyclable Paper	5.30%	7,904.36
Paper	Newsprint	2.40%	3,545.83
Paper	Non-Recyclable Paper	4.30%	6,432.42
Paper	OCC and Kraft Bags	3.50%	5,154.69
Total Paper		25.20%	37,458.25

[9] Source: Landfill Tonnage by Material from "Broome County Executive Summary, Division of Solid Waste Management, As of December 31, 2007 – Final." The tons include General MSW plus Municipal MSW from Cleanup Events.

Table 8-1
Cedar Rapids/Linn County, Iowa MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Plastics	# 1 PET Deposit Beverage Containers	0.30%	400.12
Plastics	# 1 PET Beverage Containers	0.50%	701.58
Plastics	# 2 HDPE Containers	0.90%	1,324.20
Plastics	Film/Wrap/Bags	6.30%	9,348.47
Plastics	Other # 1 PET Containers	0.20%	331.23
Plastics	Other Plastic Containers	0.40%	649.61
Plastics	Other Plastic Products	6.50%	9,642.45
Total Plastics		15.00%	22,397.67
Metals	Aluminum Beverage Containers	0.10%	112.54
Metals	Aluminum Deposit Beverage Containers	0.10%	202.13
Metals	Ferrous Food and Beverage Containers	1.70%	2,570.05
Metals	Other Aluminum Containers	0.10%	120.04
Metals	Other Ferrous Metals	3.50%	5,271.84
Metals	Other Non-Ferrous Scrap	0.50%	688.41
Total Metals		6.00%	8,965.00
Glass	Blue Glass	0.00%	71.18
Glass	Brown Glass	0.00%	57.32
Glass	Clear Glass	0.80%	1,201.60
Glass	Glass Deposit Containers	0.30%	426.87
Glass	Green Glass	0.10%	174.48
Glass	Other Mixed Cullet	1.00%	1,531.48
Total Glass		2.30%	3,462.94
Yard Waste	Pumpkins	0.70%	1,088.10
Yard Waste	Yard Waste	0.90%	1,290.44
Total Yard Waste		1.60%	2,378.54
Total Food Waste		12.40%	18,477.15

Table 8-1
Cedar Rapids/Linn County, Iowa MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Wood	Non-Treated	4.20%	6,267.79
Wood	Treated	6.10%	9,085.01
Total Wood		10.30%	15,352.79
Total Demolition / Renovation / Construction Debris		8.90%	13,184.54
Durables	Cell phones and Chargers	0.00%	14.13
Durables	Central Processing Units/Peripherals	0.20%	236.4
Durables	Computer Monitors/TV'S	0.20%	294.99
Durables	Electrical and Household Appliances	1.10%	1,615.07
Durables	Other Durables	2.80%	4,188.96
Total Durables		4.30%	6,349.55
Total Textiles And Leathers		3.30%	4,884.38
Total Diapers		2.50%	3,773.16
Total Rubber		0.20%	330.18
HHW	Automotive Products	0.00%	23.88
HHW	Household Cleaners	0.00%	30.03
HHW	Lead Acid Batteries	0.00%	-
HHW	Mercury Containing Products	0.00%	5.25
HHW	Other Batteries	0.30%	465.23
HHW	Other HHW	0.20%	262.79
HHW	Paints and Solvent	0.00%	27.91
HHW	Pesticides, Herbicides, Fungicides	0.00%	-
Total HHW		0.50%	815.09
Total Sharps		0.00%	5.93
Total Other Organic		1.20%	1,786.88
Total Other Inorganic		2.80%	4,137.14
Total Fines/Super Mix		2.10%	3,121.05
Total Other		1.40%	2,023.77
		100.00%	148,904

The per-ton estimates of GHG emissions for various solid waste management methods, per the WARM model, are shown in Table 8-2. The materials which provide the greatest benefit when recycled (per ton) include aluminum cans, copper wire, and carpet. GHG emissions are reported as metric tons of carbon equivalent (MTCE). A negative value indicates an emission reduction; a positive value indicates an emission increase.

Table 8-2
Per-Ton Estimates of GHG Emissions for Alternative Management Scenarios

Material	Source Reduced (MTCE)	Recycled (MTCE)	Landfilled (MTCE)	Combusted (MTCE)	Composted (MTCE)
Aluminum Cans	(2.26)	(3.73)	0.01	0.02	NA
Steel Cans	(0.87)	(0.49)	0.01	(0.42)	NA
Copper Wire	(2.02)	(1.36)	0.01	0.02	NA
Glass	(0.16)	(0.08)	0.01	0.01	NA
HDPE	(0.49)	(0.38)	0.01	0.25	NA
LDPE	(0.62)	(0.47)	0.01	0.25	NA
PET	(0.58)	(0.42)	0.01	0.29	NA
Corrugated Cardboard	(1.53)	(0.85)	0.09	(0.18)	NA
Magazines/Third-class mail	(2.36)	(0.84)	(0.09)	(0.13)	NA
Newspaper	(1.33)	(0.76)	(0.24)	(0.20)	NA
Office Paper	(2.18)	(0.78)	0.48	(0.17)	NA
Phonebooks	(1.73)	(0.73)	(0.24)	(0.20)	NA
Dimensional Lumber	(0.55)	(0.67)	(0.14)	(0.21)	NA
Food Scraps	NA	NA	0.19	(0.05)	(0.05)
Yard Trimmings	NA	NA	(0.09)	(0.06)	(0.05)
Grass	NA	NA	0.04	(0.06)	(0.05)
Leaves	NA	NA	(0.16)	(0.06)	(0.05)
Branches	NA	NA	(0.14)	(0.06)	(0.05)
Carpet	(1.10)	(1.97)	0.01	0.10	NA
Personal Computers	(15.26)	(0.62)	0.01	(0.06)	NA
Concrete	NA	(0.00)	0.01	NA	NA
Fly Ash	NA	(0.24)	0.01	NA	NA
Tires	(1.09)	(0.50)	0.01	0.02	NA

With the implementation of a zero waste plan, the quantities of waste being landfilled would be reduced, resulting in less GHG emissions, which in turn reduces the impact of regional climate change.

8.3 Diversion Strategies

Diversion strategies to achieve the next incremental level of diversion for a municipality require targeting select sectors and materials. Strategies to enhance waste prevention and diversion can be classified into the following four categories:

1. **Regulatory –** includes actions such as adopting extended producer responsibility mandates (i.e., producer-funded take-back programs), instituting bans on certain types of materials, charging user-fees on disposable items, or mandating recycling at construction sites.
2. **Policy –** includes changing the rate structure for refuse collection, implementing environmentally preferable purchasing guidelines to emphasize recycled or reused materials in government projects, or adding materials that may be integrated into the traditional recycling and organics waste collection service.
3. **Programmatic –** includes education, market development, or implementing changes in the actual collection of materials, including the frequency of collection and the size and type of containers used by residents and business.
4. **Contractual –** includes structuring solid waste service contracts to compensate contractors, vendors, and suppliers based on performance objectives that are aligned with the community's waste reduction or product stewardship goals.

In order to achieve higher waste diversion, it is important to focus efforts in areas with the greatest diversion potential and strong cost/benefit potential.

8.4 Application of Diversion Strategies

The diversion strategies listed above can be applied to a local government's various solid waste, recycling, and waste reduction programs. Some example applications are provided below for the County to consider.

8.4.1 Single-Family Residential Programs

Enhancements to curbside recycling and refuse collection programs can be used to optimize diversion and manage costs. Variables that can be modified include rate structures, collection frequencies, container sizes, and items collected.

Some Broome County communities have volume-based garbage collection also referred to as "pay-as-you-throw" (PAYT) while other communities set limits on the amount of garbage that can be set out for collection. The municipalities offer an array of refuse collection methods (i.e., bags and cans), however no County-wide, uniform PAYT approach is currently in place. In the City of Binghamton, for example, residents purchase special plastic bags for refuse collection. The cost of the bag pays for the collection and disposal of the waste. Other communities such as the Town of Union and Johnson City have a flat fee that allows residents to set out a maximum of 6 items or containers per week. In Vestal and Endicott, residents pay based on the number of cans set out.

Even though the County does not oversee the collection of garbage throughout the County, it is possible to implement a uniform PAYT program through hauler licenses. For example, the City of Sioux Falls, South Dakota has a subscription-based hauling system in which residents choose their own garbage hauler. As a requirement of the annual hauler license, each hauler must submit their variable rate pricing schedule to the City.

Per the City Ordinance, "All licensed garbage haulers shall file, as a part of their application for a business license, a general statement of their use rate structures and billing systems consistent with the City's comprehensive plan of solid waste reduction and recycling program which shall include the following elements:

1. A rate to reward people who reduce their level of solid waste collection service based either upon volume or weight.
2. A rate to provide customers with adequate options and incentives to reduce their weekly level of solid waste collection service and the amount of solid waste collected as a result of their participation in waste reduction and recycling programs.
3. A rate that includes the combined cost of solid waste, using the above elements, and recycling collection services."[10]

In an attempt to provide a larger financial incentive to recycle and reduce quantities of garbage set out for collection, some municipalities in the U.S. have implemented a more aggressive pricing schedule (i.e., with greater increments between service levels) to encourage more recycling. For example, in Seattle, Washington, residents may choose their own subscription levels for garbage collection service. (The fees include recycling service.) The City of Seattle offers a "micro-can" level of service. The micro-can is a 12-gallon container at a price of $14.05 per month compared to a 96-gallon cart for $66.90 per month. This represents a significant financial incentive to encourage diversion and waste prevention.

One measure of Seattle's success using a variable can rate to reduce waste generation is that in 2008, 62 percent of the City's residents were one-can (32-gallon) customers, 25 percent were mini-can (20-gallon) customers, and 5 percent subscribed to the micro-can (12-gallon) service. Only 8 percent subscribe to 2 or more cans of service. These percentages contrast with the situation prior to the introduction of variable rates, when 60 percent of single-family customers subscribed to one can and 39 percent subscribed to two or more cans.

The City of Austin, Texas has one of the most mature variable rate programs in the country. The program is designed as an economic incentive to increase diversion. Billing occurs monthly and residents have the choice of three cart sizes. The 2008 base rate of $8.75 per month includes unlimited curbside recycling and yard debris collection. Cart sizes and prices are $4.75 for 30 gallons, $10.00 for 60 gallons, and $16.50 for 90 gallons, and the cart exchange fee is waived for customers seeking smaller cart sizes.

[10] Source: Revised Ordinances of Sioux Falls, South Dakota, Chapter 18, Article IV. Commercial Haulers, Sec. 18-59. Solid Waste Collection Rates.
http://www.siouxfalls.org/Council/Cityclerk/ordinances

The City of Minneapolis offers a unique program to attempt to reward those who recycle. Residents are billed a flat monthly fee of $24.00 for solid waste services that includes collection of refuse, recyclable materials, yard waste, and bulky materials. They offer a large cart for a $4.00 per month disposal fee and a small cart for $2.00 per month. If the resident participates in the recycling program, they receive a $7 per-month credit on their bill. In other words, the resident receives a recycling rebate.

A relatively new approach to recycling incentives is the RecycleBank™ program which offers rewards to residents based on the quantities of materials set out for recycling. Each recycling container has an identification tag that is scanned and recorded by the collection truck each time the address is serviced. The amount of materials recycled is converted to RecycleBank Points, which can be redeemed for gift cards and/or coupons to local retailers.

The incentives in the RecycleBank program are derived from two sources – donations of discounts and gift certificates by local businesses (in exchange for advertisement) and the City's payment to RecycleBank to participate in the program. The City of Minneapolis' $7 per-month credit is budgeted as part of an expense that the City pays to operate the program. In essence, the user fees pay the rebate to those who choose to participate in the recycling program, which is appropriate, as the cost of recycling collection and processing (when markets are strong) is typically less costly than the collection and disposal of garbage. Recycling program user fees should be assessed periodically as participation changes.

The success of enhancing residential diversion hinges on both convenience and adequate financial incentives. Collection services offered must be comprehensive and convenient. Residents need to be adequately rewarded in order for the residential programs to maximize diversion.

8.4.2 Multifamily Residential Programs

Most communities find the implementation of effective multifamily programs to be a challenge. Multifamily recycling and refuse collection tend to be regulated the same as the commercial sector, but the waste generated is more like the residential sector.

Part of the challenge in the multifamily sector, is that there is little direct link between recycling goals or requirements and the behavior of individual tenants. Tenants have little to no control over the location, capacity or convenience of the recycling system at their residence. Property managers and owners have no control over the actual recycling and disposal behavior of the tenants. Overcoming multifamily recycling barriers requires tenant education as well as oversight of property managers and owners. Details of multifamily recycling issues and overcoming barriers are addressed in Issue Paper #2 - Commercial and Multifamily Recycling.

An example of a successful multifamily recycling program can be found in Portland, Oregon. A City ordinance was passed in 2005 requiring standardized recycling systems at every multifamily property. Glass is collected in one container and all other recyclables (paper, metal, plastic) are commingled in a second container. A consistent and predictable collection system at the multifamily properties makes

recycling education for tenants more effective. While all properties must be in compliance, City staff has assisted about one half of the complexes in converting to this standard. All properties are expected to be in compliance by 2010.

Other requirements for Portland's multifamily properties include:

- Multifamily property owners are required to provide a recycling system for tenant use at each property;
- The collection system for recyclable materials must be as convenient as that provided for garbage; and
- Property managers are required to provide tenants with recycling education materials within 30 days of move-in, and on an annual basis.

8.4.3 Commercial Sector Programs

In most communities, the commercial sector generally has a moderate recycling or waste diversion rate, while generating the greatest portion of disposed waste. Disposed commercial waste includes significant volumes of recyclable materials, including glass, metal, paper and cardboard, wood, food, plastics, and yard debris. Details of commercial, industrial, and institutional recycling issues and overcoming barriers are addressed in Issue Paper #2 - Commercial and Multifamily Recycling.

The City of Seattle offers a commercial diversion incentive by offering businesses that generate low volumes of waste (i.e., less than 90 gallons per week) a less expensive, residential-type collection service, including recycling.

The City of Portland, Oregon provides for commercial collection of recyclable materials through permitted private contractors. The City has adopted a goal of diverting 75 percent of the commercial waste stream by 2015. A key to this program is that waste haulers providing service within the City must also collect specifically listed recyclables, report collection volumes to the City, and pay a tip fee surcharge for disposal (no fee is imposed on recyclables). In addition, Portland has a mandatory food waste recycling requirement for the City's largest food-producing businesses. Also, all building projects in Portland with a permit value of $50,000 or more are required to separate and recycle the following construction and demolition (C&D) materials from the job site:

- Rubble (concrete/asphalt);
- Land clearing debris;
- Corrugated cardboard;
- Metals; and
- Wood.

One additional commercial diversion strategy implemented by the City of Portland, is a ban of polystyrene foam containers. Since 1990, the City has prohibited restaurants,

grocery stores and other retail vendors from using polystyrene foam containers for prepared food.[11]

Many corporate businesses have adopted a zero waste policy. One example is Subaru's Indiana automotive manufacturing plant in Lafayette, Indiana which attained "zero landfill" status in 2004 and has remained that way ever since.[12] In 2006, the plant recycled 97 percent of its materials including steel, plastic, wood, paper and glass. The remaining three percent was sent to a waste-to-energy incinerator where steam is produced to heat some of Indianapolis' downtown buildings.

8.4.4 C&D Debris Programs

As discussed in detail in Issue Paper #3 – C&D Debris Recycling, common recyclable C&D materials include wood, drywall, metals, masonry (brick, concrete, etc.), carpet, roofing debris, rocks, soil, paper, cardboard, and land clearing debris.

There are typically two primary methods of improving C&D diversion. The first is facility-based, and involves improving customer access to drop-off facilities and support for the development of mixed C&D recycling facilities in a region. This could also include take-back programs for used building materials and the expansion of salvage and re-use stores and materials exchange programs.

The second primary method for enhancing C&D diversion is based on directing generator behavior, which can be done with the use of rate incentives, building permit requirements, and market development. This could include such methods as:

- Adopting rate incentives that make disposal of mixed C&D waste more expensive than recycling;
- Mandating submittal of a recycling plan for all building projects over a certain dollar value;
- Mandating that C&D waste be delivered only to a licensed recycler;
- Setting a C&D diversion rate goal;
- Developing and promoting pilot projects that show the benefit of de-constructing and recycling as compared to demolition; and/or
- Developing markets for building products made with recyclable materials.

8.4.5 Food Waste Programs

Several communities throughout the country are beginning to collect residential food waste in the same container as curbside yard waste. This is possible in places where processing facilities receiving the materials are permitted to accept both food and yard waste. In addition, a few pilot programs have been implemented around the U.S.

[11] Source: City of Portland website.
http://www.portlandonline.com/osd/index.cfm?a=109474&c=41472
[12] Source: Subaru website. http://subarudrive.com/Sum05_SubaruDifference.htm

collecting residential food waste and non-recyclable materials separately from yard waste. The cost effectiveness of such an approach is still being evaluated.

Currently, there are no facilities in the County that actively compost food waste or co-compost food and yard waste. Nevertheless the following examples of food waste diversion programs are provided for the County to consider, as food waste diversion opportunities may arise in the future and will be discussed as part of the alternative technology evaluation.

In Seattle, post-consumer commercial food, such as cafeteria waste contaminated with takeout containers, paper plates, cups, etc. is diverted and processed by co-composting it with yard waste. A key to success with post-consumer food waste is that the containers and cutlery must be compostable. Many products advertise that they are "biodegradable," although whether a material that claims to be biodegradable can *actually* be composted is dependent on the receiving facility and its processes. Therefore a material testing and approval program, such as the one managed by Cedar Grove Composting[13], the private company that processes Seattle's post-consumer cafeteria waste, is suggested before biodegradable items are accepted in the food waste program.

The St. Paul, Minnesota Independent School District recently implemented a large-scale, post-consumer food waste composting program. This district has more than 42,000 students and 80 different schools. In the 2007/08 school year, 52 schools within the district implemented a food-for-livestock program. Each of these sites has trained its students and staff to source-separate their food waste in the cafeterias. The food waste is then cooked per Minnesota Animal Health Standards and fed to pigs. The program is estimated to reduce the volume of commercial waste requiring disposal by nearly 30 percent. This has resulted in cost savings to the district because of reduced MSW collection costs realized through a resource management program.

Pre-consumer commercial food waste, such as trimmings produced by restaurants and grocery stores, is compatible with a source-separated collection and processing program because it tends to be produced in higher volumes and is less likely to be contaminated with packaging.

Grocery stores have a financial incentive to reduce their waste stream because not only is trash service expensive, but trash takes up valuable space. Some stores have contracts for organics collection service, while others backhaul compostable materials to a distribution center where it is directed to a composting facility. Examples include Safeway[14] and Whole Foods.[15] Whole Foods even markets its own bags of finished compost in some of its stores.

Large-scale food waste diversion, whether collected with yard waste or as a separate commodity, is relatively new in the U.S. As such, compost facilities are becoming better at managing the material, and energy recovery technologies such as anaerobic digestion, are being considered by the public and private sectors alike. (Anaerobic

[13] Source: Cedar Grove Composting website. http://www.cedar-grove.com/services/compost.asp
[14] Source: Safeway website. http://www.safeway.com/IFL/Grocery/CSR-Recycling
[15] Source: BioCycle, November 2004. http://www.jgpress.com/archives/_free/000309.html

digestion will be discussed in more detail in the Evaluation of Alternative Technologies section of the County's Local Solid Waste Management Plan update.) As collection and processing capacity develop over time, it is expected that communities will begin to consider mandatory diversion and/or disposal bans for food waste.

8.4.6 Mandatory Recycling Ordinances/Disposal Bans

Regulatory options that include mandatory recycling ordinances and disposal bans have the potential to increase diversion at little cost to the local government. (Most costs incurred are related to enforcement of the ordinances/bans.) However, reliable management options must be available upon implementing such an approach.

Mandatory recycling ordinances typically require generators to separate a defined list of materials for recycling, or to recycle a certain percentage or number of the materials they generate. Enforcement of mandatory recycling ordinances is typically directed at the generator.

Disposal bans prohibit disposal of certain materials and/or limit solid waste loads to a maximum percentage of banned materials. Enforcement of disposal bans is usually directed at collectors, but can focus on generators and/or disposal facilities such as landfills and transfer stations. In 1989, the County banned leaf and yard waste from the Landfill. Effective December 1990, newspaper, kraft paper, corrugated cardboard, office paper, metals, glass, recyclable plastic, tires and batteries were banned from the Landfill.

Based upon experiences in other communities, it is observed that the most successful disposal bans have certain essential features in common including:

- Reasonably available alternatives to disposal exist and are relatively convenient for the generator;
- The disposal ban and alternatives to disposal are widely publicized;
- Support is built among stakeholders such as haulers, businesses, and residents; and
- A phase-in or grace period is used to introduce the program and allow a collection and processing infrastructure to develop or mature before strict enforcement is implemented.

In general, bans that are enacted without provision for enforcement, or with weak enforcement, are not effective.

In 2003 Portland Metro (Oregon) commissioned a study to determine the impact that mandatory recycling ordinances and disposal bans aimed at the commercial sector have on markets for recycled paper. The study investigated the impact of mandatory recycling and disposal bans on the quantity, quality, and price of recycled paper in five North American communities. The study found that these policies increased the amount of commercial fiber recovered, and that they had limited impact on fiber quality or price. Since most programs were adopted concurrently with other

enhancements to recycling programs and measurement methodology, the study did not attempt to isolate any specific impact on diversion rates.

The study also identified a number of factors that should be considered in terms of how they might impact government, collectors, processors and end-users when mandatory recycling or disposal bans are under consideration. A few are listed here as examples:

Government

- Outreach efforts need to include broad-based activities for the entire commercial sector, as well as sector-specific programs aimed at large-volume sources (e.g., packing and shipping, office buildings, etc.) and "problem" sources (e.g., food service and multi-tenant).
- Recycling collection costs and logistical problems for small generators tend to be prohibitive. Moreover, it is difficult for small generators to achieve savings from reduced trash service to offset their recycling costs. The jurisdiction should work to identify viable strategies such as shared bins, commercial rates that include the cost of recycling services, distributing and sharing costs among larger and smaller generators, drop-off sites, etc. that help reduce the economic burden for small- and medium-sized enterprises.
- Enforcement is essential. It must be integrated with outreach activities and not simply punitive.

Collectors

- Mandatory recycling ordinances and disposal bans increase the "demand" for recycling services and thus tend to increase competition among collection service providers. Traditional waste collection companies have more incentive to offer recycling services and compete against established commercial fiber recycling companies.

Processors

- Processors have experienced some increase in contamination after implementation of mandatory recycling ordinances and disposal bans, but not beyond what they can handle. Processors continue to be able to readily meet market specifications for the paper grades they produce.

End Users

- End users are generally "insulated" from local program issues. They draw supply from many sources, and local processors must deal with problem loads. Those contacted could not identify specific quality problems due to the mandatory recycling ordinances and/or disposal bans implemented by the five jurisdictions in this study.

A list of example ordinances and disposal bans is provided in Section 8.12 – Resources.

8.5 Diversion Potential

Most U.S. communities claim to have a diversion rate in the 40 to 50 percent range. The City of San Francisco, California announced in May of 2009 that the City had achieved a 72 percent recycling rate for 2007, up from 70 percent the year before.[16] The City has a goal of 75 percent landfill diversion by 2010 and zero waste by 2020 and is making strides to achieving those goals. A mandatory C&D debris recovery ordinance was passed in 2006 and plays a large role in the City's high recycling rate. It is important to note, however, that comparing diversion and recycling rates among communities is challenging due to the manner in which different communities define and measure recycling and waste reduction, as well as the MSW stream.

A number of diversion programs could be considered by Broome County to enhance diversion beyond its current rate. These programs may include a mix of targeted programs focusing on specific materials (i.e., food waste) and/or specific sectors (i.e., commercial sector). Strategies for consideration include regulatory (i.e., disposal bans), policy changes (i.e., upgraded pay-as-you-throw), and programmatic (i.e., larger container sizes).

Tables 8-3 through 8-8 provide strategies for the County to consider for each sector (single family, multi-family, commercial, etc.) as well as strategies for increasing food waste diversion and strategies related to disposal bans and producer responsibility. R. W. Beck recommends that the County use these strategies as a guide to develop official waste diversion or zero waste goals. Each strategy could be ranked by diversion potential, as determined by the County.

One means of ranking diversion potential was developed by Skumatz Economic Research Associates, Inc. (SERA) for Metro Vancouver's (British Columbia) solid waste management system in 2007. SERA's diversion code ranking is provided in Table 8-3 below.

Table 8-3
Diversion Range Codes[1]

Diversion Value	Diversion Description	Diversion Code
Very High	Over 5.0%	VH
High	Up to 5.0%	H
Medium	Up to 2.0%	M
Low	Up to 1.0%	L
Very Low	Up to 0.3%	VL
Super Very Low	Up to 0.06%	SVL

[1] Source: Skumatz Economic Research Associates, Inc.

[16] Source: City & County of San Francisco website.
http://sfgov.org/site/frame.asp?u=http://www.sfenvironment.org

The ranking should be based upon a qualitative estimate of diversion potential, ease of implementation, and estimated cost to implement.

8.5.1 Single-Family Residential Waste Diversion Strategies

Table 8-4
Single-Family Residential Diversion Strategies

Implement a residential food waste disposal ban
Add food waste to yard waste collection
Increase illegal dumping fines
Implement curbside collection of C&D waste (by appointment)
Implement performance-based contracting for solid waste service contracts
Implement curbside collection of electronic waste (by appointment)
Implement county-wide volume-based rate structures for residential garbage
Implement bulky item recycling collection (by appointment)
Enhance waste screening at the Landfill for exclusion of banned recyclables
Adopt a compostable plastic bag mandate for yard waste and organics collection
Add dry cell batteries to existing curbside recycling program
Offer a thermometer exchange to replace mercury-containing fever thermometers with digital thermometers
Develop a pesticide container recycling program
Enforce Landfill ban of recyclable materials
Add additional materials to curbside recycling program
Require all haulers to leave education tags for customers who set out improperly prepared items and/or contamination

8.5.2 Multifamily Residential Waste Diversion Strategies

Table 8-5
Multifamily Residential Diversion Strategies

Establish mandatory recycling requirement for all multifamily buildings
Monitor multifamily properties to verify that adequate recycling is provided and is as convenient as garbage disposal
Expand residential food and yard waste collection to multifamily properties
Implement bulky item recycling collection (by appointment)
Adopt minimum requirements for space for recycling containers at new multifamily developments
Increase recycling education to multifamily residents
Provide apartment-sized recycling totes or bags to multifamily dwelling units

8.5.3 Commercial Waste Diversion Strategies

Table 8-6
Commercial Diversion Strategies

Establish an overall mandatory recycling requirement for businesses to achieve by a prescribed date/year
Expand inspection & enforcement program
Conduct/expand commercial and institutional waste audits
Require commercial haulers to offer recycling service of certain materials
Offer residential garbage rates to businesses who generate <90 gallons/week
Implement weight-based commercial garbage rates (incorporates disincentive to dispose organics)
Establish a commercial food waste collection and composting program
Establish mandatory food scrap diversion in commercial waste
Promote reusable transport packaging
Develop a pesticide container recycling program
Work with local businesses to promote green purchasing and business practices

8.5.4 Food Waste Diversion Strategies

Table 8-7
Food Waste Diversion Strategies

Increase availability of commercial food waste collection and composting
Implement a commercial food waste disposal ban
Implement a residential food waste disposal ban
Implement commercial weight-based garbage rates (incorporates disincentive to dispose organics)
Enhance residential curbside organics collection to include all food waste
Implement multifamily collection of food waste
Adopt a permit requirement that states restaurants must have food waste collection space
Provide technical assistance to commercial kitchens
Establish new mandatory food scrap diversion in commercial waste
Establish a commercial food scrap collection program with subsidized tip fee
Investigate/potentially implement an anaerobic digestion program for organics processing, possible biofuels production

8.5.5 C&D Debris Diversion Strategies

Table 8-8
C&D Debris Diversion Strategies

Incentivize development of private mixed C&D debris recycling facility
Require C&D waste pre-processing for commingled material
Ban PVC plastic packaging
Implement a disposal ban on all (or specific types of) C&D waste
Increase illegal dumping fines
Create a larger difference between disposal tip fee and fee to deliver source-separated C&D waste
Promote salvage and reuse swap sites
Encourage market development for C&D materials
Research feasibility of a take-back program for carpet
Building & demolition permit to include a C&D reuse and recycling fee deposit
Take-back program for used building materials at home product centers
Residential collection of C&D waste (by appointment)
Pre-approved certification of C&D recycling compliant facilities
Pilot deconstruction and salvage projects
Mandatory waste diversion plan for projects over a specified size
Mandatory C&D recycling of 75 percent (example) including development of notification, education and verification of compliance
Recycle 75 percent of construction, remodeling and demolition (CR&D) waste at projects with a permit value over $50,000 (numbers are provided as an example)

8.5.6 Producer Responsibility, Disposal Bans and Disposal Fee Strategies

Table 8-9
Extended Producer Responsibility, Disposal Bans, Retail, and Advance Disposal Fee Programs

Ban PVC plastic packaging
Implement a commercial food waste disposal ban
Implement a residential food waste disposal ban
Establish a take-back program for product packaging by retail sellers
Charge a fee on incandescent bulbs to fund fluorescent bulb recycling
Enforce disposal ban for recyclables in commercial waste
Establish a take-back program for used building materials at home product centers

Table 8-9
Extended Producer Responsibility, Disposal Bans, Retail, and Advance Disposal Fee Programs

Establish a take-back program for carpet
Establish a take-back program for electronic waste
Enhance waste screening at landfill for exclusion of banned recyclables
Encourage/mandate the use of reusable transport packaging
Implement a compostable plastic bag mandate for yard waste and organics collection
Establish a product ban for polystyrene to-go containers and single-serve foodservice
Implement a take-back program for foam packaging – negotiate with the Association of Foam Packaging Recyclers
Implement a packaging tax
Establish/encourage an eco-labeling program in retail stores
Encourage/mandate retailers to charge an advance disposal fee (ADF) on disposable shopping bags (or alternatively, provide a per-bag discount for shoppers who bring their own reusable bags)
Implement a phased ban on plastics in food takeout containers and utensils/shift to compostable disposables
Enforce Landfill ban of recyclable materials

To achieve significant increases in diversion, the County would need to embark on systematic incremental planning that includes commitments from stakeholders to implement specified waste diversion strategies, as well as commitment on the part of local government to provide adequate enforcement.

8.6 Steps in Developing Diversion Projections

To determine the current and future waste diversion projections for Broome County, R. W. Beck recommends the following steps:

- Identify the current MSW and C&D composition by quantity and material types (preliminary estimates are included in Appendix A);
- Gather data on current diversion quantities by material type;
- Calculate current waste generation by summing the material quantities disposed with quantities diverted;
- Identify additional waste diversion programs by material type that are planned for implementation or could be implemented in the future;
- Divide the future planning period into five-year increments for further analysis;
- Calculate waste diversion for MSW, C&D and combined sectors for each of the five-year increments to develop waste diversion projections both in the aggregate and by material type;

- Apply a waste generation growth rate to the existing generation rate based on existing per-capita waste generation rates and agreed-upon population growth rates; and
- Project waste generation, disposal, and diversion quantities for the planning period.

8.7 Education Tactics

Educating stakeholders (in this case, government officials; MSW, C&D, and recyclable materials haulers, processors, and end-users; businesses; multifamily building owners/managers; the general public; etc.) about a zero waste approach to waste management is critical in order to obtain key stakeholder feedback and support. Developing a zero waste policy and getting it adopted, would most likely take at least a year. Once adopted, multiple education tactics should be implemented in order to educate the stakeholders in the County.

Education and outreach tools should be developed to focus on particular types of waste (such as food waste and C&D debris) as well as particular sectors (single-family, multifamily, commercial). Disseminating education might be done through:

- Website/Intranet/Internet (which can be used to convey various types of information as well as provide access to some of the other tools listed below);
- List serve;
- Email bulletin;
- Conferences/seminars/workshops to inform various sector representatives or specific waste collectors and processors of the zero waste plan;
- Fact sheets (e.g., detailing requirements of the policy, alternatives to disposal, commodity-specific fact sheets, etc.); and
- Technical assistance to businesses (e.g., waste audits).

It is suggested that, to the extent possible, all education and outreach materials be offered electronically in order to minimize waste and expenses.

Also, it will be critical for the County to educate all stakeholders about the County's zero waste plan and provide periodic updates regarding the progress made with regard to the policy, so that the County's dedication to reducing waste and minimizing health and environmental impacts is conveyed.

8.8 Capital and Operating Expenses

The capital and operating expenses to implement a zero waste plan would be dependent on the breadth of the program, but would most likely be sizable, because a policy change such as this would be far-reaching and affect most sectors within the County. A zero waste plan would require dedicated staff time for policy development, increased education efforts (including designing and distributing education pieces,

website development, site visits and audits, additional data tracking, etc.), and policy enforcement. The extent of the capital expenditures would depend on the level of involvement from the County. Zero waste programs not only require policy, regulatory, and contractual changes be made, but also programmatic changes. If the County took a hands-on approach to making changes to its waste diversion programs (e.g., expanded its C&D program, expanded its composting program to include food waste, or subsidized the purchase of containers for volume-based collection, etc.), the capital expenses could be great. However, if most program changes were implemented by the private sector, the County would have less capital expenditures. Regardless of the approach, a large capital expenditure for a zero waste campaign would be the ongoing promotional and education pieces.

A successful zero waste program would inevitably reduce the amount of waste requiring disposal, thus reducing the revenue from tipping fees received at the Landfill and possibly reducing Landfill operating expenses.

While developing and implementing policies are most likely activities that are part of existing staff time, a zero waste policy would most likely require additional time and labor because of its scope and ongoing need for monitoring and enforcement. Many municipalities have dedicated staff to specifically implement and maintain a zero waste program. These programs, as described in this issue paper, are multi-faceted and take many years to fully implement. Section 8.9 provides a basic outline of the implementation requirements, however the extent of the requirements is something that would be determined by the County.

8.9 Implementation Requirements

If the County were to move forward with researching the zero waste concept, it may consider forming a task force or a "team" of stakeholders to consider the practicability and implications of such a plan. The steps required to implement a zero waste plan might include, but not be limited to:

- Research other communities that have implemented a zero waste plan to ensure all stages of the process are included;
- Determine Broome County's current diversion rate;
- Develop a diversion plan including a list of sectors and materials to target for diversion;
- Develop diversion projections for the near future and for the long-term (e.g., twenty years);
- Set goals and target dates for future waste diversion;
- Inform stakeholders of intent to develop a zero waste policy;
- Solicit stakeholder input;
- Identify goals of the policy;
- Develop the policy;

- Inform stakeholders of the policy;
- Present/adopt the policy;
- Develop policy tools;
- Educate stakeholders about policy tools;
- Evaluate the effectiveness of the policy and supporting programs (ongoing basis); and
- Enforce the policy (ongoing basis).

Based upon R. W. Beck's review of waste diversion rates in several communities with successful recycling programs, we note that reaching diversion targets greater than 50 percent requires a strong commitment by the local government, participating municipalities, waste haulers, processors, and end-users, manufacturers, producers and retailers, and by the residents and businesses which generate waste.

One barrier to increasing diversion can be the lack of uniformity in program services and requirements throughout the County. The variety of recycling services offered can make it more difficult to assess the impact of program enhancements or to provide consistent technical assistance to businesses and residents.

The adoption of certain minimum standards for recycling services could serve to standardize expectations in both urban and rural areas. Standardizing service levels could reduce costs as jurisdictions could share technical assistance, education, and promotional materials and programs.

It should be noted that recycling alone will not increase diversion significantly. Nationwide, waste generation per person continues to increase each year. As a result, the proportion of waste being diverted has remained stagnant in many communities, while the volume of waste requiring disposal continues to grow.

8.10 Addressing Stakeholder Concerns

The implementation of a zero waste plan would most likely impact every sector of Broome County. Stakeholders would include, but not be limited to, government officials; MSW, C&D, and recyclable materials haulers, processors and end-users; residents; business owners and managers; multifamily building owners and managers; product manufacturers, producers and retailers; and the Landfill Citizen Advisory Committee.

As mentioned in Section 8.9 – Implementation Requirements, the County may want to consider establishing a task force to discuss the concept of zero waste, determine diversion strategies, and consider the policy language and implications. One role of the task force would be to address concerns which may include, but not be limited to:

- Resistance from residential, commercial, C&D and food waste stakeholders to mandatory bans of specific materials;
- Concerns from cities, towns and villages regarding potential increase in duties to monitor recycling ordinances and/or disposal bans;

- Concerns from contractors, developers, and business owners regarding perceived cost increases to comply with disposal bans (i.e., the need to provide multiple containers or dumpsters to divert multiple materials);
- Concerns from product manufacturers and retailers regarding take-back programs; and
- Concerns from haulers required to collect and haul an increased number of source-separated materials.

8.11 Benefits and Drawbacks

Implementing a zero waste plan has benefits as well as drawbacks, as outlined below.

8.11.1 Benefits

The benefits of a zero waste plan to the County may include, but not be limited to, the following:

- A reduction in MSW quantities landfilled resulting in GHG emissions reduction.
- Disposal bans and recycling ordinances increase the quantities of materials recycled and diverted from disposal.
- Packaging bans and incentives to buy in bulk can lead to increased waste diversion, thus increasing the life of the Landfill.
- Products and services that use fewer resources (such as water and energy) save natural resources.
- Expanded materials processing and markets create new business opportunities.
- EPP programs increase the demand for recycled materials to be used as feedstock for recycled-content products.
- When held accountable for the materials they produce, manufacturers have an incentive to create less waste. Promotes designs that consider the entire product life cycle.
- An overall increase in awareness of recycling and environmental-related issues and a potential move towards increased sustainability.
- A reduction in hazardous waste, toxic emissions, and energy waste.

8.11.2 Drawbacks

The drawbacks to implementing a zero waste plan would most likely be financial. Increased staff time and resources would be needed to develop a zero waste plan and policies; track the County's diversion rate; increase outreach, education and technical assistance efforts; and enforce the policies, bans and ordinances.

In addition, it may be difficult to obtain support from community leaders and stakeholders regarding the zero waste concept.

As stated in previous issue papers, when considering the "cost" of recycling and waste diversion programs there are both "economic" considerations and "non-economic" considerations. Under economic considerations, the County must take into account the reduction in revenue from tipping fees received at the Landfill as a result of a successful zero waste program. Also, the cost of a zero waste program should be compared with the cost of landfill disposal, including transportation costs and long-term disposal obligations after the landfill is closed (post-closure obligations). For "non-economic" considerations there are factors such as environmental sustainability, carbon footprint, public desire for and participation in recycling and waste diversion, and New York State Rules and Regulations. These factors should all be considered as the County formulizes its integrated solid waste management planning efforts.

8.12 Resources

Provided below is a list of program information supporting R. W. Beck's analysis which may assist the County.

- City of Austin, Texas – Zero Waste Plan
  http://www.ci.austin.tx.us/sws/0waste.htm
- GrassRoots Recycling Network
  http://www.grrn.org/zerowaste/
- Metro Portland study "Impact of Mandatory Recycling Ordinances and Disposal Bans on Commercial Fiber Recycling," by Moore & Associates.
  http://www.oregonmetro.gov/index.cfm/go/by.web/id=19318
- City of Oakland, California – Zero Waste Resolution and Strategic Plan
  http://www.zerowasteoakland.com/Page749.aspx
- Product Stewardship Institute
  http://www.productstewardship.us/index.cfm
- RecycleBank
  https://www.recyclebank.com/
- San Francisco, California – Zero Waste Legislation and Initiatives
  http://sfgov.org/site/frame.asp?u=http://www.sfenvironment.org
- Zero Waste Alliance
  http://www.zerowaste.org/
- Zero Waste International Alliance
  http://www.zwia.org/index.html

Green Building Resources

- BREEAM
  http://www.breeam.org/
- Green Globes
  http://www.greenglobes.com/
- U.S. Green Building Council
  http://www.usgbc.org/Default.aspx
- World Green Building Council
  http://www.worldgbc.org/home

Examples of Recycling Ordinances and Disposal Bans

- City of Cambridge, Massachusetts
  http://www.cambridgema.gov/TheWorks/departments/recycle/ordinance.html
- Central Vermont Solid Waste Management District
  http://www.cvswmd.org/wp/cvswmd-to-amend-surcharge-ordinance/
- City of Durham, North Carolina
  http://www.ci.durham.nc.us/departments/solid/pdf/ordinance.pdf
- City of Gainesville, Florida
  http://www.cityofgainesville.org/GOVERNMENT/CityDepartmentsNZ/Recycling/MandatoryCommercialRecycling/tabid/488/Default.aspx
- Lee County, Florida
  http://www3.leegov.com/solidwaste/uploads/Final_Scanned_Ordinance.pdf
- Linn County, Iowa – Corrugated Cardboard Recycling Ordinance, Chapter 35
  http://www.linncounty.org/content.asp?Page_Id=836&Dept_Id=6
- Nova Scotia, Canada
  http://www.gov.ns.ca/nse/waste/regulations.asp
- City of Portland, Oregon
  http://www.portlandonline.com/osd/index.cfm?c=47899&
- San Francisco, California
  http://www.sfenvironment.org/downloads/library/mandatory_pdf.pdf
- Solid Waste Association of North America (SWANA) Technical Policy on Solid Waste Disposal Bans
  http://www.swanacal-leg.org/downloads/T-32%20Policy%20on%20Solid%20Waste%20Disposal%20Bans.pdf

Appendix A
MSW and C&D Debris Estimates by Material Type
Broome County

As part of Broome County's Local Solid Waste Management Plan update, R. W. Beck assessed the County's waste stream for future diversion potential. R. W. Beck identified recent waste characterization studies completed for communities with demographics and solid waste management systems similar to those of Broome County. Together, the County and R. W. Beck selected the 2005 composition results for Cedar Rapids/Linn County, Iowa from the Iowa Statewide Waste Characterization Study as an appropriate comparison. Table A-1 below lists the estimated quantities of material in Broome County's waste stream that were calculated by applying the County's 2007 MSW landfill tonnage (148,904 tons)[1] to the MSW composition results from Cedar Rapids/Linn County.

Table A-1
Cedar Rapids/Linn County MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Paper	Compostable Paper	7.1%	10,541
Paper	High Grade Office	1.6%	2,373
Paper	Magazines	1.0%	1,507
Paper	Mixed Recyclable Paper	5.3%	7,904
Paper	Newsprint	2.4%	3,546
Paper	Non-Recyclable Paper	4.3%	6,432
Paper	OCC and Kraft Bags	3.5%	5,155
Total Paper		25.2%	37,458
Plastics	# 1 PET Deposit Beverage Containers	0.3%	400
Plastics	# 1 PET Beverage Containers	0.5%	702
Plastics	# 2 HDPE Containers	0.9%	1,324
Plastics	Film/Wrap/Bags	6.3%	9,348
Plastics	Other # 1 PET Containers	0.2%	331

[1] Source: Landfill Tonnage by Material from "Broome County Executive Summary, Division of Solid Waste Management, As of December 31, 2007 – Final." The tons include General MSW plus Municipal MSW from Cleanup Events.

Table A-1
Cedar Rapids/Linn County MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Plastics	Other Plastic Containers	0.4%	650
Plastics	Other Plastic Products	6.5%	9,642
Total Plastics		15.0%	22,398
Metals	Aluminum Beverage Containers	0.1%	113
Metals	Aluminum Deposit Beverage Containers	0.1%	202
Metals	Ferrous Food and Beverage Containers	1.7%	2,570
Metals	Other Aluminum Containers	0.1%	120
Metals	Other Ferrous Metals	3.5%	5,272
Metals	Other Non-Ferrous Scrap	0.5%	688
Total Metals		6.0%	8,965
Glass	Blue Glass	0.0%	71
Glass	Brown Glass	0.0%	57
Glass	Clear Glass	0.8%	1,202
Glass	Glass Deposit Containers	0.3%	427
Glass	Green Glass	0.1%	174
Glass	Other Mixed Cullet	1.0%	1,531
Total Glass		2.3%	3,463
Yard Waste	Pumpkins	0.7%	1,088
Yard Waste	Yard Waste	0.9%	1,290
Total Yard Waste		1.6%	2,379
Food Waste	Food Waste	12.4%	18,477
Total Food Waste		12.4%	18,477
Wood	Non-Treated	4.2%	6,268
Wood	Treated	6.1%	9,085
Total Wood		10.3%	15,353
Demolition/ Renovation/ Construction Debris	C&D Debris (Excluding Wood)	8.9%	13,185
Total Demolition/Renovation/Construction Debris		8.9%	13,185
Durables	Cell phones and Chargers	0.0%	14
Durables	Central Processing Units/Peripherals	0.2%	236

Table A-1
Cedar Rapids/Linn County MSW Composition Percentages Applied to Broome County 2007 MSW Landfill Tonnage

Material Group	Material	CR - Linn Co Avg Percent Comp.	Broome County 2007 Tons
Durables	Computer Monitors/TV'S	0.2%	295
Durables	Electrical and Household Appliances	1.1%	1,615
Durables	Other Durables	2.8%	4,189
Total Durables		4.3%	6,350
Textiles And Leathers	Textiles and Leathers	3.3%	4,884
Total Textiles And Leathers		3.3%	4,884
Diapers	Diapers	2.5%	3,773
Total Diapers		2.5%	3,773
Rubber	Rubber	0.2%	330
Total Rubber		0.2%	330
HHW	Automotive Products	0.0%	24
HHW	Household Cleaners	0.0%	30
HHW	Lead Acid Batteries	0.0%	-
HHW	Mercury Containing Products	0.0%	5
HHW	Other Batteries	0.3%	465
HHW	Other HHW	0.2%	263
HHW	Paints and Solvent	0.0%	28
HHW	Pesticides, Herbicides, Fungicides	0.0%	-
Total HHW		0.5%	815
Sharps	Sharps	0.0%	6
Total Sharps		0.0%	6
Other Organic	Other Organic	1.2%	1,787
Total Other Organic		1.2%	1,787
Other Inorganic	Other Inorganic	2.8%	4,137
Total Other Inorganic		2.8%	4,137
Fines/Super Mix	Fines/Super Mix	2.1%	3,121
Total Fines/Super Mix		2.1%	3,121
Other	Other	1.4%	2,024
Total Other		1.4%	2,024
		100.0%	148,904

Note: Totals may not sum due to rounding.

As stated in Issue Paper #3 – Construction & Demolition Debris Recycling, the County does not require C&D debris to be separated from MSW when brought to the Landfill. The Landfill does track the tonnage of mixed C&D debris that comes in as dedicated loads from area contractors. In 2007, the Landfill accepted approximately 22,400 tons of dedicated C&D debris. (The Landfill also received C&D mixed with MSW, however the quantities are unknown because the loads were recorded as MSW tons.) For planning purposes, R. W. Beck applied the C&D percentages from the 2008 Bartow County, Georgia visual C&D waste characterization study to Broome County's 2007 C&D debris tonnage, as shown in Table A-2 below.

Table A-2
Estimate of C&D Tonnage, by Material Type
Accepted at the Broome County Landfill

Tier 1 Materials	Projected Tonnage	Percent of Total
Non-Treated Wood	6,642	29.60%
Treated Wood	3,613	16.10%
Asphalt Shingles	3,052	13.60%
Pressboard and other sheet lumber	1,503	6.70%
Gypsum Board	1,257	5.60%
Tier 1 Materials Sub-total	*16,066*	*71.60%*
Tier 2 Materials	**Projected Tonnage**	**Percent of Total**
Yard Waste	808	3.60%
Ferrous Metal	740	3.30%
Carpet	516	2.30%
Non-Reinforced Concrete	494	2.20%
MSW	471	2.10%
OCC	449	2.00%
Rubber	314	1.40%
Other Masonry	292	1.30%
Soil	247	1.10%
Glass	247	1.10%
Plastic - Other Plastic Products	224	1.00%
Brick	224	1.00%
Reinforced Concrete	157	0.70%
Expanded Polystyrene	157	0.70%
Textile	135	0.60%
Durables - Electrical Appliances, Computer, TV's	112	0.50%

Table A-2
Estimate of C&D Tonnage, by Material Type
Accepted at the Broome County Landfill

Tier 1 Materials	Projected Tonnage	Percent of Total
Office Paper	112	0.50%
Tile	112	0.50%
PVC	112	0.50%
Other Paper	90	0.40%
Crushable Inerts	67	0.30%
Asphaltic Concrete	67	0.30%
Linoleum	45	0.20%
Plastic Film/Wrap/Bags	45	0.20%
Other Inerts	22	0.10%
Insulation	22	0.10%
Tires	22	0.10%
Non-Ferrous Metal	22	0.10%
Newspaper	0	0.00%
Aluminum	0	0.00%
Wood Packaging	0	0.00%
Phonebooks	0	0.00%
Food Waste	0	0.00%
Brush	0	0.00%
Dirt/Fines	0	0.00%
Drywall/Sheetrock	0	0.00%
HHW	0	0.00%
Magazines	0	0.00%
Other Non - C&D (please Specify)	0	0.00%
Other C&D	0	0.00%
Rock	0	0.00%
Tier 2 Materials Sub-total	*6,328*	*28.20%*
Total	22,394	99.80%

Note: Totals may not sum due to rounding.